Abstracts of Papers Presented
Chicago, Illinois, USA
July 17–19, 2016
Sessions by Track
(session numbers)

**Note: Sessions without abstracts are not listed in this publication. Due to speaker changes, some abstracts may be missing or out of date.**
Abstracts are available for the following sessions. Author blocks for each abstract list the primary author first. E-mail addresses for the primary authors are available at the end of the author block. Please contact primary authors directly if you have questions about their research.

001 - Innovative Technology and Emerging Research on Fiber’s Role in Gut Microbiome and Bone Health

002 - Microwave Thermal Processing: Recent Advances and the Next Chapter

003 - Sensory Myth Busters: A Curated Symposium Sponsored by the Sensory & Consumer Sciences Division of IFT: Sensory Booths and Colored Lights…Fact or Fiction?

004 - Electron Beam Processing as a Platform Technology for the Food Industry

005 - How to Address Dust Concerns for Food Manufacturers

006 - Understanding Food Safety Modernization Act (FSMA) Rules and Preparing for Implementation and Compliance

007 - Can High Pressure Processing in Combination With Heat Serve as a Safe Alternative to Inactivate Clostridium Botulinum Spores?

008 - Improving Microbial Safety of Locally Grown Fresh Produce in Several US States Through Research and Extension Approaches

009 - Nutritional Economics and Value Based Decision Making: A Positive Influence for Health Outcomes

010 - Recent Advances in Creating New Opportunities and Overcoming Challenges Associated With Acid Whey

011 - Sustainability of Alternative Protein Sources: From Micromycelium to Insects to Urban Farming

012 - The Role Sensory Science Can Play in Mitigating Corporate Risk: Be a Sommelier, Not a Waiter

013 - Attachment, Detachment, and Inactivation of Allergens and Microbes on Food Contact Surfaces

014 - Emerging Tools and Future Needs for Meeting FSMA Requirements Related to Economically Motivated Adulteration (EMA) Hazard Analysis and Preventive Controls

016 - The “How and “Why” of Win-Win-Win Curriculums for Professionals, Companies, and Schools

017 - Build Your Own Career Pathway

018 - CulinoIn Action: How Restaurant Chefs Are Using Functional Ingredients to Drive Menu Trends

019 - Science Versus Sensationalism and Soundbites: How Can Consumers Make More Informed Choices?

020 - Major Food Trends: How Does Consumer Behavior Compare with the 2015-2020 Dietary Guidelines for Americans?

021 - Emerging Nonthermal Separation Technologies

022 - Toxicological Science: Risk, Communication, and Regulation

023 - The Clean Label Market and How to Overcome Formulation Challenges Using Functional Clean Label Ingredients

024 - A New Paradigm for Healthy Fats and Oils

025 - Formulation and Processing Challenges and Insights Into the Development of New and Healthier-For-You Snacks

026 - Advances, Challenges, and Opportunities in Nonthermal and Other Novel Food Processing Technologies: Engineering and Packaging Aspects

027 - Spotlight on Vitamin D: Understanding the Vitamin D in Our Diets, Methods to Measure It, and Considerations for New Sources

028 - Critical Considerations in Pathogen Surrogate Identification and Utilization for Non-Thermal Food Process Testing and Food Safety Verification

029 - Expanding the Tool Box: Discussions on the Application of Less Familiar Sensory Tools to Address Product Development Challenges

030 - Trailblazer Lectureship: Nutrition and Food: An Obvious but Little Appreciated Partnership

031 - Hot Topic Session: Advances in High Pressure Processing for Healthier Foods: Case Studies in Commercial Products, Clostridium Difficile and C. perfrigens Spores Germination, and Non-proteolytic C. botulinum Inactivation by High Pressure Thermal Processing
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034 - Telling the Story of Science in an Age of Misunderstanding
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036 - Nutraceutical and Functional Food Regulations in the United States and Around the World
037 - Safety of Imported Food Ingredients and the Role of the Food Safety Modernization Act (FSMA)
038 - Sustainability and Food Waste: Challenges for the Food Industry
039 - Breakthroughs in Sensory Science: Temporal, Consumer and Psychophysical
040 - A Dietary Staple for the 21st Century: Celebrating 2016, the International Year of Pulses
041 - Using Botanicals to Build Better Functional Foods and Beverages
042 - Packaging Innovations for Processed Meat, Poultry, and Seafood
043 - Trends and Ingredient Solutions for Clean Label/Non-GM Sweeteners
044 - Critical Factors Influencing the Oxidative Stability and Shelf-Life of Lipid-Containing Foods
045 - Gilbert A. Leveille Lectureship: Food and Nutrition: Integrative Science in the 21st Century
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047 - Training in Food Regulatory Affairs
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052 - Protein Trends and Technologies: Protein Identification, Protein Allergens, Gluten Intolerance, and Regulatory Challenges
053 - Maximizing Freshness and Reducing Waste of Packaged Food Using Shelf-Life Simulations: Basic Principles and Case Studies
054 - Infant Formula Nutrition: Regulatory and Safety Evaluation of Ingredients
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056 - Engineering Sustainability and Water Conservation in Food Production
057 - Let’s Get Real: Does Food Science Promote or Undermine Nutrition?
058 - Achieving a ‘Clean Label’ While Maintaining the Quality and Safety of Your Product, Is It Possible? Part 1
059 - W.K. Kellogg Lectureship: Regional Development Models for Value Addition to Underutilized Whey in South America
060 - Fennema Lectureship: What’s New: Process, Products and Authentic Learning in STEM
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062 - Genomics Day: Spoilage
063 - The Impact of the International Food Regulations on Global Supply Chain: An Update
064 - Current Innovations in Biosensors for Food Quality and Safety
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066 - Functional Ingredients for Cognitive Health in Food and Beverage Applications
067 - How Interoperability and Traceability Improve Food Safety
068 - Concentrating on Fruits and Vegetables: New Advancements and Applications for Juice Concentrates and Their Byproducts
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110 - Food Engineering Solutions to Food Security in the Developing World

111 - Alternative Approaches to Control Foodborne Pathogens

112 - Health Benefits of Whole Foods and Molecular Targets of Bioactive Components: Part 1

112 - Health Benefits of Whole Foods and Molecular Targets of Bioactive Components: Part 2

112 - Health Benefits of Whole Foods and Molecular Targets of Bioactive Components: Part 3

113 - Certified Food Scientist (CFS): An Introduction and Exam Strategies

114 - Genomics Day: Whole Genome Sequencing Enhances Food Safety by Rapidly and Accurately Detecting Pathogens in Food Products

116 - Teaching Students how to Investigate and Discuss Controversial Topics in the Food Industry

117 - Genomics Day: Regulations

118 - Hot Topic Session: Update on FDA’s Nutrition Initiatives

119 - How to Negotiate Your Salary

120 - A Sneak Peek at the Food Evolution Documentary

121 - Higher Education Review Board Can Help
Abstracts
(by session number)

001-001 Insights Into Novel Technologies for Studying Added Fibers' Impact on Intestinal Microbiome
A. Hoffman, Tate & Lyle, Email: andrew.hoffman@tateandlyle.com

Dr. Hoffman will first set the stage by explaining microbiome basics, what it is, how it develops and changes throughout life and why it plays a critical role in maintaining health—even beyond simply digestive health. Then he will present a novel platform for studying the interaction of gut microbiota and nutrients with a focus on the fermentation profile of fibers and the effects on host interactions, such as improved immune function, improved lipid metabolism and decreased inflammation. In addition, Dr. Hoffman will discuss the functional benefits of added fibers in applications as well as fiber’s role in addressing public health and nutrition needs.

001-002 Role of Prebiotic Fibers in Modifying Calcium Absorption and Bone Indices via Changes in Gut Microbiota
C. Weaver, Purdue University, Email: weavercm@purdue.edu

Some of the physiological benefits of dietary fibers may come from modulation of the gut microflora, colonic fermentation, and the production of short chain fatty acids. Dr. Weaver will present recent data on the modification of calcium absorption by prebiotic fibers via changes in gut microbiota and the effects on indices of bone health. Research will be presented from animal studies as well as human clinical trials in adolescents and postmenopausal women, both populations of concern for calcium nutrition and bone health.

002-001 Synergies and Impact of Large-Scale Collaborative Research
H. Chen, USDA/NIFA, Email: hchen@nifa.usda.gov

This presentation will assess the impacts and synergies of interdisciplinary research programs of multiple institutions for advancing food science and engineering and developing advanced thermal processing technologies. USDA/NIFA supported CAP project on microwave assisted pasteurization technology will be used as a case study.

002-002 Microwave Sterilization and Pasteurization: Major Developments in Engineering, Packaging and Food Quality
J. Tang, Washington State University, Email: jtang@wsu.edu

This presentation is devoted to the application of scientific principles and advances involved with MATS and MAPS technologies.

002-003 Heat Inactivation of Select Foodborne Pathogens: How Should We Select the Target Microbe?
D. D'Souza, Email: ddosouza@utk.edu

Properties and inactivation kinetics of select pathogenic bacteria and viruses in food matrices under conditions of microwave pasteurization will be discussed.

002-004 Assessing Partnership-Based Technology Transfer Initiatives
D. Gray, NC State University, Email: denis.gray@ncsu.edu

Program assessment and impacts for applied science research programs and industry/university partnerships will be discussed.

003-002 Overview of Sensory Booths
J. Beckley, The Understanding & Insight Group, Email: jackie@theuandigroup.com

Kenneth and Jacqueline will provide a brief overview of sensory booths and the importance they have in testing protocol.

003-003 Testing Booths and Lighting: Finding the Right Solution
J. McLean, Diageo, Email: janet.mclean@diageo.com

Janet will present the idea of why it is important to use testing booths and lighting. She will discuss how the practical needs of the testing situation and question guide the why and how of using these approaches.

003-004 Consumers and Sensory and the Experience Economy: Why Immersive Testing Environments Matter More Than Ever Today
C. Simons, The Ohio State University, Email: simons.103@osu.edu

Dr. Simons has created a highly immersive testing environment for sensory and consumer evaluation at OSU. He will present a series of examples of the value of these approaches and how they change understanding of sensory properties around food experiences today.

003-005 To Booth or Not to Booth? Is It a Question or Is There Another Question We Need to Understand
C. Findlay, Compusense Inc, Email: cfindlay@compusense.com

Dr. Findlay will take the previous two presentations and help the audience understand that it is not either-or but perhaps what question do I need to answer and what should I know to get the best answer possible. He will challenge current thinking and help elevate a discussion that at one level may seem simple and trivial on the surface.

004-001 Understanding eBeam Technology to Enhance Applications
S. Pillai, Email: s-pillai@tamu.edu

Introductory talk will discuss the core technology underline the low energy, medium energy, and high energy application.

004-002 Electron Beam technology to ensure safety and quality of fresh produce
S. Shayanfar, Texas A&M University, Email: shayanfar@tamu.edu

the talk (15 min) will address how ebeam technology is being used to ensure the phytosanitary and microbiological quality of fruits and vegetables

004-003 Electron beam: a “green” sterilization technology in aseptic packaging
J. Simon, COMET, Email: jeremy.jimerson@cometusa.com

the talk (15 min) will address how ebeam technology is making a paradigm shift in the aseptic packaging world by replacing hydrogen peroxide which has been the mainstay of aseptic packaging for over 50 years

004-004 eBeam technology in the aseptic packaging world
B. Thane, Tetra Pak Inc, Email: brian.thane@tetrapak.com

This brief (5 min) presentation will be part of the panel discussion where current industry users will discuss the technology from their perspective

004-005 Electron beam technology for grocery stores
K. ODonnell-Cahill, Email: kathleen.odonnell-cahill@wegmans.com

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this brief (5 min) presentation will be part of the panel discussion where current industry users will discuss the technology from their perspective.

006-001

Roundtable Panelist

D. Acheson, The Acheson Group, Email: David@achesongroup.com

Food Industry FSMA: Transitioning Final Rules to Operational Reality

006-002

Supply Chain Logistics and FSMA

J. Scimeca, Cargill Inc, Email: Joseph_scimeca@cargill.com

Roundtable component: Logistical challenges of developing a risk-based supply chain program- up and down the food chain

006-003

Foreign Supplier Verification: An Industry Perspective

C. Summers, Email: csummers@costco.com

Symposium Speaker (part 1); Discuss the impact of FSVP rule on importing foods and beverages from foreign suppliers

007-001

Spore Physiology and Resistance of Nonproteolytic Clostridium Botulinum

M. Peck, Institute of Food Research, Email: mike.peck@lfi.ac.uk

Peck will summarize properties of nonproteolytic C. botulinum types B, E and F. This will include properties of their spores, including their physiology and resistance to heat. He will also consider the risk presented to extended shelf-life refrigerated foods.

007-002

Inactivation Kinetics of Nonproteolytic Clostridium Botulinum Spores by High Pressure Processing

G. Skinner, FDA/IFFSH, Email: guy.skinner@fda.hhs.gov

We evaluated large number of Clostridium botulinum types B, E, and F strains and selected the most resistant strains. Skinner will present inactivation kinetics data and associated pressure-assisted D- and thermal D-values.

007-003

The Release of Dipicolinic Acid and the Rate Limiting Step of Endospore Inactivation During High Pressure Sterilization

K. Reineke, Email: kreineke@gnt-group.com

Reineke is involved in research conducted in Germany and will present on dipicolinic acid in C. botulinum spores and its resistance and release during high pressure processing.

007-004

Influence of High Pressures in Combination With High and Low Temperatures on Resisatnce of C. botulinum Spores

B. Cadieux, McGill University, Email: brigitte.cadieux@mail.mcgill.ca

Ramasswamy will present research carried out in Canada on several types of C. botulinum spores inactivation by high pressure processing and their resistance to high pressure and heat. He will discuss about possible influence of high pressures on spores inactivation. This research is co-authored by Hosahalli Ramaswamny, Brigitte Cadieux, Lawrence Goodridge and John Austin.

008-001

Fresh Produce Growers’ Understanding and Implementation of Good Agricultural Practices in Kentucky

H. Khouryieh, Email: hanna.khouryieh@wku.edu

Increased consumption of locally produced food along with outbreaks of food related illnesses has caused concern regarding the safety of food grown for direct to consumer marketing. Through the use of surveys administered to producers at farmers’ markets in Kentucky, the study identified demographic information, and assessed producers’ knowledge of GAPs, microbial contamination, as well as current practices and perceived barriers which may prevent implementation of a food safety program.

008-002

Microbial Quality and Control Strategies of Salmonella and Listeria spp. on Fresh Produce at Farmers’ Markets in Northwest West Virginia

C. Shen, West Virginia University, Email: cangliang.shen@mail.wvu.edu

The presentation will discuss the microbial quality and presence/absence of foodborne pathogens of various fresh produce selling at farmers market in northwest West Virginia and evaluate sanitizing practices to decontaminate Salmonella spp. and Listeria monocytogenes on various fresh produce before selling at farmers’ market.

008-003

Implementation of Novel Technologies to Enhance Farmers’ Market Produce Safety in Texas

S. Sirsat, University of Houston, Email: sasirsat@uh.edu

The investigators worked with small farmers, market vendors, and managers to develop a novel sanitizing station to improve leafy green safety. The sanitizing station was designed using easy to access materials from hardware stores. The investigators also developed smartphone food safety applications for consumers and market managers. The purpose these studies was to recommend scientifically validated practices to farmers, develop educational material for vendors and managers, and hence, improve best handling and safety practices at farmers’ markets to improve overall public health.

008-004

Food and Soil Contamination Associated With Southeastern Michigan Urban Agriculture

Y. Zhang, Wayne State University, Email: Yifan_zhang@wayne.edu

With urban agriculture gaining popularity for improving local and sustainable food systems, the question of food safety has become a growing concern. We have determined the prevalence of major foodborne bacteria, heavy metals, and chemical contaminants in soil and vegetable samples collected from Detroit urban gardens and established linkages among the contaminants. We have also had an opportunity to develop outreach materials based on research findings to provide communities with guidance on how to grow food safely and in a sustainable manner.

009-001

Nutritional Economics and Value-Based Decision Making: A Positive Influence for Health Outcomes (Introduction)

J. Collins, Email: jcollins@croplifeamerica.org

This presentation will highlight work that has been done at IFT as it relates to food value decision-making and nutritional economics.

009-002

ILSI North America’s Food Value Decision Web-Based Tool Developed in Collaboration With RTI and North Carolina State University

A. Kretser, ILSI North America, Email: akretser@ilsi.org

This brief 5 minute presentation will introduce the joint project undertaken by ILSI North America, North Carolina State University and RTI International to develop the Food Value Analysis tool. This will be a brief segue into the next presentation.

009-003

ILSI North America’s Food Value Decision Web-Based Tool Developed in Collaboration With RTI and North Carolina State University

C. Dunn, NC State University, Email: carolyn_dunn@ncsu.edu

The marketplace offers consumers a wide variety of food choices for purchase. Many factors including cost, preparation time, taste, nutrition quality, food safety, shelf-
life, and food waste influence food selections. This web-based application has been developed for use by nutrition educators to evaluate trade-offs between food product attributes in food decision-making. The presentation will present data that looks at factors involved in meal preparation. The database output weighs the key factors that influence whether an individual, for example, chooses to make homemade spaghetti sauce or buy jar sauce. The goal is to provide research to advance public health through the identification of multiple pathways for optimizing food patterns in alignment with current dietary guidance.

009-004
Application of Cost-Benefit Analysis to New and Evolving Food Technologies
P. Jones, Richardson Centre For Functional Foods, Email: Peter.Jones@umanitoba.ca

This presentation will focus on the newly minted field of nutrition economics, which inputs direct and indirect cost savings due to shifts in ingredient intake patterns by calculating monetary valuations for the health benefits realized by such behavior changes. Assessment of how a change in intake of a nutritional ingredient impacts health care expenditures can be evaluated using a multi-step process. These steps include (i) assessment of adoption rate, (ii) evaluation of the disease reduction rate for individuals who adopt the intervention, and (iii) the calculation of the direct and indirect cost savings associated with that disease reduction rate.

Modeling estimates shed light on the economic value of functional foods and ingredients within the marketplace. Being able to derive such valuations is important in communicating the economic benefits of easily achievable change with the use of such food technologies and products by the general public. These valuations set the stage for public policy strategies that advocate healthy behavioral changes to address and manage the challenges of healthcare and societal systems.

009-005
Application of Cost-Benefit Analysis to New and Evolving Food Technologies
J. Jones, Email: jasonjones@r4l.org

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Modeling estimates shed light on the economic value of functional foods and ingredients within the marketplace. Being able to derive such valuations is important in communicating the economic benefits of easily achievable change with the use of such food technologies and products by the general public. These valuations set the stage for public policy strategies that advocate healthy behavioral changes to address and manage the challenges of healthcare and societal systems.

009-006
Call for Implementation of These Approaches in Future Research and Analysis
B. Layden, FoodMinds LLC, Email: blayden@foodminds.com

This presentation will explore new research opportunities in areas which further evaluate food value attributes to meet dietary recommendations and incorporate the analysis of health cost savings into research designs. Such efforts will help to improve public health and quality of life. Education will also play a key role in disseminating these novel approaches.

010-001
Value-Added Components From Acid Whey Using Membrane Filtration Technologies
M. Molitor, Wisconsin Ctr For Dairy Research, Email: molitor@cdr.wisc.edu

This presentation will cover the latest research on application of membrane technologies to isolate/harvest value-added components from acid whey stream.

010-002
Isolation and Characterization of Functional and Sensory Properties of Proteins From Acid Whey
M. Drake, Email: mdrake@ncsu.edu

This presentation will cover the latest research outcome from collaborative industry-funded projects between Cornell University and North Carolina State University. The main topic of presentation is novel isolation techniques for extraction of proteins from acid and their characterization for functional and sensory properties.

010-003
Application of Novel Processing Technologies to Eliminate Acid Whey During Manufacture of Greek Yogurt
H. Patel, Land O’ Lakes Inc, Email: hpate1@landolakes.com

This presentation will cover the latest research on alternative methods and new technologies that have been applied to eliminate acid whey generation during manufacture of greek yogurt. The combination of the technologies applied to solve this problem allows manufacturing of superior quality yogurt with extended shelf-life without generation of acid whey during their manufacture.

010-004
Facing the challenges in Acid Whey Processing
R. Floris, Holland Food Valley, Email: rene.floris@inizo.com

This presentation will discuss how acid whey streams are growing significantly as Greek yogurt is becoming more popular. This results in known considerable challenges, i.e. production of highly hygroscopic and sticky powders and how to apply the large volumes into value-added food applications. NIZO approached the acid whey challenge by building up a detailed understanding of product-process interactions in the acid whey streams to turn these into added-value applications.

Three types of high-lactose low protein acid dairy streams were produced from one batch of skimmed milk on pilot plant scale: (1) casein whey (H2SO4 and HCl acidified), acid whey from (2) quark and (3) Greek yoghurt. The samples were evaporated to different dry matter contents. Viscosity and lactose crystallization were monitored of concentrated acid whey products during controlled cooling cycles and subsequent incubation. Produced powders were characterized on e.g. stickiness and powder flow properties.

The mechanistic understanding gained from these studies will be discussed in this presentation. This knowledge can be used to improve whey (permeate) powders of industrially available inhomogeneous whey streams and/or to identify application areas for acid whey in food in sufficient amounts resulting in added functionality and/or ingredient cost reduction.

011-001
Sustainability of Insect and Algae Proteins for Food and Feed Purposes
A. Mathys, Email: alexander.mathys@hest.ethz.ch

Insects and algae are two protein sources, which are progressing rapidly in food and feed. Great variety of these species and multiple possibilities of their growing, harvesting and processing create options for claiming them to be more sustainable than traditional protein sources. This presentation will reveal the comparative advantages of insect and algae protein use for food and feed purposes based on Life Cycle Assessment (LCA) results of real industrial and modeled data.

011-002
Land Use Impact of Alternative Protein Sources
R. Floris, Holland Food Valley, Email: rene.floris@inizo.com

It is generally accepted that plant proteins are more sustainable than animal proteins. However, understanding the sustainability implications of plant proteins with respect to each other is less well known. Starting from the search for local alternatives for soy protein we focus on land use of various alternative protein sources. Based on crop yield and protein content the protein yield per land use was calculated. This analysis covers the major protein crops, but also alternatives such as algae, duck weed and insects, although insects are not plants and should be compared to other animals.

011-003
Sustainable Meat from Farmed Cells
U. VALETI, MEMPHIS MEAT, Email: uma@memphismeats.com

Instead of farming animals to obtain their meat, Memphis Meats is farming the meat directly from cells. We’re combining decades of experience in both the culinary and scientific fields to farm real meat cells - without the animals - in a process that is healthier, safer, and more sustainable than conventional animal agriculture.

011-004
Role of Pulses in Global Nutrition
D. Menses, Ph.D., Email: nicolas.meneses@buhlergroup.com

Meat substitutes containing peas, pasta enriched with Chlorella protein, black soldier fly meal as sustainable feed for aquacultures: In order to supply a growing global population with high-grade protein, new and innovative approaches are required today. By the year 2050, we will need 265 million tons of additional proteins a year. Alternative protein sources such as pulses, algae, or insects will soon play a key role in feeding humans and animals alike. Buhler is developing the industrial-scale solutions for processing them. In this talk we will focus on the role which pulses can play in global nutrition, changing consumer preferences from East to West. Also we will address open
questions to be solved by the food processing industry and what role Buhler can play to help overcome those challenges. Particular solutions for incorporation of pulses into products such as breads, snacks and pasta, as well as in meat alternatives are presented.

012-001
The Role of Statistics in Risk Management
T. Carr, Email: tom.carr@carrconsulting.net
A discussion of the importance of properly aligning statistical applications and the sensory methodology to the overall test objectives. Ultimately the statistical results should be reviewed in a role of guiding decisions to mitigate risk and not dictating conclusions.

012-002
N. Rodriguez, Food Mktg Support Svcs Inc, Email: nancy.rodriguez@fmssinc.com
Descriptive methodologies are central to risk minimization in all phases of the innovation, design, development, and production cycles. Descriptive application options are robust - rich in opportunities to hone concepts, define marketplace gaps and opportunities, gather competitive intelligence on a global level, construct relevant stimuli for qualitative consumer insight and design modeling purposes. Descriptive techniques can be used to track product evolution from protocel phase through development, specification design, in-plant quality training and maintenance, as well as, shelf-life.

012-003
Consideration of Product Variability in Risk Management: A Case Study
J. Fountain, Alttria Client Services, Email: Janine.L.Fountain@alttria.com
It is with some frequency that ingredients or processes require changes, leaving the sensory experience of your product in subsequent jeopardy. A multitude of approaches exist to manage the risk associated with product maintenance initiatives – discrimination testing, descriptive analysis, affective testing, etc. Too often the approaches we use to manage our sensory risk are based on the assumption that the product experience is static, when in fact it may be variable. This variability is not necessarily problematic, but it may not be well understood and not incorporated into current testing approaches. Developing an understanding of the inherent variability in your products can help you minimize the incidence of false-positives and better manage true sensory risk. The approach we are recommending can be utilized to not only track product variability on an ongoing basis to establish norms, but also used on an ad-hoc basis to mitigate sensory risk of individual initiatives.

012-004
The Role of Sensory and Consumer Science Beyond Statistics
A. Williams, PepsiCo, Email: alexa.williams@pepsico.com
A discussion of additional knowledge, insights, and direction that Sensory and Consumer Science can contribute to assure that risk assessment is is viewed and managed in the proper perspective

012-005
How do we predict sensory risk (marketplace performance) of new products and product changes
M. Jeltema, Email: melissa.jeltema@theaudigroup.com
Examples from a tenured career on how this question has been addressed, and also the types of testing that can be used to predict marketplace risk

013-001
Regenerative Antimicrobial Coatings for Food Processing Surfaces
J. Goddard, Cornell University, Email: goddard@cornell.edu
Cross-contamination by pathogenic and spoilage organisms from food contact and non-contact materials present in food processing environments remains a significant challenge to food safety and quality. To improve the sanitation of such surfaces to be cleaned and other factors. This presentation will examine the considerations and challenges associated with removing allergenic food residues from food-contact surfaces.

013-003
Understanding Microbial Attachment and Detachment to Produce Surface During Washing
D. Salvi, Email: salvi@aesop.rutgers.edu
Multiple cases for foodborne pathogens outbreaks on fresh produce has been reported in recent years. Since most of the fresh produce is consumed raw or without any processing/kill step to inactivate harmful pathogenic microorganisms before consumption; ensuring safety of these products during washing is of prime interest. Various researchers have investigated factors affecting attachment and detachment of the microorganisms to produce during washing to understand cross-contamination, experimentally and numerically. Microorganism characteristics (strain, shape, ability to form biofilm, etc.), produce characteristics (shape, surface topology, type, etc.), flow conditions (laminar or turbulent), organic load, and use of surfactants are reported to influence the attachment or detachment mechanisms. In this presentation we will summarize the current state of science in terms of the mechanisms involved and quantitative predictive models that have been developed and also present our view on the future research direction which would be beneficial to both industry and academia.

013-004
Engineered Water Nanostructures: A Chemical Free, Nanotechnology Based Method for Inactivation of Foodborne Microorganisms
P. Demokritou, Harvard University, Email: p.demokritou@hsph.harvard.edu
We investigate the effectiveness of a novel, chemical free, nanotechnology-based method for the inactivation of pathogenic and spoilage microorganisms on the surface of fruits and vegetables method using Engineered Water Nanostructures (EWS). EWS are synthesized by electro spraying and ionizations of water and it was recently shown that they possess unique physico-chemical and biological properties. More importantly, EWS can interact with and inactivate microorganisms on both air and surfaces, reducing risks for foodborne disease and extending shelf life of fresh produce.

013-002
Global Challenges of Food Fraud (and EMA) Hazards and Preventive Controls
J. Spinck, Email: spinkjj@cvm.msu.edu
This session will describe global food fraud challenges and anti-counterfeit strategy, and focus on current global initiatives in Food Fraud (and EMA) hazards analysis and preventive controls.

014-001
The Food Fraud Database: A Tool to Support EMA Hazard Analyses
K. Everstine, US Pharmacopeia, Email: kde@usp.org
The speaker will present an overview of the new Food Fraud Database and its application in identifying EMA-vulnerable ingredients and hazards based on published reports. The new Food Fraud Database includes enhanced features for searching and graphing capabilities and supports industry and government use for conducting EMA hazard analyses. The speaker will also address the need for a user-friendly platform for individual companies to create tailored quantitative risk assessment and ranking models for food ingredient EMA vulnerability.

014-002
An Innovative Approach to Carry Out and Document EMA Hazard Analysis and Control
J. DeVries, US Pharmacopeia, Email: drj.devries@devriesassoc.com
The speaker will present on how to assess the vulnerability of ingredients and processes to EMA and how to use the Food Fraud Guidance Tool to systematically evaluate vulnerabilities and establish mitigation programs. The speaker will also discuss how to use the USP Food Fraud Mitigation Guidance as an innovative approach to carry out and document EMA hazard analysis and control.
014-004
Implementation of Hazard Analysis and Preventive Controls for EMA Involving Food Allergens
S. Gendel, Email: steven.gendel@iehinc.com
The detection and characterization of EMA involving food allergens is particularly complex because of the many different foods that are allergens and the many ways that they are used as ingredients. The recent problem with peanut protein in spice shows how difficult it can be to characterize allergen EMA and to rapidly adapt existing methods when new problems emerge. The speaker will discuss the importance of developing appropriate sampling and testing protocols, understanding how existing tests can be used effectively, and identifying critical gaps in our analytic capabilities related to food allergen EMA.

014-005
Food Chemicals Codex: A Food Standard Applicable for Developing Preventive Controls and Verification Procedures
L. Chen, US Pharmacopeia, Email: lzc@usp.org
The speaker will present an overview of the modernized FCC standard, what aspects are considered when USP modernizes FCC, and the major changes during the modernization. The speaker will also discuss the potential applications of the modernized FCC standard in the preventive controls and verification procedures of the Food Safety Plan required by FSMA’s Preventive Controls Rule, as well as the potential usage of the modernized FCC standard in supply-chain program, foreign supplier verification program, and to address other issues related to FSMA.

016-001
The Design and Implementation of Online Programming to Meet Diverse Learners’ Needs
N. Fortin, Institute for Food Laws & Regulation, Email: fortinne@anr.msu.edu
Design strategies used for the development of a Global Food Law curriculum from individual courses, a defined certificate program, and a master’s degree program for meeting the present and future needs of the food industry, regulatory, law, and government.

016-002
The Design and Utility of an Online, Research-Based Master’s Program
M. Wilkins, Email: wilkinsm@msu.edu
Dr. Wilkins will discuss the Online Master of Science in Food Safety program and ways online learning can be integrated into professional educational degree programs while maintaining rigor and meeting traditional graduate-level requirements such as mentored research projects.

016-003
The Value and Challenges in Online Professional Degrees While Working Full Time
M. Baum, Feeding America, Email: mbaum@feedingamerica.org
As a graduate of the MSU Online Master of Science in Food Safety program, she will share some of the challenges encountered by students in pursuing an online degree and how her education and degree have personally and professionally assisted both her and her career.

016-004
The Value and Challenges of Obtaining a Second Professional Degree When You Already Have a Career
A. Khoury, Nestle/Student, Email: amjad.khoury@us.nestle.com
This will be a discussion on the challenges and benefits of pursuing professional educational certificates and degrees and how an understanding of the law has helped him to become a more effective advocate for his employer.

016-005
What’s In It for the Company? How Advanced Education for Employees Helps More Than Just the Employee
J. Heine, Kalsec Inc, Email: jheine@kalsec.com
The presenter will discuss what participation in the various educational programs has meant from the standpoint of an employer and the significant benefits received from professional educational programs by both the employee and the employer.

017-001
Panel Discussion
J. McEntire, Grocery Manufacturers Assn, Email: jmcentre@gmaonline.org

017-002
Panel Discussion
R. Clemens, USC School of Pharmacy, Email: Clemens@usc.edu

017-003
Panel Discussion
J. Fideler, North Carolina State University, Email: fidelerj@gmail.com

018-001
Culinology In Action: How Restaurant Chefs Are Using Functional Ingredients to Drive Menu Trends
C. Proper, Research Chefs Association, Email: Catherine.Proper@savealot.com
Fried mayonnaise? Nitro Popcorn? Edible Menus? This session on the expo floor (floor kitchen?) will showcase how Culinology, the blending of Culinary Arts and Food Science, is being utilized by today’s top chefs to drive menu innovation that will inspire the next phase of consumer packaged goods products. As you look to drive your business through innovation you are likely looking at restaurant trends to determine the next new consumer packaged goods item that will keep you ahead of the competition. This session will take a live look at how restaurant chefs are applying commercial functional ingredients to their menus for innovative plate presentations and can’t-miss menu items. The presentation will progress to how these menu items can translate to commercializable goods for the mass market. We will review the Culinary Gastronomy ingredient toolbox and techniques and how these might translate to full-scale production.

018-002
C. Warsow, Bell Flavors & Fragrances, Email: jellegood@bellff.com

018-003
J. Draz, Email: drazecceccerc@miniat.com

019-001
Science Versus Sensationalism and Soundbites: How Can Consumers Make More Informed Choices?
J. Rousseau, University of Capetown, Email: jacquesrouseau@ift.org
Consumers have a history of being cautious in adopting technological innovations in food. Pasteurised milk took years to gain acceptance, and some consumers still use words like ‘Frankenfood’ to describe genetically altered products that have been with us for decades, never mind newer innovations such as AquAdvantage salmon. However, the reasons why people fear innovation with regard to food are frequently not grounded in good scientific reasoning, but are instead motivated by misunderstanding or ignorance of the science, as well as a number of logical fallacies and psychological biases. These problems are exacerbated by a number of factors, including advocacy groups who care less for good science than for sensationalism; “churnalism”, where press releases fail to convey the complexities of the science; and how difficult it can be for members of the public to differentiate science from pseudoscience. Examples of technological innovation in food and related debates will be used to identify and clarify the distinguishing features of good science, pseudoscience, and effective and ethical science communication, in order to assist scientists and science communicators to help consumers understand the ways in which they might be prone to be misled, and to provide them with resources that will make them better able to evaluate scientific claims in order to make more informed decisions.

020-001
Dietary Guidelines Recommendations Impact Human Health and the Food Industry
W. Campbell, Email: campbellw@purdue.edu
This presentation will identify the major recommendations of the Dietary Guidelines Advisory Committee and provide insights and perspectives on impacts and challenges for the food industry.

020-002
Major Food Trends and Consumer Behavior in the Retail Marketplace
E. Sloan, Email: lizsloan@sloantrend.com
This presentation will identify the major food trends and consumer behaviors in the retail marketplace today.

020-003
C. Adams Hutt, Rdi Solutions, Email: cadams@rdi-sol.com
This presentation will compare and contrast consumer behaviors and major trends at retail and foodservice with recommendations of the Dietary Guidelines. We will discuss how consumer behaviors have and have not been impacted by policy recommendations and what may come next, and what the food industry needs to do to prepare for and take advantage of the opportunities provided by the Dietary Guidelines for Americans.

021-001
Novel Membrane Technologies for Separation and Fractionation
K. Schroen, Wageningen University, Email: karin.schroen@wur.nl
Microfiltration could be used much more efficiently if particle behavior were taken as a starting point. We will show how shear induced migration and particle skimming can positively affect membrane microfiltration and fractionation, and show results obtained with a metal sieve with pores that are much larger than the particles, and link that to observations with microfluidic devices. The main conclusion is that only the process conditions determine the particles size in the permeate. The process can be carried out at high flux, without particle accumulation, and at much lower energy input.

021-002
Megasonics for the Separation and Fractionation of Food Components
K. Knoerzer, CSIRO, Email: kai.knoerzer@csiro.au
In recent years the use of high frequency ultrasound for droplet or cell separation from biomass has emerged outside the microfluidics space into the liter to industrial scale applications. The principle for this separation technology (also called Megasonics) relies on the differential positioning of individual droplets or particles across an ultrasonic standing wave field within the reactor and subsequent biomass material predisposition for separation via rapid droplet agglomeration or coalescence into larger entities. Large scale transducers have been characterized with sonochemiluminesce and pressure characterization methods to enable better reactor designs. High frequency separation technology has been demonstrated at industrial scale for oil recovery in the palm oil industry and at liter scale to assist olive oil, coconut oil or milk fat separation. Other applications include algal cell dewatering and milk fat globule fractionation. Frequency selection depends on the material conformation in the biomass mixture and higher frequencies have proven preferable for better separation of materials with smaller sized droplets such as milk. For palm oil, olive oil and milk, separation has been demonstrated within the sound region of high free radical production without detectable impact on product quality.

021-003
Scale-Up and Optimization of Supercritical Carbon Dioxide Extraction Coupled With Subcritical Water Extraction Applied to Food Processing
J. King, University of Arkansas, Email: kingjw100@hotmail.com
Modern supercritical fluid extraction (SFE) – primarily with compressed CO2 – coupled with low pressure compressed sub-critical water extraction (SWE) allow the extraction of a wide spectrum of beneficial food ingredients, and in some cases, beneficial reaction conditions to produce higher-value ingredients from low cost, bio-renewable materials such as food-related bio-polymers. A particular emphasis will be placed on conditions applicable to producing specifically designed food-related products applicable to the nutraceutical/functional food marketplace such as antioxidants.

021-004
Low Energy Concentration Using Forward Osmosis
K. DeSilva, CSIRO, Email: Kirthi.Desilva@csiro.au
Efficiency of drying is significantly improved when the solids content of the feed stream into the dryer is increased and this is often achieved by thermal evaporation. Forward osmosis (FO) is a technology currently being developed for waste water treatment and desalination, but its potential application as a cost effective concentration technology has not been fully explored by the food industry. This presentation will focus on the development of FO as an alternative concentration technology to thermal evaporation in dairy applications and assess its cost benefit.

022-001
Detecting and Determining Toxicological Effects of Ingredients to Contribute to Food Safety
M. Holsapple, Institute for Food Laws & Regulation, Email: holsappl@msu.edu
Dr. Michael Holsapple will cover the scientific endeavor of toxicology, going over what toxicology research can and cannot answer about food ingredient risks and introducing some initial research plans that are emerging from the CRIS at Michigan State University.

022-002
Effective Strategies to Communicate ‘The Science’ About Food Safety to Consumers and Regulators
C. Arnot, The Center for Food Integrity, Email: charlie.arnot@foodintegrity.org
Dr. Charlie Arnot will discuss strategies for effective risk communication about food safety. He will specifically focus on why consumers so often seem to misinterpret and misapply toxicological risk, and how to effectively use scientific information and still connect with consumers.

022-003
GRAS: What It Is and How We Got Here
N. Fortin, Institute for Food Laws & Regulation, Email: fortinne@anr.msu.edu
Neal Fortin will cover a confusing area of law that pertains to toxicological risk – GRAS designation of ingredients – and explain how the current regulatory system evolved and the ways it is effective and ineffective at achieving clarity on the risks and regulatory status of food ingredients.

023-001
What’s New in Clean and Clear Labeling in 2016
L. Williams, Innova Market Insights, Email: luann.williams@innovami.com
“From Clean to Clean Label” was identified by Innova Market Insights as the number one trend for 2015, recognizing that it is no longer a niche area for the food and drinks industry. “Clean label” focuses on greater transparency, both through the heightened use of origin claims, and indeed through the adoption of transparent packaging in the aftermath of major supply chain scandals. Manufacturers have responded to the clean label demand. According to Innova Market Insights data, 20.7% of US products tracked in 2014 featured a “no additives/ preservatives;” “natural” or “organic” positioning; up from 16.7% in 2013. But there has been a steady rise in clean label launches for years, with just 7.9% of products tracked in 2008, featuring one of these positions.

023-002
Clean Label Formulation Using Fiber and Proteins From Ingredients Such as Flax, Quinoa, Oats, Chia, and Whey Proteins
A. Ambadekar, Glanbia Nutritional, Email: aambadekar@glanbia.com
Consumers want to recognize ingredients that are used in food formulations. Research has been done to create clean label ingredients that are recognized by the consumer and provide texture, viscosity, structure, and other desired functional attributes. Fiber and proteins originating from ingredients such as flax, quinoa, oats, chia, and whey can provide nutrition and functional characteristics that result in clean label, good tasting and nutritious food products. These ingredients can be applied to muffins, cakes, cookies, tortillas, breads, nutritional bars, fresh dairy, and other applications.

023-003
Formulating Texture and Stability Using Clean Label Hydrocolloids
D. Grazzitis, Email: dgrazzitis@itcigums.com
The clean label trend has forced many commonly used hydrocolloids to be reformulated using unmodified hydrocolloids. This has opened the door to look further into blend synergies and exploring into new applications will be covered, followed by a case study in a beverage application to show how clean label hydrocolloids can be used successfully.

023-004
Clean Label Solutions for Industrial Baking
G. Feng, Corbion, Email: guohua.feng@corbion.com
Industrial baking made possible for consumers to enjoy the high quality and fresh bakery products at very affordable cost. The technologies that support the industrial baking are a group of functional ingredients or additives. It is these additives that make it possible for the flour dough to go through the high-speed production machines, while maintaining a consistent and fresh quality product to the consumer. However, the current clean label consumer trend has made some of these very functional additives unfavorable to consumers’ acceptance. There is a strong demand from consumers to remove these additives from the ingredient list. The presentation will try to address the challenges in replacing these chemical additives, such as the chemical dough conditioners, chemical crust softeners, and chemical preservatives, as well as the clean label alternatives. We will discuss the some of the most current technologies and ingredients that can be clean label solutions for baking industry. Showing some
Designing Clean Label Bakery Products: The Conversation Moves On!  
M. Beavan, Watson Inc, Email: mike.beavan@watson-inc.com
This session will cover the market trend of clean labeling in bakery and provide options for ingredients based on cultured flours, natural emulifiers, enzymes, mechanically modified fibers, and whole grains to create flavorful, textural, and healthful baked products.

Consumer Insights: The Demand for Healthier Ingredients  
D. Sprinkle, Email: dspinkle@marketresearch.com
David Sprinkle, the publisher of Packaged Facts, will discuss the latest data on the consumer’s perspective on healthier foods, ingredients and how this relates to their buying practices. New data on labels, types of information on labels, and how consumers use them will be discussed.

New Guidelines, New Science on Fats and Oils  
P. Kris-Etherton, Email: pmk1@psu.edu
Dr. Penny Kris-Etherton will discuss the new US Dietary Guidelines and the scientific rationale for the recommendations, including some of the controversial elements on fats and oils. As chair of the AHA Nutrition Committee, she will explain how the Guidelines review affects the policies other major scientific groups. She will also review the latest science on fats and oils and the emerging roles of various fatty acids in the diet.

Better Labels, Better Function with New Generation Oils  
D. Booher, Email: DMBooher@dow.com
David Booher will delve into the industry’s perspective on how continued innovation is creating new oil solutions for health, functionality and cleaner labels. A greater toolbox of solutions is allowing industry to not only remove the last remnants of trans fats, but improve the healthier fat profile and the functionality and taste of products. Examples will be provided to show how industry can deliver the whole “package” to healthier foods and snacks.

The Impact of Pulse Ingredients in Extrusion Processing for Snack Food Development  
G. Ganjyal, MGP Ingredients Inc, Email: girish.ganjyal@wssu.edu
Pulse ingredients are a good source of nutrients. Each of the components of the pulses, including starch, protein, and fiber has a significant impact on the final extrudate quality. This presentation walks through the impacts of each of these components in extrusion processing. Strategies for developing extruded snacks with pulse ingredients will be discussed.

Using Starch-Based Texturizer to Deliver Product Differentiation and Enhanced Texture in Healthy Baked Sheeted Snacks  
M. Yurgec, Ingredion Incorporated, Email: matt.yurgec@ingredion.com
This presentation will discuss how snack product quality suffers when fat is reduced going from a fried to a baked snack, such as a traditional fried tortilla chip versus a baked tortilla chip. This presentation will explore how starch ingredient technology can be used to deliver enhanced and differentiated texture, such as longer lasting crunch or increased dissolvability, in a baked tortilla chips.

Understanding of Food Oral Processing Is Essential to Design Innovative Snacks  
H. Koc, PepsiCo, Email: hicran.koc@pepsico.com
This presentation will explore how the emerging field of oral processing can be utilized to understand differences in how a consumer breaks a product down in the mouth and use this knowledge in the product development process. In addition to process and ingredient knowledge, understanding of food oral processing will enable the tools to design novel textures and also develop healthier snacks without compromising texture.

Research in Advanced Thermal and Nonthermal Technologies: Opportunities and Pitfalls  
S. Sastry, Ohio State University, Email: sastry.2@osu.edu
Much research has been conducted in recent years on alternative processing methods, including thermal and nonthermal technologies. Yet, much activity is of an applied nature. If these technologies are to progress significantly, deeper and more fundamental understanding will be necessary. This discussion will cover research opportunities in this area, together with the difficulties and pitfalls associated with the same. For example, research on high pressure is limited by lack of access and sensors that function within the process environment. Pulsed electric field processing is challenged by difficulties in monitoring spatial distribution of field strengths, while the extreme transient nature of the process poses major measurement challenges. Yet, these challenges may be seen as opportunities to develop new methodologies that may apply not only to foods but represent a contribution from food engineering to the larger world of processing and engineering.

Application of High Pressure Based Technologies in The Food Industry: Present Status and Future Prospects  
V. Balasubramaniam, Email: balasubramaniam.1@osu.edu
Over the past two decades, food manufacturers have gained experience in various industrial application of nonthermal processing methods, particularly high pressure based technologies. These technologies satisfy the health conscious consumer demand for fresh tasting foods with minimal or no chemical preservatives. Through originally introduced as a food safety technology, the creative application of high pressure led to the opportunity to preserve foods with cleaner ingredient label, the potential to reduce salt, fat or sugar in formulated products, or nutrient infusion. By creatively controlling the intensity of pressure treatment with advanced thermal or other nonthermal methods will enable the preservation of extended shelf-life, shelf-stable foods as well as freezing and thawing of foods. Development of high pressure homogenization, a pressure based continuous flow process, allows for preserving novel formulations of beverage products without destroying health promoting bioactive compounds. This presentation will review the current status and future potential applications of high pressure based technologies in the food industry. The importance of continuing fundamental studies that aid in the future development of next generation of nonthermal based technologies for industrial use will be highlighted.

Designing Polymer Packaging for Advanced Food Processing Technologies  
S. Sablani, Washington State University, Email: ssablani@wsu.edu
Advanced microwave and high-pressure processing technologies show great promise for maintaining food quality and food safety. Many studies over the past two decades have aimed to improve these processes. Recent advances in processing technologies highlight the urgent need for flexible packaging that is compatible with new processing technologies. The commercial success of microwave and high pressure processes for food processing depend on high performance, flexible and food process compatible. Structural properties must withstand these processes and remain stable during storage. This presentation will highlight some of the efforts being made for the design and development of high performance polymer packaging for advanced food processing technologies.

Vitamin D and 25 Hydroxy Vitamin D Content of Selected Foods  
J. Roseland, USDA-ARS-Nutrient Data Lab, Email: janet.roseland@ars.usda.gov
To make accurate Vitamin D intake assessments, accurate and complete data are necessary. The USDA Nutrient Data Laboratory maintains a database of Vitamin D content of foods. Vitamin D intake assessments may be incomplete without including 25(OH)D. Recently, NDL coordinated a study of analytical methodology measuring 25 hydroxy vitamin D (25(OH)D) in foods. Also, as Vitamin D content of foods changes, it is important to keep the database up to date. The presenter will talk about the analytical study, how dietary assessments are made, and maintaining current data, especially on Vitamin D.

Measuring Vitamin D and Vitamin D Metabolite Concentrations in Food Using HPLC and LCMSMS  
J. Shippas, Email: Jeffrey.Shippas@cavance.com
Vitamin D and 25-OH vitamin D are generally found in only low amounts within most natural foods. Chromatographic interferences within these foods there are often encountered when using HPLC separation. This interference also presents a problem with LCMSMS analysis, due to a significant number of isobaric interferences often
encountered. Combining the low limits of quantitation required with a multitude of potential interferences makes analysis of Vitamin D and metabolites in foods particularly challenging.

027-003
Yeasts: A Suitable Vehicle for Vitamin D Fortification of Bread and Baked Goods
J. Côté, Lallemand/Macco, Email: jfcote@lallemand.com

Lallemand recently developed a new process to increase the amount of Vitamin-D2 (ergocalciferol) in conventional Saccharomyces cerevisiae baker’s yeast. Similar to the conversion in skin, yeast exposed to UV-B light will convert endogenous ergosterol to Vitamin D2. The company characterized the Vitamin D2 baker’s yeast to ensure its safety and functionality, the stability and bioavailability of the Vitamin D it contains. The results show that the new yeast product is in conformance with specifications applicable to Vitamin D2, provides a convenient and safe method to enhance the Vitamin-D content of baked products, it has the same baking performance, and no genetic modification or alteration occurs in the photo-chemical reaction. Bioavailability studies showed that bread baked with Vitamin D2 containing yeast could significantly increase the 25-Hydroxy Vitamin D serum level in human, and improve trabecular and cortical bone health in rats. Lallemand submitted a petition to the FDA and in 2012 the FDA amended the food additive regulations to provide for the safe use of Vitamin D2 baker’s yeast as a source of Vitamin D2 and as a leavening agent in yeast-leavened baked products. Lallemand also submitted a novel food dossier in Europe which in 2014 resulted in the publication by the European Food Safety Authority of a positive opinion on the use of Vitamin D2 rich baker’s yeast and the granting of a marketing authorization for Vitamin D2 baker’s yeast.

028-001
Application of Cultivable Enteric Viral Surrogates to Determine Inactivation by Processing Approaches
D. D’Souza, Email: ddsouza@utk.edu

Foodborne viruses have gained immense attention in the recent years due to the increasing number of foodborne viral outbreaks. Improved methods to prevent, contamination and control their spread continue to be researched. However, due to the inability to reproducibly cultivate human noroviruses in the laboratory, cultivable surrogates have been used to determine survival characteristics and inactivation by various processing methods. As previously known and reported, finding a single ideal surrogate that is a suitable candidate for all methods as in a “one-size fits all scheme as a universal surrogate,” remains challenging. Therefore, the behavior of the various surrogates used in research by various processing conditions will be discussed.

028-002
Non-Pathogenic Surrogates for Application of High Pressure Processing
J. Dickson, Iowa State University, Email: jrdickson@iastate.edu

HPP is a well-established post packaging intervention to reduce the probability of foodborne pathogens in various foods. As the application of this technology grows, it is imperative that processors are able to validate the effectiveness of their processes. Currently, there are no established non-pathogenic surrogate bacteria which can be used for process validation. The objective of this presentation is to discuss the identification of surrogates, from their physiological characterization to their validation of appropriateness for high pressure processing.

028-003
Critical Parameters in Identifying Useful Pathogen Surrogates for Foodborne Pathogens For Control by Chemical Food Preservatives
T. Taylor, Email: matt_taylor@exchange.tamu.edu

While some data are available linking foodborne pathogens with non-pathogenic organisms as pathogen surrogates for food antimicrobial/preservative-based food safety protection, the foods industry remains in need of recommended practices and procedures for the identification and utilization of pathogen surrogates when chemical food preservatives are used as the preservation technology or used in concert with other processes. Additionally, consumer trends towards clean label packaging and foods have resulted in greater interest in non-traditional antimicrobial preservatives being tested. This session will identify the critical considerations that must be determined prior to the initiation and completion of a food safety intervention validation that incorporates the use of a non-pathogenic organism as a surrogate for pathogen(s) of concern in a food product. The presenter will also discuss methods of antimicrobial tolerance testing which may be used to identify possible surrogate organisms which may then be used in food process validations either in research laboratories which simulate a commercial process, or a commercial pilot or industry process.

028-004
Utilization of High Hydrostatic Pressure to Preserve Food Safety: An Industry Perspective
L. Johnson, West Liberty Foods, Email: lee.johnson@wilfoods.com

The presenter will participate as a panel member but will not give a formal presentation. Will participate in panel to counter, supplement, and inform on industry concerns in the implementation of non-thermal processes per audience questions.

029-001
Using Tribology in Product Design
S. Baier, PepsiCo Inc, Email: stefan.baier@pepsico.com

Eating or oral processing is a dynamic process that involves mastication, mixing of food with saliva, and swallowing involving deformation (rheology) and lubrication (tribology) processes, which result in a series of sensory attributes. Although tribology has become a recognized tool in the study of texture and mouthfeel perception, most work still focuses on a linear correlation between lubricating properties of an intact food specimen and sensory attributes. Since oral processing is a highly dynamic process and the food undergoes multiple changes, it is important to realize that tribology is just one of many in vitro techniques that can provide important insights in the design of food and beverages.

029-002
Sensory and Structure-Function Analysis in Development With Co-Texturizers
C. Gregson, Ingredion Incorporated, Email: christopher.gregson@ingredion.com

Knowledge of microstructure, and rheological functionality, sensory properties, and consumer trends enables rational food texture design by bridging the gap between formulation/process and sensory performance. However, foods are often complex multiphase microstructures, so determining the role of specific ingredients in modulating rheology and sensory performance and consumer acceptance can be challenging. In this work we use a combination of sensory profiling, consumer association and structure-function analysis to provide a predictive understanding of co-texturizer performance.

029-003
Sensory and Structure-Function Analysis in Development With Co-Texturizers
L. Jegede, Email: layo.jegede@ingredion.com

Knowledge of microstructure, and rheological functionality, sensory properties, and consumer trends enables rational food texture design by bridging the gap between formulation/process and sensory performance. However, foods are often complex multiphase microstructures, so determining the role of specific ingredients in modulating rheology and sensory performance and consumer acceptance can be challenging. In this work we use a combination of sensory profiling, consumer association and structure-function analysis to provide a predictive understanding of co-texturizer performance.

029-004
Flash Profiling: A Valuable Tool to Drive Product Development in a Resource Limited Environment
M. Jackson, Sweet Green Fields LLC, Email: mjackson@sweetgreenfields.com

In a small company with limited resources and limited access to professionally trained panels it is often difficult to acquire statistically meaningful data that can drive product development decisions. Flash Profiling is a way to use panelists in sensory experiments who have varied expertise and descriptors and make sense of it so that a common result is found. Flash profiling provides a 2-dimensional “sensory space” in which data can be displayed in a directly comparative coordinate way. This allows for decisions to be made based upon data that would not normally be easily analyzed and understood and potentially allows for a more consumer driven product development program.

029-005
The Application of Tetrad Testing: How This Discrimination Tool Can Benefit the Development Process
J. Kamerud, General Mills, Email: Jennifer.Kamerud@genmills.com

A discussion of the application of the Tetrad overall difference test in a business setting. Setting up the discussion, presenters will address the basics of Tetrad – when to use it, its benefits and watch-outs, touching on comparison/contrast with other Discrimination Methods. The perspective of product developer will come into play in application and utilization within the process. Group discussion and dynamics will then address specific questions, clarify misunderstandings and other possible application situations.

030-001
Nutrition and Food: An Obvious but Little Appreciated Partnership
C. Weaver, Purdue University, Email: weavercm@purdue.edu

Nutrition is delivered through diet. Food production and selection is largely aimed at meeting nutritional needs for growth, maintenance, and health. When the food supply
does not take into consideration the health of consumers, there are consequences. When public health policies related to diet are developed without an understanding of food, they may not be translatable. So why has research and training in nutrition and food science practically divorced? The result is a population who knows little about how to feed themselves for optimal health. The speaker has spent her career at the interface of food science and nutrition. The rewards have been rich.

031-001
Case Studies in Commercial Products
C. Tonello, Hiperbaric, Email: c.tonello@hiperbaric.com
This presentation will outline details of commercializing products preserved with HPP.

031-002
Clostridium Difficile Spore Germination by High Pressure
P. Setlow, UCONN Health, Email: setlow@hsa2.uconn.edu
This presentation will outline research on findings of C. difficile by HPP using population and single spore methods.

031-003
Synergistic Inactivation of Non-Proteolytic C. Botulinum Spores by High Pressure Thermal Processing: Challenges and Opportunities
S. Olivier, CSIRO, Email: sandra.olivier@csiro.au
Part of the successful commercialisation of high pressure thermal processing for the safe shelf-life extension of low-acid, chilled foods relies on demonstration of synergistic inactivation of spores of non-proteolytic C. botulinum. In this presentation Sandra will share research conducted in Australia that has aimed to meet this objective as well as other findings with respect to spore resistance and strain response variation that have raised important questions regarding meeting food safety objectives whilst still delivering a sufficiently mild process that maximises product quality.

032-001
What I Learned in my First Six Months on the Job
L. Zhao, Burdock Group, Email: rivera@burdockgroup.com
Dr. Lu Zhao will discuss his past work in academia and industry in both China and the United States, and give the audience key takeaways and suggestions for navigating internships, academic studies, as well as the transition from academia to the workplace. He will also discuss advice for students and young professionals seeking to study and work internationally, and best practices for cultural integration in the classroom and the office.

032-002
From Academia to Industry: What I Gained from Past Extracurricular Experiences
W. Wang, Burdock Group, Email: rivera@burdockgroup.com
Working in academia and industry requires a diverse skill set to navigate through research assignments and extracurricular activities, all on top of completing your academic studies. Dr. Wang will give a brief background of her experience of college study in Beijing and doctorate education at University of Illinois at Urbana-Champaign. She will introduce what she learned from extracurricular activities, internship and project for top players in industry. She will provide the audience with advice to balance academic and occupational work and guidance for transitioning from academia to industry.

032-003
From Industry to Academia: Successful Stories
P. Lu, Email: peter.lu@abbott.com
Food industry is a fast-paced, market-driven business built upon bright talents. Successful collaborations between educators and industry professionals can keep curriculum relevant and further strengthen Food Science core competencies. From a graduate student’s initiative to Department-wide program, Dr. Lu will share successful stories from the past 10 years throughout his career as a graduate student, postdoctoral fellow, university instructor and industry professional.

033-001
Expect the Unexpected: Lessons Learned From a Career in New Product Launches
J. Farinella, Imbibe, Email: jfarinella@imbibeinc.com
During this session, Joe Farinella of Imbibe will walk through numerous case studies of challenging new beverage launches and share his experiences and lessons learned.

He will also provide critical insight into how to prevent last-minute surprises, as well as reveal strategies to quickly and accurately identify the root cause when problems inevitably arise.

034-001
Telling the Story of Science in an Age of Misunderstanding
B. Goldacre, Email: bengoldacre@ift.org
In today’s society, consumers are overwhelmed with claims of miracle cures and sinister hidden scares, particularly in food. But how do they know if those claims are true? And how can the evidence be twisted? Ben Goldacre charges through the history and magic of evidence based science, using examples of bad science... to explain how good science really works.

035-001
Consumer Panel: A Clean Label Revolution
P. Metz, Email: pmetz@ift.org
There’s no doubt the clean label trend is impacting the food industry. so let’s hear directly from the consumers. This session will feature original data presented by Paul Metz, Executive Vice President, of C+R Research. Then, a panel of Chicagoland consumers will join the stage to reveal their opinions about products currently on the shelves, and what they’d like to see in the future.

036-001
Nutraceuticals and Functional Food Regulations in the United States
With a Special Emphasis on New Dietary Ingredient (NDI) and Generally Recognized as Safe (GRAS) Status
G. Burdock, Burdock Group, Email: rivera@burdockgroup.com
This presentation will explore updated nutraceuticals and functional food regulations in the US and Europe with a special emphasis on Generally Recognized as Safe (GRAS) Status.

036-002
Food for Specified Health Uses and Japanese Regulations: The Inventor of Functional Foods in the World
H. Ikeda, Biohealth Research Ltd, Email: ikeda@biohealth.com
Food with functional claims is a newly introduced category in Japan. This presentation outline and discuss the new initiative by comparing it with the regulatory systems in the US and the EU.

036-003
Regulations of Functional Foods in the Association of Southeast Asian Nations (ASEAN) countries
J. Zawistowski, University of British Columbia, Email: jerzy.zawistowski@ubc.ca

036-004
Understanding Medical Foods Under FDA Regulations
C. Lewis, Of Counsel Venabel LLP, Email: shodge@ift.org

036-005
A Brief Overview on Toxicological Studies Required for Regulatory Approvals
D. Bagchi, University of Houston College/Pharmacy, Email: debasisbagchi@gmail.com
This presentation will explore safety and toxicological requirements for nutraceuticals and functional foods.

037-001
Safety of Imported Food Ingredients and Compliance With FSMA Regulations
R. Lawrence, McCormick Co Inc, Email: roger_lawrence@mccormick.com
Mr. Lawrence will provide an overview of the multiple challenges facing the imported food ingredients including the number of product and suppliers, variation in global standards, size of the activities, and stringent regulatory expectations. He will also present several proactive strategies which can be used for sourcing, supply chain control principles, etc. Mr. Lawrence’s talk will set the stage for others.
037-002
Implementation of FSMA for Imported Foods and Compliance
R. Brackett, Institute For Food Safety and Health, Email: rbrackett@iill.edu
This presentation will provide an overview of the FSMA regulations. In addition, the presentation will cover what is expected from the industry and the compliance timelines for implementation based on the size of the company and the product. Moreover, the resources available, such as the Technical Assistance Network, will be discussed.

037-003
Food Safety Preventive Controls Alliance (FSPTCA) Training and Outreach for Successful Implementation of FSMA
P. Vasavada, UWW River Falls, Email: purnendu.c.vasavada@uwrf.edu
The Food Safety Preventive Controls Alliance (FSPTCA) is a public-private partnership established to help the food industry, especially small- and medium-sized human food and animal food companies, comply with the preventive controls regulations required by the Food Safety Modernization Act. The FSPTCA has developed a standardized curriculum on preventive controls for hazards related to FDA-regulated human and animal foods to help successful implementation of FSMA Preventive Controls for Human Food.
This presentation will provide a basic review of the Preventive Controls (PC) and Foreign Supplier Verification Program (FSVP) rule and a brief overview of FSPTCA and FDA’s training, outreach program and resources for the international community and improving the safety of imported foods.

037-004
Challenges, Needs, and Opportunities: Perspectives From an Exporting Country
V. Menon, Food Safety/Quality Solutions Inc, Email: venu@foodsafe.in
The harvesting, manufacturing, storage, and transportation procedures utilized in the countries exporting various food ingredients greatly affect the safety of these ingredients. Often these countries are developing or under developed and the practices might not be up to par to the standards. Therefore, it is really crucial to evaluate the existing practices and identify the needs and resources for training the individuals. This presentation will provide an overview of the existing practices as it relates to food safety and evaluate how easy or difficult it will be to train the individuals. If additional resources are needed or additional strategies are warranted, they will be identified.

038-001
Technology Trends and Opportunities for Sustainable Food and Feed Value Chains
E. Georget, Buhrler Group, Email: erika.georget@buhrlergroup.com
Participants will learn about reduction of food and feed losses across the processing chain, process control and optimization for dry commodities, and links between losses reduction and food safety and quality issues.

038-002
Emerging Food Value Chains to Reduce Resource Utilization and Food Waste
A. Mathys, ETH Zurich, Email: alexander.mathys@hest.ethz.ch
Participants will learn about food safety as key discipline to reduce losses, more sustainable and efficient value chains based on algae and insect ingredients, and tailor-made preservation technology development to meet emerging consumer demands, such as in mega city environments.

038-003
A Holistic and Entrepreneurial Approach to Food Waste
O. Gruess, General Mills, Email: olaf.gruess@gemmills.com
Participants will learn about a holistic, pre-competitive approach to food waste, and connecting to the right “consumer”. Are we asking the right people to solve the problem?

039-001
Advances in Temporal Check-All-That-Apply (TCATA) Methodology and Analysis
J. Castura, Compusense Inc, Email: jcastura@compusense.com
TCATA is a temporal sensory method that allows assessors to track changes in the applicability of sensory attributes over time. Intensity is not tracked directly. Recent research has shown that both trained assessors and consumers can use this method effectively to characterize products with greater sensitivity than similar temporal sensory methods. This presentation will focus on recent advances. Results from methodological refinements in data collection will be discussed, along with developments in statistical analysis and exploratory data analysis to visualize TCATA product trajectories.

039-002
The Power of Disliking: Predicting Consumer Choice
J. Hayes, Pennsylvania State University, Email: jeh40@psu.edu
Sensory studies generally investigate sensations, hedonic response, or food intake either in isolation, or as a pair of variables (e.g., liking > intake). These studies are often conducted using consumer panels that independently investigate individual factors which presumably, implicitly or explicitly, influence food choice. A more holistic view is needed to understand the causal chain between sensations and hedonic response, and between liking and subsequent intake. Recommendations to improve the predictive value of such studies include collecting data from larger numbers of consumers, or by collecting more information about these individuals, as relationships between sensation and use can be informed by genetics or personality traits. Disliking, rather than liking, might better predict use and intake. This presentation will review recent literature on determinants of food choice, and present suggestions on how to better assess the multiple factors which potentially influence food choice.

039-003
Meeting Consumer Expectations: The Importance of Cognitive-Sensory-Nutrient Associations in Satiety
M. Yeomans, University of Sussex, Email: martin@sussex.ac.uk
While it has long been recognized that the experience of satiety is influenced by consumer beliefs, sensory experience and nutrient content of ingested products, we have a limited understanding of how these factors interact. This talk highlights advances in our understanding of satiety from three perspectives: identifying the key sensory cues that underlie satiety expectations, highlighting how these expectations can be manipulated by engineering satiety-relevant sensory cues, and demonstrating how satiety expectations can be learned. The careful application of these ideas in new product development allows products to be optimized to generate satiety, so reducing risks of overconsumption by consumers.

040-001
Old Food for New Bodies: The Role of Low GI Pulses in the Western Diet
D. Jenkins, Email: NutritionProject@smh.ca
Pulses have long been recognized as low glyemic index (GI) foods. They have been tested as such in diabetes and as part of low GI or high-fiber diets. Benefits have been seen in improved glyemic control, lower blood lipids and more recently improved blood pressure. All these attributes make them ideal for the diets of those with diabetes, or those at risk for diabetes and other chronic diseases associated with western dietary patterns.

040-002
How Pulses Fit on the Plate: Dietary Guidelines Update
J. Slavin, University of Minnesota, Email: jslavin@umn.edu
Pulses have the unique position of being both a vegetable and protein source in US dietary guidance. Despite the important role of pulses in the diet, usual intake of pulses in the US remains low.

040-003
Prescribe Pulses for our Patients? Review of the Evidence for Cardiometabolic Health
J. Sievenpiper, Email: john.sievenpiper@utoronto.ca
Diet and lifestyle are universally seen as the cornerstone of efforts for the prevention and management of obesity, diabetes, and cardiovascular disease. Although early studies showed that carbohydrates from dietary pulses was absorbed very slowly resulting in a very low postprandial glycemic response, a property exploited extensively in low glyemic index and high fiber interventions, the role of diets high in dietary pulses remained relatively unappreciated. To address the need for high-quality synthesis of the evidence, systematic reviews, and meta-analyses of randomized clinical trials have shown that diets high in dietary pulses lead to clinically meaningful improvements in glycemic control, established lipid targets, blood pressure and body weight. These data make a compelling case for the benefits of dietary pulses in the prevention and management of cardiometabolic diseases.

040-004
Pulses: Varied and Versatile in Form and Function
B. Tyler, Email: bob.tyler@asask.ca
Pulses and pulse constituents are available to food manufacturers and consumers in a variety of forms, including whole or split seed, pre-cooked whole seed, flour, canned
whole seed or puree, pre-cooked flour, hull (seed coat) fiber and cotyledon fiber ingredients, protein concentrates and isolates, and refined starch. Each form possesses unique nutritional, functional and flavor characteristics. This diversity in form and function translates into a myriad of possible food applications.

**041-001**  
**Technical Challenges: Using Botanicals to Build Better Functional Foods and Beverages**  
**M. Wagner, BI Nutraceuticals, Email: mwagner@botanicals.com**

Working with functional ingredients poses technical challenges, especially when it is natural ingredients that provide the functionality. In today’s truly global supply chain, growing conditions, local farming and manufacturing processes can cause tremendous variation in raw material. New research on biologically active compounds coupled with changing customer and consumer demands creates a constantly shifting product landscape. With these hurdles, how can the industry guarantee safety and consistency of products? This portion of the session will look at issues surrounding production concerns, as well as functional ingredients and botanicals that are on the rise in foods and beverages.

**041-002**  
**Product Application: Using Botanicals to Build Better Functional Foods and Beverages**  
**A. Raban, BI Nutraceuticals, Email: araban@botanicals.com**

Which food and beverage applications are the most promising for the use of functional ingredients and botanicals? This portion of the session will look at effective delivery formats; the largest areas of opportunity for new product development; how these ingredients can be used in products addressing dietary restrictions (vegan, gluten-free, etc.); and how to create truly functional products that still appeal to consumers’ changing preferences.

**041-003**  
**Marketing: Using Botanicals to Build Better Functional Foods and Beverages**  
**R. Kreienbrink, Email: randyki@botanicals.com**

Now that you have a product that utilizes functional ingredients/botanicals, how do you effectively tell that story to the consumer? This portion of the session will discuss utilizing health claims, touting clean label appeal, discussing the origins of unique and exotic ingredients from other parts of the world and other marketing strategies for educating consumers about product functionality.

**042-001**  
**Effects of Packaging Systems on Safety, Shelf Life, and Quality of Minimally Processed Foods**  
**H. Daryaei, Illinois Institute of Technology, Email: hossein.daryaei@gmail.com**

Novel non-thermal and thermal food processing technologies have been developed in response to the increasing consumer demand for safe and healthy foods, with more fresh-like characteristics. Many of these methods enable in-package processing of foods with minimal impact on the product’s desirable quality attributes. When using these technologies, it is crucial to select suitable packaging systems and materials that can withstand the process without losing structural integrity and barrier properties to ensure the product remains intact. Packaging also plays an important role in protecting the safety and quality of processed foods during storage. This presentation will discuss the packaging requirements for non-thermal based food processing technologies, such as high pressure processing (HPP) and pressure-assisted-thermal sterilization (PATS). Recent advances in the development of packaging systems for minimal processing of selected food products, including meat, poultry, and seafood will also be presented.

**042-002**  
**Shellfish Life Extension of Fresh Fish and Pork by an Oxygen Management System Coupled to Super Chilled Temperature**  
**A. Oliveira, Email: alex.oliveira@bluwrap.com**

This presentation will discuss applications of BluWrap’s SAF-D® System for the transport of fresh fish and pork via ocean freight. Airfreight is expensive and highly pollutant, transporting fresh protein via ocean freight reduces CO2 emissions by up to 92%. Combination of this green technology to other environmentally conscious practices, such as packing product in fully recyclable cardboard boxes and the banning of polystyrene, proposes a new approach to global transport of fresh proteins to far markets.

**042-003**  
**The Safety of Packaged Foods That Are Agitated During Thermal Processing**  
**B. Ates, Nofima, Email: Baris.Ates@Nofima.no**

Longitudinal agitation at high frequencies during thermal processing dramatically improves the heat transfer of foods that may be heated by forced convection. To take advantage of the quick processing it is necessary to document the uniformity of the heating within the product and the integrity of the packaging. Optimization of agitation frequency in order to minimize the stress on the packaging while maintaining effective heat transfer within the food has been studied. By challenge studies of the products inoculated with both vegetative bacterial cells or spores the safety of the process has been demonstrated.

**043-001**  
**The Clean Label Revolution: Insights and Opportunities in Sweeteners**  
**S. French, Natural Marketing Institute, Email: steve.french@NMIsolutions.com**

This presentation will quantify the macro shift in the demand for clean label products based on research from more than a million consumer interviews conducted in 20+ countries over the past 10 years. There will be a specific focus will be on market trends and consumer behavior of clean label and non-GM sweeteners, labeling, and other related considerations.

**043-002**  
**Clean Label and Non-GM Sweeteners: Ingredient Solutions for a Changing Market**  
**A. Berzins, Ingredion Incorporated, Email: adams.berzins@ingredion.com**

This presentation will highlight common clean label sweeteners such as honey, agave, etc., and also novel sweeteners derived from tapioca and potato. Application, perception, and nutrition aspects of these sweeteners will be discussed.

**043-003**  
**How Fruit Juice Can Be Used to Replace Sugars in Food Product Applications**  
**E. Marinan, Tree Top Inc, Email: erinm@nw naturals.com**

This presentation will highlight fruit based sweeteners including apple juice, fruit syrups, and blends, and will discuss challenges of using fruit as a sweetener (i.e. cost, availability, usage limitations). It will focus on what the food developers should be aware of while formulating, focusing on food applications such as breads, beverages, and desserts.

**043-004**  
**Flavor Modulators Enabling Great Tasting Low Sugar Products Sweetened With Clean Label (High Potency) Sweeteners**  
**A. Daniher, Email: andrew.daniher@givaudan.com**

This presentation will discuss how temporal profiles of clean label high potency sweeteners vs. gold standard sugar is differentiated and can be used as a first step in understanding sweetness modulation. It will demonstrate how flavor tools can be developed to overcome these taste deficiencies. Increasing the positive flavor attributes sugar brings beyond sweetness will be discussed to create great tasting low sugar products using clean label high potency sweeteners.

**043-005**  
**Flavor Modulators Enabling Great Tasting Low Sugar Products Sweetened with Clean Label (High Potency) Sweeteners**  
**I. Ungureanu, Email: ioana.ungureanu@givaudan.com**

This presentation will discuss how temporal profiles of clean label high potency sweeteners vs. gold standard sugar is differentiated and can be used as a first step in understanding sweetness modulation. It will demonstrate how flavor tools can be developed to overcome these taste deficiencies. Increasing the positive flavor attributes sugar brings beyond sweetness will be discussed to create great tasting low sugar products using clean label high potency sweeteners.

**044-001**  
**Rethinking How to Document Oxidative Degradation in Foods**  
**K. Schaich, Rutgers University, Email: schaich@copes.rutgers.edu**

Oxidation in foods is typically measured by lipid peroxide and hexanal levels. This approach misses dimers, epoxyides, and other products generated while bypassing hydroperoxides, and it ignores radical transfers that broadcast oxidation away from lipids to other molecules – actions that significantly underestimate lipid oxidation and give an erroneous picture of total oxidation. This paper reviews complexities presented by multiple lipid oxidation and co-oxidation pathways, and argues for a new analytical paradigm that encompasses a broad range of lipid oxidation and co-oxidation products.
044-002
Oxidation Control and Shelf-Life Extension of Muscle Foods and Lipid-Containing Foods
F. Shahidi, Email: fshahidi@gmail.com

Oxidative processes in muscle foods and lipid-containing foods are influenced by different factors and are influenced by adjuncts added to meats and fish during the processing as well as the constituents of the meat, the species as well as the type of the muscle considered. Other lipid-containing foods may also be influenced by light and may be more prone to oxidation than muscle foods where photo-oxidation is not as important. It is also important to note that the oxidative processes are quite different in raw as compared to heat processed products. Examples will be provided to demonstrate the oxidation processes and how antioxidants may arrest oxidation in foods.

044-003
Oxidative Stability and Shelf Life of Low-Moisture (Dry) Foods Containing Fats and Oils
M. Hu, DuPont Nutrition & Health, Email: Min.Hu@dupont.com

The presentation will be focusing on definition, classification and characteristics of low-moisture (dry) foods containing fats and oils, internal and external factors impacting on the oxidative stability and shelf life of low-moisture foods, as well as the strategies on how to increase the oxidative stability and shelf life of low-moisture foods. The oxidative stability of milk powders, egg powders, encapsulated oil powders, extruded breakfast cereals, and snack foods will be highlighted.

044-004
Packaging Technologies to Control Lipid Oxidation
J. Koontz, FDA/FSHE, Email: john.koontz@fda.hhs.gov

A wide range of O2, water vapor, and light barrier properties for packaging can be optimized with the oxidative sensitivity of food. Modified atmosphere packaging can further reduce the O2 concentration. Active packaging offers control of lipid oxidation by removing O2, transition metals, or off-flavors from foods, adding antioxidants to foods, or inhibiting light from degrading quality. O2 scavengers, UV absorbers, controlled-release and immobilized antioxidants, and aldehyde scavengers are reviewed for their ability to maintain oxidative stability and extend the shelf life of packaged foods.

045-001
Food and Nutrition: Integrative Science in the 21st Century
B. German, Email: brucegerman@ift.org

Solving the problems of food production, food safety, nourishment and sustainability will require a much more detailed and integrated understanding of the complex interplay between human health and food. In effect agriculture must move from the simplifying reductionist principles of chemistry to the integrative principles of biology. Fortunately, many of biology’s valuable principles learned under the relentless pressure of Evolutionary selection are encoded in life’s genomes. As life sciences interrogate organisms in genomic detail, the study of lactation and its remarkable product, milk, provides unique insight into the evolution of animals and food. Most organisms evolved in part to avoid being eaten. Agriculture’s success has been to select and process commodities into safe, stable and delicious foods. Agriculture’s challenge now is to enhance their nutritional quality and the question is how? Our Rosetta stone of food and commodities into safe, stable and delicious foods. Agriculture’s challenge now is to enhance their nutritional quality and the question is how? Our Rosetta stone of food and nutrition is mammalian lactation and milk. Milk as a complete and comprehensive source of Evolutionary selection are encoded in life’s genomes. As life sciences interrogate organisms, including humans, plants, animals and microorganisms. The need to produce food and nutrition is mammalian lactation and milk. Milk as a complete and comprehensive source is the product of 200 million years of symbiotic co-evolution between mammalian mothers and their infant. All of the tools of modern science from genomics to molecular anthropology can now be leveraged to understand this remarkable process. Milk is personal, dynamic, active and structured. Molecular insights from sugars to oligosaccharides, proteins to encrypted peptides, structures from globules to micelles, intact cells from stem cells to immune cells represent just the first wave of discoveries of how complex and functional components can function in unique ways in the diet. As an example, mothers recruit a unique group of bacteria to populate their baby’s intestine and provide them a selective food source, complex oligosaccharides, to keep both them and their baby’s healthy and happy. In parallel with our discoveries of new nutritional targets and component bioactivities are new insights into principles of sustainability. The complex competition between maternal cost and infant benefit for milk’s resources is a vivid biological model of cost versus benefit relationships in food production.

046-001
Wearing Two Hats: A Professor’s Experiences in Developing Intellectual Property From Academic Research Into a Startup Company
B. Applegate, Email: applegate@purdue.edu

The presentation gives very interesting insights on how to establish a startup company with a product being the result of academic research. It will cover (1) managing the conflict of interest between being a professor and startup founder, (2) starting with bootstrap financing as opposed to venture capital, and (3) identifying a partner company to help in distribution of the developed product.

Prof. Bruce M. Applegate is Associate Professor at the Departments of Food and Biological Sciences at Purdue University. He has i.a. a research interest on the detection of viable foodborne pathogens using bacteriophages, on the enumeration of microorganisms using quantitative PCR (polymerase chain reaction), as well as on the use of bioreporters in bioelectronics, metabolic engineering, detection of problematic microorganisms in industrial environments, and on the construction of recombinant bacterial strains to rapidly evaluate antimicrobial products. He has received the Seed for Success Award (’Vice Provost for Research’) in 2005 and the NASA Inventions and Contributions Board Award in 2009.

046-002
Transfer of innovative Multi Hurdle Technology Concepts Into Operations
A. Mathys, Email: alexander.mathys@hest.ethz.ch

The presentation deals with the technology transfer from “Academia to Industry” and has a focus on efficient scale up.

Topics will include the scalability of innovative multi hurdle technology concepts, process engineering as continuous lab tool for rapid and efficient scale up, and experiences from industry with focus on new preservation technology implementations.

Prof. Dr.-Ing. Alexander Mathys is food technologist and received his Ph.D. in food processing in 2008. He is Assistant Professor (Tenure Track) in Sustainable Food Processing at the ETH Zurich, Switzerland since 2015, where he is focusing on more efficiency and sustainability of value chains in food and feed. Between 2012-2015 Prof. Mathys developed the industry driven Bioeconomy department at the German Institute of Food Technologies DIL. He was expert in preservation technologies and micro process engineering at the Nestlé Research Center Lausanne in 2009-2012. Prof. Mathys is the author of 57 publications and attended more than 60 international conferences. He won several prestigious research awards at the International Union of Food Science and Technology IUFoST, International Congress on Engineering and Food ICFE, Institute of Food Technologists IFT and European High Pressure Research Group EHPRG. Furthermore Prof. Mathys was selected Young Researcher of the 60th Meeting of Nobel Laureates 2010, Einstein Young Scholar 2010, and A.T. Kearney Scholar 2011 and 2012 at the Falling Walls conferences.

047-001
The International Food Law Internet Certificate
N. Fortin, Institute for Food Laws & Regulation, Email: fortinne@anr.msu.edu

Neal will describe the content of the certificate proposed by IFLR.

047-002
Postgraduate Training in Food Regulatory Affairs
K. Pentieva, Ulster University, Email: k.pentieva@ulster.ac.uk

Kristina will present the program proposed by the University of Ulster and describe its advantages.

047-003
Global Compliance Management Systems for Food Regulation
P. Waldo, Email: pwaldo@decemris.com

Pat will describe the potentialities of using the food legislation database Decemris.

047-004
Training in Food Regulatory Affairs: Business Needs
D. Taeymans, FoodREG Consult, Email: d.taeymans@bluewin.ch

Dominique will discuss the importance of training in food regulatory affairs and describe the business needs.

048-001
Genomics 101
L. Goodridge, McGill University, Email: lawrence.goodridge@mcgill.ca

Genomics refers to the analysis of the entire set of genes (the genome) found in living organisms, including humans, plants, animals and microorganisms. The need to produce ever increasing amounts of safe, nutritious food in a cost effective manner has ushered in the era of genomics and food science. For example, genomics-based approaches are being used to increase food safety, decrease food spoilage, and optimize food production.

This session will provide an introduction to the field of genomics. Beginning with an overview of the history and terminology of genomics, attendees will also learn about advanced genomics concepts including whole genome sequencing, metagenomics, epigenomics, and bioinformatics analysis. The session concludes with practical examples of the use of genomics in food science.
The Science of Brewing Beer
K. Villa, Blue Moon Brewing Co, Email: keith.villa@entzandblake.com

Beer has been consumed for more than 6,000 years and as a result has become intertwined with numerous cultures worldwide. The fundamentals of brewing beer have not changed, however due to scientific and technological advancements the beer industry continues to provide one of the most diverse products on the market. The commercial brewer not only is a product developer, but also must possess the food science skills to manage a complex process with ever-changing agricultural ingredients to produce a consistent product desirable by consumers. An overview of modern brewing from fields to pint will be discussed. A case study will be presented on how a style of beer with the right blend of ingredients and imagination was developed over twenty years ago which has become a mainstream brand and top selling beer in the United States.

How Policy Affects the Pint
J. Dubost, Email: jdupost@beerinstitute.org

After learning about the science of brewing we will than discuss how the current regulatory environment is impacting the beer industry, including the Federal Drug Administration (FDA) menu labeling and the United States Department of Agriculture (USDA) 2015 Dietary Guidelines. The Federal menu labeling law requires alcohol beverages listed on standard drink menus to list calories and provide additional nutrition information upon request. Starting December 1, 2016 restaurants or retail food establishments with more than 20 locations nationwide will be required to list calories on the menu. The intricacies of these regulations will be discussed particularly as they apply to the alcohol industry. In addition, the 2015 Dietary Guidelines are used as the basis for educating consumers and driving policy. This includes guidance on beer consumption, including the so-called “standard drink." We will review the current regulatory landscape on Capitol Hill and how these policies impact your pint.

FDA’s Office of Criminal Investigations Perspective of Food Fraud
G. Hughes, FDA/Office of Criminal Investigation, Email: george.hughes@fda.hhs.gov

The objective of this presentation is to provide a thorough background on the “roles, responsibilities, and capabilities” of the FDA Office of Criminal Investigations (OCI) and their perspective of food fraud. The presentation will highlight FDA working relationships with partners in the law enforcement, intelligence, public health communities and the private sector. Discussed will be the function of FDA/OCI supporting the FDA mission of protecting FDA regulated products and ensuring their safety for public consumption. Various food fraud investigations will be highlighted.

Advances in Portable Vibrational Spectroscopy Technologies for Screening Economically-Motivated Adulteration of Food Ingredients
L. Rodriguez-Saona, Ohio State University, Email: rodriguez-saona.1@osu.edu

This presentation will cover fundamentals and advances in portable vibrational spectroscopy technologies for screening Economically Motivated Adulteration (EMA) of food ingredients. Portable instrumentation for use in out-of-lab applications is uniquely positioned for rapid on-site authentication of incoming ingredients because of its speed, ruggedness, compactness, ease of use and portability. Vibrational spectroscopy provides fingerprinting capabilities for reliable authentication programs for high-value food ingredients, and applications on several food ingredients will be covered.

Chemometric Processes for Food Authentication and Adulteration Analysis
J. Kalivas, Idaho State University, Email: kalijohn@isu.edu

Classification processes are presented to detect and quantitate adulterants in food matrices. Two case studies use fluorescence spectroscopy to detect Economically Motivated Adulteration (EMA) in Argan oil and extra virgin olive oil (EVOO). Quantitative adulteration of commercial Argan oil and EVOO are also presented. Two food authentication issues are also addressed. The first involves using ICP-MS for “fava Santorini” a yellow split pea species from Greece with protected designation of origin. The other research involves origin determination of Italian craft beer with five instruments.

Funding Opportunities with USDA-Small Business Innovation Research Grant Program
J. Williams, US Natl Inst of Fd & Agriculture, Email: JWILLIAMS@enifa.usda.gov

This presentation will highlight how the programs can allow entrepreneurs interested in commercializing insect based foods can benefit from the program.
proteins evolve from lab experiment to industrial production. In this presentation the audience will be made aware of which protein identification and allergen challenges may lie ahead for food analytical labs and regulating bodies.

053-001
An Overview of Shelf-Life Simulation of Packaged Food: Methodologies, Experimental Designs, Equations, and Data Analysis Techniques
E. Almenar, School of Packaging Michigan State Univ. Email: ealmenar@msu.edu
This talk will focus on the basic principles related to shelf-life simulations of packaged food including methodologies, experimental designs, equations, and data analysis techniques. In addition, the application of these basic principles for packaging development to maximize food freshness and minimize food and packaging waste will be illustrated using a few examples. Different spoilage mechanisms common in food will be covered.

053-002
Stabilized Foods for Use in Extended Spaceflight: High Barrier Packaging for the NASA Mars Mission
M. Richardson, U.S. Army, Email: michelle.j.richardson.civ@mail.mil
This presentation will explore stabilized foods for use in extended spaceflight: high barrier packaging for the NASA Mars Mission.

053-003
The Application of Shelf Life Simulation and How Business Decisions are Driven From the Data and Insights Gathered
T. Clark, Mondelez International, Email: evan.ziolkowski@mdlz.com
This presentation will explore the application of shelf life simulation and how business decisions are driven from the data and insights gathered.

054-001
Infant Formula Innovations for Improved Infant Health
R. Clemens, USC School of Pharmacy, Email: Clemens@usc.edu
The Infant Formula Act (1980) and its amendments (1986), and the FDA’s critical overview of infant nutritional requirements (1996) provided an important foundation for safety and functional properties of future infant formulas. Recent innovations applied to these products include technologies to reduce cow milk and soy protein allergenicity, and the addition of docosahexaenoic acid for improved cognitive development and visual acuity. Future innovations require an increased understanding of human milk biology, infant physiology and strategic, and progressive clinical research.

054-002
General Guidelines on the Safety Assessment of Novel Ingredients for Infant Formula
C. Kruger, Spherix Consulting. Email: clairek@chromadex.com
A GRAS determination for an infant formula ingredient must address safety issues required to satisfy regulatory standards. FSMA emphasizes prevention and this approach is utilized for the safety evaluation of infant formula ingredients. A GRAS evaluation must consider chemical or biological composition, supply chain control, production process specifications, intended use and use levels, structure-activity relationships, and safety assessment using data derived from animal pharmacokinetic and toxicology studies and clinical trials. Case studies of GRAS Notifications will be highlighted.

054-003
The Neonatal Pig as a Research Model for Infant Formula Safety Assessment
B. Thorsrud, Experimur, Email: bthorsrud@experimur.com
Preclinical testing of novel ingredients for use in infant formula requires evaluation of their safety during the lactation period. This presentation will focus on the neonatal pig as a good research model. This is based on the similarities in anatomy, physiology, dietary requirements and immune system to infants. The advantages of the neonatal piglet model will be presented along with the existence of a robust database of studies that strengthen the evaluation of the safety of new substances to be added to an existing infant formula and highlighted with case studies.

054-004
Infant Formula Regulation: Nutritional Adequacy and Ingredient Safety
C. Assar, Food & Drug Administration, Email: carrie.assar@fda.hhs.gov
Infant formula is a food for use by infants that simulates human milk or is suitable as a complete or partial substitute for human milk. For infants who are not fed human milk, infant formula serves as the sole source, or the major source, of nutrition during infancy, particularly during the first four to six months of life. An infant relies on the formula to provide proper nourishment at a time of rapid physical growth and mental development. The presentation will include information on how infant formula is regulated with an emphasis on the Infant Formula Final Rule published in 2014.

055-001
FSMA: Pain, Progress and Promise
J. Levitt, Email: joseph.levitt@hoganlovells.com
This presentation will explore the Preventative Control for Human Foods Rule.

055-002
FSMA: Pain, Progress and Promise
J. McEntire, Grocery Manufacturers Assn, Email: jmcentire@gmaonline.org
This presentation will feature a discussion of produce safety standards.

055-003
FSMA: Pain, Progress and Promise
S. Armstrong, Campbell’s Foods, Email: steve_armstrong@yahoo.com
This presentation will feature a discussion of the industry perspective.

055-004
FSMA: Pain, Progress and Promise
R. Brackett, Institute For Food Safety and Health, Email: rbrackett@ill.edu
This presentation will feature a discussion of FSMA implementation and training requirements.

056-001
Water Saving Techniques in Food Production and Food Processing: Do They Increase Water Productivity?
J. Libra, Leibniz Institute for Agricultural Eng., Email: jlibra@atb-potsdam.de
Judy Libra worked as a chemical engineer before getting her Ph.D. (UCLA) in Civil Engineering and Habilitation (Technical University Berlin) in Environmental Process Engineering. Her research and teaching activities ranged from environmental management to treatment processes in Berlin and Cottbus. After working at the German Federal Environment Agency, she moved to the German Academy of Science and Engineering (acatech) to work on sustainable management of water resources. Judy Libra joined the Leibniz Institute of Agricultural Engineering, Potsdam-Bornim in 2011 to work on connecting agricultural food production and water resources from an agricultural-hydrological perspective.

After presenting an overview of the major water users in the process chain of food production, the talk will give an overview of water saving techniques that can be used in plant and animal production as well as in food processing. Evaluating the techniques for their effect on water productivity, however, can be tricky. Appropriate evaluation methods will be discussed.

056-002
Water Conservation During Peach Processing
G. Choudhury, California Polytechnic State University. Email: gchoudhury@calpoly.edu
Dr. Gour Choudhury is the Department Head of the Food Science and Nutrition Department at California Polytechnic State University, San Luis Obispo. His current research interests are water conservation, sustainable food processing, green approaches to plant and equipment cleaning, value-added product/process development, by-product utilization, process reengineering for fruit and nut processing, and unit operations. Dr. Choudhury has a Ph.D in Food Engineering and has expertise in Process Engineering, Development and Automation. He has 27+ years of professional experience at five different universities (Utah State, Alaska, Wisconsin, California State Fresno and Cal Poly San Luis Obispo). Over this period he developed and managed numerous collaborative research projects with industry and academic institutions (MIT, Vanderbilt University, and University of Manitoba). He has executed two “concept-to-commercialization” projects and holds 6 patents in the areas of process engineering and automation. He has published extensively (9 book/monograph chapters, 25 articles in refereed journals, and 67 abstracts), and presented 70+ research papers in international, national and regional conferences and 7 invited seminars in different universities and research institutes.

California is the home of the largest number of food processing companies in the nation; shipping approximately $50 billion worth of food products every year. These companies use large volumes of water (960-17,000 gallons/ton of product) and generate large
volumes of wastewater containing microorganisms and chemicals. The water demand and wastewater disposal issues are becoming a major impediment to the growth and expansion of the food processing industry in California. This project was aimed at reducing water demand and wastewater discharge from a peach processing plant. An individually quick frozen (IQF) peach slice manufacturing process was examined with a focus on peach peeling unit operation. A new system for ly peeling was conceived, designed, locally fabricated, installed, and tested. The system reduced water demand by 80% with a similar reduction in wastewater discharge. The system has been scaled-up and commercialized, and is operational in commercial peach processing.

056-003
Optimizing the Water Energy Nexus (WEN) at the Campbell Soup, Dixon, California Facility, A Case Study
R. Amón, Email: ramon@ucdavis.edu

This case study provides actionable information from the Campbell Soup, Dixon, California facility. In 2012, researchers conducted engineering WEN assessments to establish the water energy intensity at the processing facility. Results identified energy efficiency and hot water conservation opportunities, recovery of waste steam, capture of waste heat, and recycling of tomato water. The case study documents economic benefits of plant improvements conducted during the 2013, 2014, and 2015 production seasons.

056-004
Use of Rotating Algal Biofilm System for Treating Wastewater From Food Industrial Effluents
Z. Wen, Iowa State University, Email: wenzi@iastate.edu

Dr. Zhiyou Wen is an Associate Professor of Food Science and Human Nutrition at Iowa State University. His background is bioprocessing engineering. He got his Ph.D degree from the university of Hong Kong, did his postdoc training at Washington State University, and was Assistant Professor at Virginia Tech university before moving to Iowa State in 2010. Dr. Wen's research program at Iowa State include the algal research for wastewater treatment and value-added products, conversion of the lignocellulosic biomass to fuels and chemicals through a thermochemical-biological hybrid processing, and production of the environmental friendly biofuel material for construction. His algae-related research projects include development of algal biofilm based system, wastewater treatment and mitigation of greenhouse using algal biofilm, the heterotrophic algal culture for producing value-added components. He has been working on microalgae research for 15 years and has authored more than 60 peer-reviewed publications on various algae production processes.

In this presentation, Dr. Wen will present his group's most research on wastewater treatment using microalgae. Microalgae have been widely studied to remove nutrients from wastewater due to their rapid absorption of those nutrients for their growth. However, commercial implementation of open pond- or enclosed photobioreactors-based microalgae cultivation as a treatment system has not happened due to high operation cost and the large footprint of these systems. Dr. Wen's group researchers developed a unique algal culture system so called revolving algal biofilm (RAB) for solving the above problems. The RAB system drastically increases the algae growing surface area by using a vertical orientation of algal biofilm to capture sunlight and CO2, thus requiring a much smaller footprint. Also, the biomass can be retained on the RAB system's attachment material for a much longer solids retention time than the hydraulic retention time of the liquid, which is crucial for highly efficient nutrient removal from wastewater. The RAB system has been used for treating effluent from various food industrial operations, including meat processing effluent, yeast fermentation based broth; and animal feed production, with high removal efficiency of nitrogen, phosphorus, and special chemicals such as selenium.

057-001
Is Modern Food Production Meeting on Dietary Guidance and Consumer's Perception of Nutritious Foods?
M. Ferruzzi, Purdue University, Email: mferruzz@purdue.edu

While the dietary guidelines provide a path to achieving better health through a balanced diet, consumers are increasingly interested in foods that deliver positive nutritional and health attributes. The food industry has responded by developing new products and technologies. Microalgae-based products can deliver on consumer perception of health and nutrition, factors central to modern food production continue to drive safety, quality, affordability, and convenience. This session will explore how the current evolution of processed foods is addressing both consumer demand and delivering on the principles of the Dietary Guidelines for Americans 2015.

057-002
Does the Nutritional Science Used to Form Dietary Guidance Support Consumers’ Perceptions of What Represents Nutritious Foods?
R. Post, CHOBANI, LLC, Email: Robert.Post@chobani.com

Federal nutrition policy, the Dietary Guidelines, depends on the latest nutrition science to inform the basis for federal nutrition programs, food assistance programs, nutrition education and promotion programs, and nutrition research priorities. The Dietary Guidelines recommendations are based on a preponderance of the scientific evidence for nutritional factors that are important for promoting health and lowering risk of diet-related chronic disease. They result from a thorough review of key nutrition, physical activity, and health issues, including those related to energy balance and weight management; and nutrient adequacy. Absent among the aspects of nutrition science studied for deriving the Guidelines are factors related to environmental health, systems of food distribution and methods of production, manufacturer social responsibility, among others. Current trends reflect the view that such issues relate to the nutritional value of healthful foods. This session will consider if these expectations are realistic extensions of a modern view of what is “nutritious,” and how nutrition principles that guide healthful food choices may or may not relate.

058-001
Introductory Comments: What is a Clean Label?
J. David, Email: jairus.david@conagrafoods.com

We will provide an overview of the symposium and how the term clean label and food safety and quality are related.

058-002
Clean Labels: Truth, Myths, and Implications
L. Williams, Innova Market Insights, Email: luann.williams@innovami.com

What is a clean label and what do consumers actually want in a clean label? Who are the consumers that are pushing for clean labels? Are there positives and/or negatives identified as to the rapid move by the food industry to achieving this?

058-003
Global Perspective and Approach
W. de Heij, Holland Food Valley, Email: deheij@cwip-bv.nl

How is the industry responding to the clean label initiative? What is the food industry doing to maintain the safety and quality of clean label foods? The food industry has a big challenge around these points, maintaining the high quality and safety of the food supply while under the constraints of the new clean label initiatives.

059-001
Regional Development Models for Value Addition to Underutilized Whey in South America
P. Juliano, CSIRO, Email: Pablo.Juliano@csiro.au

A large majority of cheese-makers in South America are small enterprises that use less than 25,000 litres of milk per day. Currently, whey produced by these companies goes mostly to animal feed or waste as a highly contaminating effluent, because small manufacturers cannot preserve it to consistent quality levels. Technologies for whey transformation into ingredients are not accessible or affordable at the individual level, or the development potential for products from various types of whey is not fully implemented. This presentation will tell the journey for the development of a program for whey value addition sponsored by the Australian Agency for International Development, AusAID, gathering 30 collaborators from 7 institutions from Australia, Argentina, Brazil, Colombia, and Uruguay and the impact achieved in these regions. Some highlights include the development of handbook for whey value addition to assist this transformation, which describes the manufacture of high value added fermented and non-fermented beverages, specialty cheeses, and other innovative products and technologies. Furthermore, an economic decision making tool has been developed to optimise the logistics, while simultaneously identifying the location of processing facilities to introduce technological solutions according to volumes collected in each cheese cluster, and obtaining the optimum cost breakdown and investment for developing a supply chain for the underutilised whey. This unique model is being utilised as a tool for governments and cheese-maker groups to promote the development of whey supply chains in selected regions that suffering from environmental problems and to promote regional development in areas where poverty and low access to nutrition prevail.

060-001
What's New: Process, Products and Authentic Learning in STEM
T. DeWitt, Email: tylerdewitt@ift.org

Where is STEM education headed? What’s new in the field? We’ll discuss some of the most recent trends in STEM education, analyzing the impact that they have on student learning. We will cover ways in which technology is changing higher education, as flipped classroom approaches, crowdteaching, and digital feedback and assessment mechanisms. Then, we’ll examine pedagogical shifts which are particularly relevant in the sciences, such as the push towards more “inquiry-based” and “critical thinking” assignments and assessments. Throughout, we’ll discuss concrete, practical ways that instructors can immediately make use of these approaches in their teaching.
061-001
IFIC's Consumer Perception Data: Sustainable Brands, Retailers, and Practices
L. Sanders, International Food Information Council, Email: sanders@ific.org
IFIC will share study results on consumer perceptions of sustainability: which sustainable practices consumers expect from brands and retailers, which brands and retailers consumer perceive as sustainable, and how these perceptions affect consumer shopping habits.

061-002
McDonald's Case Study: How Sustainable Practices Affect the Bottom Line
B. Langert, GreenBiz Group, Email: langertbob@gmail.com
Langert will explain how McDonald’s, the world’s leading global foodservice retailer, works with suppliers to support sustainable products through the entire chain – reworking sourcing models, eliminating food waste and communicating sustainable practices to consumers. He will also unveil how implementing these sustainable practices affects the bottom line.

061-003
View From the Farm: Insights About Soy’s Sustainability
J. McClellan, United Soybean Board, Email: JMCCell@smithbucklin.com
McClellan will discuss U.S. soybean farming’s impact on sustainability and the reasons why U.S. soybean farmers employ sustainable practices. He’ll also discuss future technological advances in sustainable practices that are in the pipeline. McClellan will share a case study centered on a “U.S. Grown” labeling promotion partnership with major Midwest grocery retailer Hy-Vee, including which sustainability messages resonated with consumers and how much they affected sales.

062-001
Use of Genomics Methods to Identify Spoilage Microorganisms in Fermented Cucumbers
I. Perez-Diaz, USDA Agri Research Service, Email: ilenys.perez-diaz@ars.usda.gov
Ms. Christine Summers will discuss how to develop or adapt a product specification in order to meet food regulations of multiple countries? Case studies and real life examples will be discussed.

063-002
Food Regulatory Issues in Canada and Their Importance in Global Perspectives
O. Rodriguez-Gonzalez, Rodriguez Gonzalez Services Corp., Email: oscar@rodriguez-gonzalez.net
Dr. Rodriguez-Gonzalez will discuss regulatory changes in Canada and their importance and challenges in global context.

063-003
International Food Regulations: Update
M. Cole, CSIRO Food and Nutrition, Email: martin.cole@csiro.au

064-001
Development and Validation of a Nano-Enabled Self-Reporting Biosensor for Rapid Detection of Infectious Pathogens in Food Samples
E. Alciija, Michigan State Univ, Email: alciija@msu.edu
We present a self-reporting biosensor that uses magnetic nanoparticles functionalized with synthetic receptors for broad extraction, concentration, and detection of Escherichia coli O157:H7 and Salmonella Enteritidis in complex food matrices with a processing time of 30 min. Results show that the extraction efficiency is 80-100%, concentration factor is 2-30 times, and the limit of detection is 10^3 colony forming units per milliliter (cfu/ml).

064-002
Biomimetic Nanosensors for Measuring Pathogens and Biomarkers of Contamination in Food Products
E. McLamore, University of Florida, Email: emclamor@ufl.edu
The presence of unsafe levels of microorganisms in food is a persistent economic and public health problem. In many conditions, such as in impoverished regions or disaster zones, standard analytical tests are not feasible due to the cost of reagents and need for trained personnel. Thus, rapid and inexpensive sensor technologies are sorely needed to ensure that food products remain safe. Over the last few decades many biosensing technologies have been developed for measuring pathogens or biomarkers of contamination using expensive techniques from the semiconductor industry (such as silicon-based micro-electro-mechanical systems, or MEMs). These approaches exacerbate the economic burden of pathogen detection since the chip must be disposed after use due the risk of cross contamination. To transition these biosensor technologies into the consumer market, many recent efforts have focused on development of low cost disposable sensor platforms (e.g., paper, plastic, foam) that are more realistic for disaster mitigation, developing regions, or household use. The two major challenges for these biosensors are selective capture of the target strain, and determination of pathogen viability without the use of endogenous reagents or complex equipment. In nature, there are numerous highly specific systems that selectively capture pathogenic bacteria, while also distinguishing microbial viability (e.g., host-symbiont interactions, the innate immune system, etc). This talk will discuss emerging biomimetic nanosensor technologies for creating point of use diagnostics. The discussion will be centered around the Hawaiian bobtail squid and its unique symbiotic association with Vibrio fischeri, and will also include aspects of immunology.

064-003
Immobilization and Stabilization of Enzyme Biosensor Under High Pressure
J. Reyes De Corcuera, Email: jireyes@uga.edu
Rapid detection of pathogen biomarkers, pesticides, fertilizer residues, sugars, alcohol and other compounds is very important to the food and agricultural industries to ensure food safety and quality, as well as to diagnose plant diseases. Because food and agricultural samples are complex mixtures of hundreds of compounds, analyses typically require tedious sample treatment, compound separation, and identification. Enzymes that specifically interact with compounds of interest can be coupled to electrodes to make biosensors that directly and rapidly measure such compounds in complex mixtures. Arguably the most difficult challenge that prevents the development of practical, reliable enzyme biosensors is that, over time and under the effect of temperature, enzymes unfold and lose their activity which results in rapid sensor drift and loss of sensitivity. Most reported enzyme biosensors have operational life of less than one week. The stability of enzymes depends on many factors including the balance between hydrophobic and hydrophilic groups in the protein. In addition, application of high hydrostatic pressure often stabilizes enzymes. This research focuses on the stabilization of enzyme biosensors relevant to food and agriculture using a combination of chemical manipulations of enzymes and enzyme immobilization at high hydrostatic pressure (HHP) in electrochemically generated nanofilms.

064-004
Printable Graphene-Based, Electrochemical Soil Sensors
J. Claussen, Iowa State University, Email: jclauss@iastate.edu
The need to regulate pesticide use and track pesticide run-off is paramount to environmental protection and in particular protection of surface and ground water where pesticides can be further transmitted through the food chain. Such large-scale tracking of pesticides in the environment is vital to pinpoint the route cause of negative, “unintended” consequences of pesticide use. Electrochemical enzymatic biosensors have shown promise in detecting a wide variety of organophosphates and carbamate pesticides, but they currently lack the sensitivity needed to detect pesticides at concentration limits for drinking water. This work is focused on developing low-cost, disposable, and sufficiently sensitive enzymatic biosensors to detect pesticide levels in soil samples. Enzyme activity (e.g., phosphotriesterase (PTE)) and operational pH range are increased via enzyme immobilization on nanoparticle carriers. These enzyme-nanoparticles are immobilized onto graphene electrodes that have been inkjet printed and laser annealed onto paper-based substrates. This laser processing changes the electrically conductivity of the printed graphene from highly resistive (> 100 MΩ) to highly conductive (< 1 kΩ) sheet resistance, a conductivity higher than previously published reports and a surface roughness that changes from 2D planar to 3D nano- microstructured with stitched/welded graphene flakes. The concomitance of scalable nanomanufacturing (e.g., inkjet printed graphene), disposable/degradable biosensors (paper-based substrates), and nanostructured surfaces (enzyme-nanoparticles, and 3D graphene) are expected to provide a highly sensitive biosensor that could be used for low-cost, field-side screening of pesticides. Herein we demonstrate the viability of using inkjet printed graphene for electrochemical sensing and elucidate the effects of the post-print laser processing has on the printed graphene. Also, initial results regarding the hydrolysis of the organophosphate paraaxon by PTE immobilized on gold nanoparticles will be presented.
065-001
Research Needs in Intelligent Food Packaging to Reduce Food Waste and Food Fraud and Market Food
C. Sand, Email: claire@packagingtechnologyandresearch.com

Research in intelligent food packaging has decreased since its inception in the late 1980’s. Recent advances due to the viability of intelligent packaging to reduce food waste and fraud and market food are emerging. Research needs of industry need to align with research being conducted within food science, food engineering, and food packaging universities and research institutes. This presentation highlights these needs and will also encompass audience-derived needs.

065-002
Packaging Solutions to Reduce Food Fraud
J. Spink, Email: spink@cvm.msu.edu

Overt and covert packaging solutions to food fraud can increase public safety, provide assurance for brand owners, and decrease the incidence of food fraud. Packaging solutions involve primary, secondary, and tertiary packaging from ingredients to final consumer.

This is a joint presentation with Doug Moyer.

065-003
The Role of Packaging in Preventing Food Fraud
D. Moyer, Michigan State University, Email: moyerd1@msu.edu

The FDA final FSMA rule on Preventive Controls mandates that vulnerability assessments and prevention plans address food fraud (i.e. deliberate acts that deceptively use food for economic gain). Food fraud prevention strategies must select effective and efficient tactics such as enhancing food packaging for deterrence or detection. As such, packaging can mitigate health hazards and be a key component of enterprise risk management.

This is a joint presentation with John Spink.

065-004
pH Indicator for Milk Spoilage
A. Abbas, University of Minnesota, Email: aabbas@umn.edu

Milk spoilage after consumer purchase varies as a function of temperature and time of storage in addition to the initial shelf life of the milk. A pH indicator can be applied to a package to communicate to consumers that milk is acceptable or unacceptable to drink. This presentation will focus on the process to commercialization of this technology.

065-005
Embedded Business 2 Me (B2ME) Intelligent Packaging Solutions to Better Market and Address Food Waste
J. Sinisgalli, Email: jim.sinisgalli@systechone.com

This presentation will explore trends in approaches to marketing food and engaging customers. Participants will learn about innovative ways to tackle food fraud, leveraging technologies that can be embedded in Business 2 Me (B2ME) tools; and packaging to enable the end-consumer to actively participate in helping produces manage consumption and ultimately reduce food waste.

066-001
Feeding the Brain and Ingredients for Cognitive Health
R. Paul, Email: rob@nawgan.com

This presentation will cover science behind the brain and brain health. Dr. Paul has over 230 published research articles and is the Director of the Missouri Institute of Mental Health.

066-002
Role of Omega 3, Vitamin D, and B Vitamins in Cognitive Health
M. McBurney, DSM, Email: michael.mcburney@dsanmar.com

This presentation will cover the science and mechanism of Omega 3s, D, and B Vitamins. Research behind the ingredients as well as dietary guidelines will be presented.

066-003
Role of Citicoline in Cognitive Health
D. Citrolo, Kyowa Hakko USA, Email: citrolo@kyowa-usa.com

This presentation will cover the science and mechanism of citicoline. Research behind the ingredient including new research in a majority of demographics will be presented.

066-004
Creating Your Next Brain Health Product
K. Todd, Kyowa Hakko USA, Email: todd@kyowa-usa.com

This presentation will cover consumer segmentation, marketing trends, sales data, and forecasted sales. There will be an overview of what is driving the category and the keys for creating a food or beverage with a brain health ingredient.

067-001
Advancing the Science of Interoperable Food Traceability
M. Southall, G5 US, Email: m совсall@g5us.org

The first presentation will discuss the latest advances in interoperable technologies including lessons learned from other industries such as telecommunications, pharmaceutical, banking and automotive sectors. It will also present a summary of several initiatives in the food sector designed to enable standards-based interoperability of traceability technologies.

067-002
Interoperable Food Traceability: Successes and Failures in the Produce Sector
E. Treacy, Produce Marketing Association, Email: etreacy@pma.com

The next presentation will then dive into a more specific case study of how the produce sector responded to several foodborne outbreaks by proactively enabling electronic traceability and using interoperability. The speaker will discuss roadblocks encountered and the importance of engaging stakeholders across the supply chain to implement enhanced traceability.

067-003
The Past, Present, and Future of Interoperable Food Traceability
T. Bhatt, Institute of Food Technologists, Email: tborah@ift.org

Finally, the last speaker will forecast the future of interoperability based on the historical trajectory outlined by the first two speakers, including the evolution of the science and innovation of food traceability. The session will conclude with an interactive discussion with the audience on the need for globally aligning people, products, processes, policies, and protocols to realize the true potential of interoperable food traceability.

068-001
Impact of Different Stages of Juice Processing on the Anthocyanin, Flavonol, and Procyanidin Contents of Berries
L. Howard, University of Arkansas, Email: lukeh@uark.edu

Dr. Howard's research program is focused on extraction and characterization of bioactive compounds in fresh and processed berries. Dr. Howard has published over 120 scientific articles and five book chapters and has delivered over 90 presentations at scientific meetings. He is a Professional Member of the American Chemical Society.

068-002
Fruit and Vegetable Pomace as Antioxidant, Dietary Fiber for Enhancing Nutritional Value, and Biodegradable Packaging
Y. Zhao, Oregon State University, Email: yanyun.zhao@oregonstate.edu

Dr. Zhao's research interest is in the area of value-added food processing by utilization of emerging food processing and packaging techniques. She specializes in the development, characterization, and application of biodegradable and edible packaging materials, and use of edible coating, vacuum impregnation, and infusion technique for developing high quality, longer shelf-life, and value-added fruit and vegetable products. She has published work related to the application of fruit and vegetable byproducts such as wine grape pomace.

068-003
Advancements in Citrus Fiber Technologies
B. Lundberg, Fiberstar, Email: b.lundberg@fiberstar.net

While fibrous byproducts are abundant in supply, using them in food products to improve nutrition and quality while not degrading taste or texture can be challenging. However, advancements in technology greatly improve the ease of using citrus fiber in food and beverages to maintain and/or improve taste and texture while having a clean label ingredient declaration.

Dr. Lundberg has worked for Fiberstar, Inc. since 2001 and holds a B.S. and M.S. in engineering from the University of Minnesota, where he developed new and improved processes to produce expanded fibers from agricultural byproducts. This research at the University of Minnesota served as the foundation of Fiberstar's citrus fiber products and many of its applications. He earned his Executive MBA from the University of St.
Thomas in 2008 and in 2013 earned his Ph.D. in Biological Systems Engineering from the University of Wisconsin where the focus of his research was characterizing the structure-function relationships of citrus fiber.

069-001
Learning to Like Low Sodium Foods: The Importance of Dietary Experience
N. Bobowski, Monell Chemical Senses Center, Email: bobo0005@umn.edu

Past efforts to curb Americans’ high salt intake have largely been ineffective, likely due in part to the broad hedonic appeal of salty taste. This presentation will focus on our current understanding of the role of dietary experience in establishing and shifting salt preference, in terms of both reducing overall salt intake and incorporation of single low sodium foods into the diet. An ongoing study aimed at shifting salt preference of children will be discussed with a specific focus on the importance of establishing taste preferences early in life.

069-002
A Role for Salivary Proteins in Taste and Feeding
A. Torregrossa, University at Buffalo, Email: amtorreg@buffalo.edu

Under normal feeding and drinking conditions, taste compounds invariably mix with saliva before reaching their receptor targets. This sets the stage for salivary constituents to modulate the taste signal at the most fundamental level. However, very little work has been conducted examining how salivary proteins (SPs) may modulate taste perception. This presentation will address how salivary proteins are modified by experience and how these proteins then modify diet acceptance and choice, focusing specifically on bitter taste perception.

069-003
Influence of Food and Beverages Intake on Astringency: Impact on Saliva Protein Profile
V. De Freitas, ICETA, Email: vfreitas@fc.up.pt

Procyanidins are polyphenols present in the human diet mainly through fruits and vegetable-based beverages like red wine. These compounds have the ability to interact with salivary proteins, imparting the sensation of astringency. Saliva is rich in different salivary protein families described to be involved in astringency. However, due to saliva being a complex fluid, its protein profile may vary under different conditions. This presentation will address how this profile can change as a result of diet and what implications these changes may have on the sensory perception of foods and beverages.

069-004
Consumers’ Changing Expectations and Opportunities for Product Development
S. Kirkmeyer, Givaudan Flavors Corp, Email: sarah.kirkmeyer@givaudan.com

In developing successful food products, basic tastes, mouthfeel, and volatile flavors play an important part in consumer acceptance. When focusing on bitterness and astringency, consumers are exposed to products where these cues contribute positively to the experience, however, one must manage in products where consumers expect equivalent taste. This talk will utilize innovative case studies incorporating market, consumer, and sensory research to better understand the integrated effect from basic tastes, flavor, and mouthfeel, leveraging these changing patterns to exceed consumer expectations.

070-001
Food Industry Issues and Constraints
J. McIntire, Grocery Manufacturers Assn, Email: jmcentire@gmaonline.org

There is a move to utilize natural antimicrobials to replace “synthetic” ones to achieve clean labels. What are the implications of this as far as the GRAS process? Outside of implementing physical preservation procedures, what can the food industry do to maintain safety and quality without “synthetic” antimicrobials, and are “natural” antimicrobials the solution?

070-002
Validation Issues in FSMA Preventive Controls
M. Parish, FDA, Email: mickey.parish@fda.hhs.gov

What effect might FSMA have when food formulations are changed to reduce or eliminate antimicrobials? What does the industry need to do when replacing antimicrobial hurdles? How will a move away from traditional synthetic antimicrobials impact the need for validation and verification?

070-003
Current Research and Development on Natural Alternatives for Synthetic Antimicrobials: Are We Close to a Solution?
P. Davidson, University of Tennessee, Email: pmdavidson@utk.edu

There has been a very limited innovation pipeline in the development of novel antimicrobial solutions for improving food safety and quality. It is not economically feasible to invest time and money on new synthetic antimicrobials. At the same time, there are very limited alternatives for controlling pathogenic microorganisms, especially in low acid, low moisture, and higher lipid and protein foods. Are there any solutions on the horizon and what can be done to make them a reality?

071-001
High intensity ultrasound as an additional tool to change physical properties of trans-free fats
S. Martini, Utah State University, Email: silvana.martini@usu.edu

This presentation will discuss the use of high intensity ultrasound (HIU) in shortenings with low content of saturated fatty acids and free of trans-fats to increase the hardness and elasticity of these fats and broaden their uses in foods. The use of this technology in batch and in a flow cell will be also described. Results from this research show that crystalline networks obtained through sonication were harder, more elastic, had smaller crystals, and melted over a narrower range of temperatures.

071-002
The functionality of monoglyceride structured O/W emulsions in baking applications
A. Marangoni, University of Guelph, Email: amarango@uoguelph.ca

Replacement of trans fats with saturated fats transformed the fats and oils industry. Saturated fats, however, have been traditionally considered not a healthy option. Combined with increasing consumer demand for healthy fats, obesity, overpopulation and poverty, will pressure the food industry to produce inexpensive but healthy fats and oils. Shortening and margarine are produced by crystallization. Once composition and manufacturing conditions are set, these cannot be easily changed. Solid fat replacement with structured emulsions of high heat resistance will be introduced and discussed.

071-003
Application of materials science to develop healthy fat systems design for bakery applications
F. Davoli, Cargill, Email: fernanda_davoli@cargill.com

The reduction of saturated and total fat in the diet is desirable from health perspectives. Baked goods can be resistant to reductions because of the complex behavior of the fat throughout the baking process. Therefore novel fat based systems are studied as potential replacers for bakery shortenings. Strong encapsulation of the water into the fat matrix, addition of particles to the fat system and manipulation of the crystal network are some of the technologies explored to study potential novel functional fat systems for bakery. In order to create functional fat bakery systems it is necessary to have strong control of the fat system composition as well as the processing steps and conditions. The understanding of the fat crystal network of fat systems in the presence of its constituents (structuring materials, for example: solid particles, emulsifiers, waxes, water) are key to provide appropriate network and consequently functionality. The material properties are determined and structure studied using rheology, microscopy, and thermal behavior to mention some of the techniques used. Further we demonstrate how the different fat based systems behave in some baking applications. Thereby we develop an understanding between novel fat systems and the functionalities that are relevant to maximize the ability to replace currently used shortenings and margarines.

071-004
Targeting Consumer Preferences with Bakery Oils and Shortenings
B. Wainwright, Cargill Inc, Email: Bob_Wainwright@cargill.com

The food industry is driven by consumer taste and preferences. A recent survey returned the following · These days, significantly fewer shoppers report paying close attention to the type of oil and/or amount of fat in foods, and more say they are paying “no attention” to oils/fats in packages. · Baby Boomers generally have higher levels of concern and are more likely to check for fats and oils compared to Gen Y and Gen X. · They consider many of the oils as less healthy than younger consumers do. · Among fats, fewer Baby Boomers felt that monounsaturated fats and polyunsaturated fats are healthy versus Gen Y or Gen X. · Younger shoppers are more positively impacted by claims of organic and sustainable than Baby Boomers. Both Gen X and Baby Boomers have more positive perception of non-GMO claims and consider them to have greater impact on purchase. In addition to the foregoing, scientific articles published the past two years have disputed the detrimental effects of eating diats high in fat, specifically saturated fat. This new information, which contradicts the recommendations of the American medical community since the late 1970s, has likely caused confusion and a sense of futility in consumers about their fat and oil choices. And the June 17, 2015 Final Determination Regarding Partially Hydrogenated Oils declarative order issued by FDA essentially retired those ingredients. The food industry has made tremendous progress to identify and
implement functional PHO alternatives that preserve the product attributes consumers expect and demand. An array of solutions has been developed to address functional requirements as well as nutritional and label appeal drivers. A variety of illustrative commercialized bakery oils and shortenings will be presented including spray oils, frying fats, dough fats and icing & filling fats.

072-001
The Amorphization of Vitamins C and B1
A. Hill, McGill University, Email: andrea.hill3@mail.mcgill.ca

The ingredient forms of vitamins C and B1 commonly used in food formulations (ascorbic acid, sodium ascorbate, thiamin hydrochloride, thiamin mononitrate) are often distributed in their deliquescent crystalline forms. As such, they exhibit maximum stability and minimum moisture sorption at environmental conditions below their deliquescence points. However, upon addition to foods and exposure to processing conditions, their physicochemical properties may be altered as they interact with other ingredients and/or convert to amorphous solids. Amorphous compounds are thermodynamically and chemically less stable, and more soluble, than their crystalline counterparts. The objectives of this study were to: 1) prepare amorphous forms of vitamins C and B1 using solid dispersion and lyophilization techniques, 2) investigate the role of polymers with different hygroscopicities, glass transition temperatures, and noncovalent intermolecular interaction abilities on inhibiting vitamin (re)crystallization, and 3) compare the properties of the amorphous solid dispersions to physical blends of the vitamins and polymers and to the single crystalline vitamins during storage in controlled temperature and RH environments. Three of the four vitamin forms (excluding sodium ascorbate) could not be made amorphous by lyophilization in the absence of a polymer, but it was possible to amorphize all of the vitamins in the presence of numerous polymers, albeit the types and ratios of polymer needed varied by vitamin type. Studies are ongoing to document the physical and chemical stability of the amorphous vitamin dispersions in comparison to physical blends of the ingredients; however, it is clear that the different salt forms of the same vitamin have distinct physicochemical properties in solid dispersions, and that polymer type, vitamin form, pH, and storage conditions significantly influence the stability of the lyophiles. It appears the physical stability of the amorphous vitamins was more dependent on intermolecular interactions between the vitamin and polymer than on the Tg or hygroscopicity of the polymers. This study builds upon a body of work in the Mauer lab that has focused on water-solid interactions, understanding deliquescent crystals, and amorphizing crystals, and is undertaken to improve the understanding of vitamin structure and stability in foods.

073-001
Recreating the Lecture and Rethinking the Test
T. DelWitt, Email: tyleredwitt@ift.org

We will look at practical ways of putting new learning approaches into practice. Attendees will take the role of students during mini-lessons and will get hands-on understanding with different types of new instructional styles. Then, we will talk about ways in which to implement these ideas in specific course settings.

075-001
The Use of High-Throughput Screening with Genome Mining for the Discovery of New Biocatalysts of Great Potential for the Production of Fructooligosaccharide Prebiotics and Functional Levan Polysaccharides
S. Karboune, McGill University, Email: salwakarboune@mcgill.ca

A bi-enzymatic system containing levansucrase (EC 2.4.1.10), a glycosyltransferase, along with levane (EC 3.2.1.65), a glycosylhydrolase, can be used to produce novel prebiotic β-(2,6)-linked fructooligosaccharides (FO5s). Genome mining along with a high-throughput screening was used to find new levansucrase and levane enzymes with desired activities. These enzymes can then be used in a bi-enzymatic system which can transform low quality maple products into desirable prebiotics. These newly discovered enzymes will also be assayed for their substrate specificity, which may lead to the enzymatic production of many useful compounds.

075-002
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A. Hill, McGill University, Email: andrea.hill3@mail.mcgill.ca

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076-001
Taming Dragons in the Age of Pseudoscience
B. Postma, Email: bevpostma@ift.org

The scientific community has long struggled with the dark art of mass communications, especially in the age of social media. Academics and health professionals are losing their status as pillars of society, while public opinion is shifting towards self-styled "pseudosciests" who disregard peer-reviewed research in a quest for instant fame. A few brave knights have tried to defend 'real' science from their high seats of learning only to suffer humiliating defeat in a very public arena that plays by an entirely different set of rules. All is not lost however. We're beginning to see the green shoots of revolution as scientists learn how to tame their social media dragons and ride them into the heart of public debate. Instead of waging a silent war of righteous 'witch-burning' against the imposters, food scientists are engaging more confidently online and presenting compelling social narratives. This is giving rise to new multi-sectoral partnerships, which are fueled by common societal goals to leave a sustainable legacy. Together, the food science community is starting to bridge the social divide in a quest to find exciting, innovative solutions to tackle the world's most complex food issues.

077-001
The Death of Common Use as the Basis for GRAS
A. Lebeau, Burdock Group, Email: riverra@burdockgroup.com

Prior to 1958, pre-market approval for drugs was required, but the addition of ingredients into food was not — a disturbing thought. In contemplation of the passage of the 1958 Food Additives Amendment to address this deficiency for pre-market approval, the House of Representatives' Delany Committee was faced with the prospect of forcing the hundreds of food ingredients then in use to go through the food additives petition process, in part because consumer advocates were adamantly opposed to "grandfathering" ingredients. In a commendably pragmatic move, the Committee decided that because many ingredients had been safely used for hundreds or thousands of years (such as spices), added ingredients could be divided into two groups: food additives (requiring approval by FDA) or generally recognized as safe (GRAS) ingredients. GRAS ingredients could be determined as such by two methods: "scientific procedures" (a safety decision based on animal testing) or "common use in food". Common use in food required that a substance be demonstrated to have been safely used in food prior to January 1, 1958. Common use in food was not a grandfathering because the common use in food still required a review by experts to confirm the historical exposure level was less than or equal to the proposed estimated daily intake. The first several hundred GRAS ingredients likely reflected this historical use, either as whole foods (such as cloves or dill) or their historical extractives listed in 21CFR172.510. The speaker will describe the ontogeny of the use of this historical use provision as a method for determining GRAS and its ultimate demise, in part as a product of another section of the Food Additives Amendment, specifically, the "may have rendered" provision of §402.

077-002
Specifications for GRAS: Setting Up an Ingredient for Success
E. Collins, Covance Inc., Email: ed.collins@covance.com

In order to make a uniform, consistent, and safe product, a manufacturer must have specifications that define each ingredient. Specifications should state characterizing information critical to the identity of the ingredient, such as data on chemical and physical properties. These can be used as a metaphorical "fingerprint" for identification and also provide the appropriate analyses that help ensure the safety of that ingredient, by defining the tests to be conducted to analyze for contaminants. The speaker will give an overview of what is important when creating specifications for an ingredient, including Food and Drug Administration (FDA) guidance as well as proper analytical methods, in order to set up an ingredient for proper quality assurance and manufacturing success.

077-004
Proper Study Design and Protocol for Pre-Clinical Trials
K. Williams, Covance Laboratories, Inc., Email: kevin.williams@covance.com

The Food and Drug Administration (FDA) requires safety data that supports the "reasonable certainty of no harm" in order to substantiate the safety of any food or feed ingredient. In this presentation, Mr. Broering will discuss best practices for new ingredient safety studies as well as what to look for in terms of study results. The presentation will cover common questions regarding proper study protocol design, study management, and how to analyze study outcomes. Mr. Broering will also explore what a company should look for when selecting a lab for a pre-clinical trial, as well as how to audit and validate a safety study results in order to support a Generally Recognized as Safe (GRAS) or food additive petition (FAP).

078-001
Quimiofobia: Mito, Realidad y Comunicación; Chemophobia: Style or Reality?
R. López-García, Institute for Food Laws & Regulation, Email: rebecalg@prodigy.net.mx
La quimophobia es un miedo aparentemente irracional hacia los productos químicos. Para muchos consumidores este es un sentimiento real. Ellos tratan de evitar lo que consideran como alimentos de "alto riesgo" sin un soporte científico real. Le tienen miedo a substancias que perciben como artificiales y prefieren lo que consideran como alimentos "libres" de compuestos químicos. ¿Cómo se logrará producir alimentos inocuos para nutrir a la creciente población mundial? Parece que hemos olvidado que comer debería ser una actividad placentera. ¿Será necesario que la industria de alimentos se adapte a esta nueva realidad? ¿Es posible producir alimentos "libres" de compuestos químicos? ¿Cómo se logrará producir alimentos inocuos para nutrir a la creciente población mundial?

079-001
Traditional and New Trends in Food Extrusion
O. Campa, Whistler Center For Carbohydrate Research, Email: campa@purdue.edu
Extrusion is considered one of the most important innovations of the 20th century and often presented as a model of scientific and technology transfer encompassing areas of food and feed production. During this presentation the extruder operation will be discussed considering important parameters that influence the extruder performance as well as the quality of the final product. Case studies including new technologies, such as enzymatic reactive extrusion, development of novel porous materials will be presented. Moreover, the novel scale-up strategies for the extrusion applications will be highlighted.

079-002
Advances in Twin Screw Extrusion Processes
G. Maller, Clextral Inc., Email: gmaller@clextiral.com
Clextral was a pioneer in developing twin screw extrusion technology for food and feed applications over 40 years ago. Since then, it has continued to innovate and is today a recognized leader in new generation twin screw extruders for various applications including coating, drying and physical and/or chemical conversion of biomaterials. Through the use of dedicated screw configurations, as well as accurate control of time-temperature parameters in screw extruders, the raw materials are subjected to a series of process functions such as conveying, compressing, heating, melting, mixing, shearing, cooling, venting, pumping, and shaping. The remarkable process-intensifying capability of twin-screw extrusion technology and associated processing lines allows determinant operational advantages to be achieved, such as: continuous HTST (High Temperature-Short Time) cooking, high productivity owing to reduced downtime and material losses, as well as generating water and energy savings and minimizing operating.

079-003
Analysis of Extrusion Processing at a Mechanistic Level to Design Functional and Sustainable Food Products
M. Emin, Karlsruhe Institute of Technology, Email: azad.emin@kit.edu
An empirical approach often fails to provide fundamental understanding of extrusion and is not efficient in finding a rational compromise between the large numbers of parameters influencing the structure and functionality of the products. To utilize the potential of extrusion process, we have developed a research approach and tools allowing us to characterize the process at a mechanistic level. This contribution will focus on this approach and the corresponding tools (e.g. CFD, rheometry) developed with respect to the design of sustainable and functional food systems.

079-004
R. Buckow, CSIRO, Email: Roman.Buckow@csiro.au
080-001
Hyperbaric Food Storage: Elevated Pressures With No Temperature Control as a Possible Alternative to Refrigeration
J. Saraiva, Universidade De Aveiro, Email: jorgesaraiva@ua.pt
This presentation will give an overview of food preservation by hyperbaric storage as a possible alternative to refrigeration, addressing possibilities, advantages, and challenges.

080-002
Hyperbaric Storage of Solid Foods: Minced Meat, Cheese Whey, and a Codfish-Based RTE Meal
R. Queirós, University of Aveiro, Email: rui.queiros@ua.pt
Results for case-studies of hyperbaric storage (HS) of solid foods (both raw and processed/cooked) will be presented, focusing on microbial and physicochemical parameters.

080-003
Hyperbaric Storage of Highly Perishable Fruit Juices (Watermelon and Melon)
M. Santos, University of Aveiro, Email: mdds@ua.pt
Results for non-acidic (highly perishable) fruit juices will be presented, showing not only the possibility of hyperbaric storage (HS) preservation as an alternative to refrigeration, but also the possibility to achieve longer shelf lives by HS compared to refrigeration.

080-004
The Effects of Hyperbaric Storage on Phenolics Transformations Compared to Refrigeration
A. Shpigelman, Technion - Israel Institute of Technology, Email: avis@bfe.technion.ac.il
The talk will describe outcomes of research regarding chemical changes occurring to phenolic compounds after exposure to low pressure treatments, under hyperbaric storage (HS) conditions, compared to refrigeration. The talk will present both kinetics and suggest both mechanistic hypothesis and possible health effects.

081-001
Using Physical Activity as a Tool in Weight Management and Optimal Health
M. Sothern, Email: melindasothern@ift.org
Dr. Sothern will present different physical activity models and concepts in weight loss measures. Insight on current evidence-based practices available in prevention and treatment of obesity in families will be discussed.

081-002
Role of Carbohydrates in Weight Management
S. Raatz, USDA ARS, Email: susan.raatz@ars.usda.gov
Dr. Raatz will discuss the current status of obesity in the country and describe methodologies of weight management. Particular attention will be paid to the role of carbohydrate containing foods in diets for weight management. The pros, cons, and specific metabolic aspects of these foods will be discussed.

081-003
Using Systems Thinking and Simulation Modeling to Inform Policy and Practice Regarding Childhood Obesity
E. Vall, Email: emilyanne.vall@dph.ga.gov
Presentation will focus on practical strategies that have an impact on physical activity and nutrition behaviors of children. To engage the audience during the session, a childhood obesity systems model that is part of an educational initiative to help Georgia’s policymakers address complex health policy issues will be used. The tool will be used to facilitate an interactive discussion among attendees on their perceptions about how certain interventions affect prevalence vs. the potential outcomes demonstrated in the model. Emphasis will be on engaging the audience in a discussion of "intervention strength" defined as dose x reach. Attendees will understand that while many policy options will reduce the prevalence of childhood obesity; mandated daily physical education and integrating moderate to vigorous physical activity in classrooms have the largest predicted impact on prevalence in the long-term.

082-001
Study of Food Safety Education and Training at Canadian Food Companies
S. Haratifar, SH Food Consulting Services, Email: sanaz_haratifar@yahoo.com
Little empirical research has been conducted to date on corporate food safety training and how it influences organizational financial performance. The aim of this exploratory study was to better understand what food safety training is currently occurring. The investigation examined methods of delivery, content,
expenditures, and organizational impact. The study provided evidence of how confusing and vague food safety training metrics are when assessing program performance. Some limitations of the study are presented and the presentation highlights avenues for future research.

082-002
Aligning Food Protection Outcomes With Training Programs
S. Charlebois, Dalhousie University, Email: fylvain.charlebois@dal.ca
Developing food protection competencies in a diverse workforce is a major challenge. However, this can be addressed by establishing assessment strategies that evaluate the change in outcomes and behavior after training has occurred. This presentation provides insight into effective use of post-training evaluation to ensure that performance improvement is measurable and relevant.

082-003
Training and Education in Food Safety
J. Vanden Hazel, Safe Food Canada, Email: joan.vandenhazel@leftfright.ca
Joan Vanden Hazel, M.Ed, CTDP, Director, Learning Strategy at Safe Food Canada, is a senior learning professional with over 25 years’ experience and a specialization in technology-based learning. Joan has held leadership roles at two of Canada’s largest banks, was the VP of Strategic Learning Services at an e-learning company, and has worked in private, public, academic, and not-for-profit organizations. Joan has developed competencies and curriculum to support large-scale learning solutions. She has designed and developed solutions for a variety of learning channels, including classroom, video, webinar, mobile, internet/elearning, and social media, and all program components, such as certification, testing, and measurement, communications, promotions, and marketing, global learning policy, change management, and adoption. Joan helps organizations optimize their learning function, fine tune their approaches for governance, funding, organization structure, policies, and processes. Joan’s focus in recent years has been on developing solutions for healthcare and health safety initiatives, designing and implementing innovative solutions that enable long-term behaviour change.

Joan's work won a GOLD award for Excellence in E-learning from Brandon Hall. Joan is passionate about the creation of quality learning and in 2010 was a judge for CSTD’s E-learning Award for Training Excellence.

083-001
Supercritical Carbon Dioxide for Extraction of Functional Lipids From the Milkfat Globule Membrane
R. Jimenez-Flores, The Ohio State University, Email: jimenez-flores.1@osu.edu
This presentation will include the latest research findings from the studies on extraction of lipid materials from the milk fat globule membrane using supercritical carbon dioxide.

083-002
Health Benefits of Milk Phospholipids
J. Anamcharla, Kansas State Univ/Meast in Agribusiness, Email: jayendra@k-state.edu
The presentation will include recent research findings on the health benefits of milk phospholipids.

083-003
Milk Phospholipids and Gangliosides
G. Ward, Land O' Lakes Inc, Email: ghward@landolakes.com
The presentation will examine phospholipids and related compounds in milk and their importance.

083-004
Functional Attributes of Milk Phospholipids
A. Patel, Email: ashokap1914@gmail.com
The presentation will include data and discussion on various physico-chemical properties of phospholipids from milk.

084-001
Importance of Dietary Protein: a Passing Trend or Here to Stay?
J. Slavin, University of Minnesota, Email: jslavin@umn.edu
Protein plays an essential role for health and should be included in the diet every day. Consumers are increasingly turning to food to support health and associate protein with areas of interest including weight management, building muscle, maintaining cells, immunity, and energy. There are other areas where evidence is emerging to demonstrate the potential role of protein, including risk factors associated with cardiometabolic disease. This presentation will address the importance of daily dietary protein intake and how protein can not only meet basic needs but also support improved health. In addition, Dr. Slavin will discuss current knowledge on the state of the science around different protein sources, as there is growing consumer awareness of alternative protein sources.

084-002
Application of Protein Quality: What You Need to Know to Make Credible Claims
G. Hughes, Email: ghughgs@sbcglobal.net
This presenter will address an area of current confusion that exists today in the food industry by discussing the different ways the consumer packaged goods companies can inform consumers on protein content of products. From the Nutrition Facts panel to front of pack labels, she will discuss the sources of data and methods that are currently available and approved for use in informing statements on packages. Practical advice for how to apply protein quality, amino acid reference values, nitrogen conversion factors, and available resources for each will be conveyed.

084-003
Yesterday, Today, Tomorrow: What Does the Food Industry Need to Know to Navigate the Changing Landscape?
R. Burns, Grocery Manufacturers Assn, Email: rburns@gmanonline.org
As available technology improves and the state of the science evolves, methods for assessing protein quality have also changed. The final presenter will discuss changes that have occurred over time in methods and policies that incorporated those methods. While the US does not face an immediate change in policy related to protein quality evaluation, there is change on the horizon. Dr. Burns will discuss how those changes may impact the food industry and the potential timeline for incorporation and adoption in global policy and regulations.

085-001
Leveraging front end panels for rapid decision-making
L. Barisas, Tyson Foods, Inc, Email: faretta.barisas@tyson.com
Leveraging the voice of the consumer early in the development process is invaluable for targeted product guidance. But not all tools are created equal – consumer research can be both time consuming and costly. Front end panels can be an efficient alternative and/or supplement to traditional methods. This presentation will cover panelist recruit and selection, as well as specific examples of how front end panels have led to rapid decision-making for product development teams. Key principles for early product guidance will also be reviewed; within the context of front end panels, and beyond.

085-002
Practical applications of sensory discrimination testing relative to theoretical perspectives of power
S. Lee, Email: soolee@illinois.edu
Power of discrimination test will be re-examined for commercial products with different degree of complexity and degree of difference. The presentation will provide a table to provide guidance to selecting effective discrimination testing with varying complexity and degree of difference. Findings presented will be projected out to further studies to apply the degree of difference (d') concept to consumer testing, where practical questions of what is the effect of including very different products into the consumer test design.

085-003
Achieving Consumer-Centered Design in a Resource Constrained Environment
N. Eicher, Food Perspectives Inc, Email: nicher@foodperspectives.com
Raidly changing consumer dynamics are prompting companies to work with leaner budgets and tighter timelines. Emerging research approaches are helping companies chart new paths – building consumer empathy, use of modeling activities to expand ideas, information synthesis to extract insights and more. Practical solutions will be showcased that help accelerate the development process while allowing exploration of design space edges. Included will be case studies illustrating how well-designed research can ensure the final product delights consumers and meets expectation of the concept.

086-001
Current Landscape of PHO Replacements for the Food Industry
R. Collette, Inst of Shortening & Edible Oils, Email: chelsea.ruka@mslgroup.com
To navigate the changing landscape, the presentation will include recent research findings on the health benefits of milk phospholipids and related compounds in milk and their importance.
Collette will review the impact of the recent FDA announcement to remove GRAS status of partially hydrogenated oils in the food industry. He will provide an industry-wide perspective on how companies are approaching the mandate and what options have been successful.

*Please note: QUALISOY has been in touch with ISEO and is in the process of finalizing Robert Collette's availability to participate.

086-002
Functional Comparison of High Stability Oils
R. Daniels, ADM, Email: roger.daniels@stratasfoods.com

Stratas Foods will share results from the latest round of functionality testing of high stability oils, including high oleic soybean oil, high oleic canola oil, mid- and high oleic sunflower oil. In addition, Daniels will review advancing technologies like interesterification and blending components to eliminate trans fats while retaining the structural functionality needed for applications like doughnut frying and baking.

086-003
Applications and Insights for the Food Industry
R. Galloway, United Soybean Board, Email: richard.galloway@bellsouth.net

Galloway will share insights and testimonials from recent case studies that evaluated high stability oils in a real world setting, including a university inn and conference center and a mid-sized foodservice retail chain. In both cases, the latest functionality and sensory testing data played a role in the decision to test and try a different oil. Galloway will review the most compelling information, and what the outcomes of current case studies tell the industry about top-performing oils.

088-001
A Doctoral Training Program Focused on International Food Safety at Cornell University: Premise and Program Details
C. Moraru, Cornell University, Email: cmoraru@cornell.edu

Brief introduction of the premise, structure and elements of the featured doctoral training program, its successes and challenges.

088-002
An Observational Study of the Post-Harvest Supply Chain of Fresh Produce in Mexico for Export to the United States: Professional and Personal Reflections
C. Zoellner, Cornell University, Email: ces23@cornell.edu

Brief presentation of the objectives, activities and outcomes of a doctoral international training experience in Mexico.

088-003
Four Continents: Adventures in Food Safety, Culture, and Personal Growth
S. Beno, Cornell University, Email: smb489@cornell.edu

Brief presentation of the objectives, activities and outcomes of a doctoral international training experience in Kenya.

088-004
Navigating Food Safety Systems and Food Safety Research in Brazil. A Crash Course on a New Language and Culture
E. Griep, Cornell University, Email: erg94@cornell.edu

Brief presentation of the objectives, activities and outcomes of a doctoral international training experience in Brazil.

089-001
The Importance of the Framework in Applying Qualitative Research Sensory
G. Stucky, InsightsNow Inc, Email: greg.stucky@insightsnow.com

The talk will provide an overview of what are frameworks and how they are applied in qualitative research for sensory applications in support of product innovation and development.

089-002
How Moderators Think and Work to Generate Product Insights
C. Gillen, Gillen Research, Email: gillenresearch@gmail.com

This talk will provide a moderator's perspective in how they design qualitative research for product insights, and what frameworks she uses to glean insights from generate content. She will also provide tips on how best to work with moderators to design effective qualitative research.

089-003
Where Does Qualitative Fit Into the Product Development Process?
K. Lozano, Email: kimberly.lozano@tyson.com

This talk will provide an industry perspective for how qualitative research adds value throughout the product innovation and development process. She will also discuss the frameworks they use to address different research needs throughout the process.

089-004
Qualitative Applications for Rapid Iterative Product Development
M. Sfondilis, PepsiCo, Email: mina.sfondilis@pepsico.com

Mina will discuss how her organization uses qualitative research to bridge the gap between marketing and R&D for product innovation initiatives.

090-001
The European Food Legislative Framework: The Role of the European Food Safety Authority
R. Ellard, Food Safety Authority of Ireland, Email: rellard@fsai.ie

The European Food Safety Authority is a major player in the European Union. The presentation will explain how the EFSA is supporting innovation and legislative developments in the European Union.

090-002
The Recent Developments in the European Food Legislative Framework: Challenges for the Food Industry
D. Taeymans, FoodREG Consult, Email: d.taeymans@bluewin.ch

Dominique will update the IFT community about the latest European regulatory developments.

090-003
The European Food Nutrition Labeling Obligations
L. Murphy, Leatherhead Food Research, Email: luke.murphy@leatherheadfood.com

Luke will describe the current situation on food labeling in the European Union with a special emphasis on the nutritional labeling rules which will be in application in December 2016.

090-004
The Challenges of Compliance With European Nutrition Labeling Obligations
R. Post, CHOBANI, LLC, Email: Robert.Post@chobani.com

Robert will explain how to comply with the challenges posed by the new EU nutrition labeling obligations.

090-005
The Business Opportunities Created With the Revised European Novel Foods Regulation
D. Taeymans, FoodREG Consult, Email: d.taeymans@bluewin.ch


091-001
FDA Regulation of Color Additives Derived from Biological Sources: Spirulina Extract as a Case Study
F. Ellison, US Food and Drug Administration, Email: felicia.ellison@fda.hhs.gov

The FDA has regulatory oversight of color additives used in food in the US. All color additives must go through FDA premarket approval via the color additive petition process and be listed in the CFR before they may be used in food products. Each color additive petition must include data that establish the safety and suitability of the color additive for its intended use. The recent approvals of spirulina extract as a color additive in certain foods will be discussed as an example of FDA's scientific safety evaluation of a color additive derived from a biological source.

091-002
The Colorful World of Anthocyanins: Learning From Nature
M. Giusti, Email: giusti.6@osu.edu
Replacing synthetic colors with natural alternatives can be rather challenging. In this talk we will discuss the relevance of the anthocyanin chemical structure to their color characteristics and stability in food matrices. Acylated anthocyanins are typically more stable than their non-acylated counterparts. We will also discuss anthocyanin copigmentation, as well as other mechanisms used by plants to stabilize the anthocyanin chemical structure, and how we can imitate nature to produce a wide variety of anthocyanin-based colors and stabilize those colors in different food applications.

093-002
Light-Based Treatments as Part of Combination Treatments for Microbial Inactivation in Food Systems: Benefits and Limitations
C. Moraru, Cornell University, Email: cim24@cornell.edu

The antimicrobial effects of light-based technologies, including continuous ultraviolet (UV), pulsed light (PL) and more recently light emitting diodes (LED) have already been demonstrated. This presentation will provide an overview of fundamental and practical aspects of these technologies, as well as original research data regarding the mechanisms of action, microbial inactivation kinetics, and factors that affect the effectiveness of the treatment. A special emphasis will be placed on the practical aspects of using these light based technologies in the food industry. In recent years, there has been increased interest in using light based treatments in conjunction with other hurdles, particularly antimicrobials. Nonetheless, it will be demonstrated using experimental data that in order to obtain synergistic or even additive effects the order of applying the different hurdles is critical, due to the potential interaction between antimicrobials and UV light. Other aspects of great importance for the practical application of light-based technologies will also be presented.

093-003
Inactivation of Viruses Using Light-Based Technologies
A. Lee, Institute For Food Safety & Health, Email: alee33@iit.edu

Foodborne viruses are responsible for significant number of outbreaks. Light-based technologies are proved to be effective in inactivation of myriad viruses within a short period of time. This presentation will provide the state of the art research in this area.

091-004
Formulating Food Using Colors From Nature: Opportunities and Challenges
E. Smith, General Mills Inc, Email: erika.smith@genny mills.com

Consumers are increasingly seeking foods colored with ingredients from nature. However, nature-based colors present formulation challenges due to their high usage rates, low stability and presence of off flavors. This presentation will look at challenges that need to be overcome in formulating with colors from nature and will also outline opportunities for future color ingredient innovation.

092-001
Post-Harvest Processing of Foods: Impacts on Nutritional Quality
J. Vanamala, Email: jairam.vanamala@gmail.com

This presentation will highlight recent progress in storage and processing effects on anti-inflammatory compounds, and pre-clinical and clinical studies on food components and gastrointestinal health.

092-002
Innovative Protein Sources for a Growing Population: Repurposing Protein From Underutilized Resources
K. Matak, West Virginia University, Email: kristen.matak@mail.wvu.edu

This presentation will provide an overview of the sarcoplasmic proteins recovered from fish processing by-products. This protein, when dried, can be repurposed as protein powder with functional, sensory, and nutritional properties similar to whey protein concentrate. This easy-to-store-and-transport protein powder could be incorporated into many food products that lack or are deficient in nitrogen or amino acids to improve nutritional quality.

092-003
Preventing Obesity-Promoted Cancers by Utilizing Bioactive Components and Nanoparticle Packaging Technologies
J. Mason, Tufts University HNRCA, Email: Joel.Mason@Tufts.edu

This presentation will focus on delineating a means of preventing obesity-promoted cancers using a novel dietary regimen consisting of two bioactive food components that have established anti-inflammatory effects – Vitamin B6 and curcumin. The presentation will also look at improving the health value of food by development of an innovative nanoparticle packaging technology that directs the delivery of the curcumin and B6 to the colonic mucosa, thereby fortifying the cancer preventive properties of this regimen.

093-001
Application of UV Light Technology as an Adjunct for Pasteurization of Opaque Food Liquids and Beverages
T. Koutchma, Agriculture and Agri-Food Canada, Email: tatiana.koutchma@agr.gc.ca

Depending on microbial efficacy and types of foods, UV technology can be used as alternative to traditional heat pasteurization and as adjunct to heat processing to increase lethal effect, and control measure prior refrigeration to further extend shelf life. This presentation will give updates in research and review challenges in process and product development, validation of commercial units and process economics. Through a few case studies of UV treatments of juices and milk, the key issues of safety and efficacy, and limitations of existing pilot and commercial equipment will be discussed.

094-002
Beverage Detective: Investigate Textural Properties in Beverages for Yourself!
J. Popielarski, Ashland Inc, Email: japopielarski@ashland.com

Session presenters are collaborating to create a sensory experience for participants. In addition to the presentations, there will be a demonstration of beverage sensory experience. Participants will have the opportunity to compare mouthfeel of beverages and discuss aspects of mouthfeel as impacted by ingredients and other variables.

094-003
Beverage Applications
E. Grasso-Kelley, Email: egrasso@iit.edu

Best practices for selecting appropriate strains and methodology for culturing bacteria for greatest resistance are gaining a foothold. Methodologies for inoculating bacteria into low-moisture products have been developed without careful consideration for the impact of the method on stability and thermal resistance. Attendees will be able to describe important considerations for strain selection and inoculation method.
Measurement of Thermal Resistance in Low-Moisture Systems: Pitfalls and Opportunities

G. Fleischman, FDA/IFSH, Email: gregory.fleischman@fda.hhs.gov

Measurement of thermal resistance in low-moisture environments requires different equipment than has traditionally been used for liquids. Pitfalls and assumptions made can affect results obtained. New methodology may be needed to obtain accurate measurements. Attendees will be able to describe the limitations of thermal resistance methods associated with current methodology and identify opportunities to reduce measurement error.

Validating Legacy Processing Systems: Application of Thermal Resistance Data and Models to Predict Log Reductions in Dynamic Processes

B. Marks, Michigan State University, Email: marksbp@msu.edu

Calculating process lethality (i.e., log-reductions) for isothermal and non-isothermal data sets, using given Dref and z values is well established for iso-moisture conditions, but more complicated under conditions where product moisture decreases during processing. Attendees will be able to describe approaches for accounting for dynamic product water activity when applying lethality models to real-world non-isothermal, non-iso-moisture processes.

Recent Advances in Analytical Methods for the Detection of Food Allergens

L. Jackson, FDA/IFSH, Email: lauren.jackson@fda.hhs.gov

This presentation will focus on current analytical methods and the problems associated with them and bring into the talk new methods that are being developed, such as those using nanotechnology.

Detection of Active Botulinum Neurotoxin Using Biosensors Based on Semiconducting Nanocrystals (Quantum Dots)

T. Duncan, FDA/IFSH, Email: timothy.duncan@fda.hhs.gov

This presentation will focus on toxin sensing for the detection of botulinum neurotoxin using quantum dots.

FDA’s Guidelines on Nanotechnology

A. LeBeau, Burdock Group, Email: rivera@burdockgroup.com

FDA has issued additional guidelines in July 2014 for the use of nanotechnology in food production, seeing an opportunity to regulate this upcoming, undisputable game-changing and cross-cutting technology in many industries. But questions still arise on the benefits and safety of nanotechnology. What are the concerns surrounding nanotechnology? What is FDA’s role in the evaluation and regulation of nanotechnology when applied to food production? Dr. Matulka will summarize current knowledge regarding the potential advantages conferred by nanotechnology on food, dietary supplements, pet food and cosmetics. But along with the advantages from the differences in physico-chemical properties at the nanolevel, there may also be differences in biological activity. These differences in biological activity may or may not result in different risks to biological systems. The speaker will discuss potential benefits and risks of nanotechnology in food, the tools that FDA has to regulate nanotechnology and a call for action for self-governance by industry.

Safety Testing Considerations of Nanomaterials: What Changes?

O. Mendes, Product Safety Labs, Email: OdoMendes@productsafetylabs.com

The FDA recommends the assessment of the safety of nanomaterials (NM) be conducted under a “case-by-case” approach and states that there are no food substances intentionally engineered at the nanometer scale for which there are currently enough safety data to consider their use as Generally Recognized As Safe (GRAS) [Regulatory Toxicology and Pharmacology 73 (2015) 463-4760]. Differences in physico-chemical properties at the nanometer level may or may not result in safety concerns. Due to their small size, NM may be retained in many cells and organs to a greater extent than larger particles of similar food ingredients; therefore, NM physico-chemical characterization is paramount to assessing biological/toxicological responses. In addition to chemical composition, important properties to consider are structure, morphology, size, size distribution, surface area and surface charge. Characterization of NM toxicological potential includes a diverse array of both in vitro and in vivo tests that need to be performed in light of NM physico-chemical properties and their impact in the test systems. In vitro tests include cytotoxicity assessment and assessment of metabolic activity of cells. Additionally, genotoxicity assays can also be performed in vitro. Challenges to in vitro genotoxicity test systems include limited nanomaterial diffusion across the bacterial cell wall, lack of bacterial endocytosis ability for the Ames test (OECD 471), and NM interaction with cytoskeletal B affecting the in vitro micronucleus assay (OECD 476). In vivo testing outcomes need to be done in light of toxicokinetic investigations concerning organ-specific and system-wide NM distribution and elimination evaluations. The speaker will discuss the importance of the physico-chemical characterization of NM for toxicological evaluation and considerations of in vitro and in vivo NM toxicological testing.

Dendrimer-Like Biopolymers to Enhance Active Ingredients for Food and Health

Y. Yao, Purdue Univ, Email: yao1@purdue.edu

their specific functionalities, such as forming Pickering emulsions, nano-dispersions, or other types of assemblies. In vitro and in vivo studies have demonstrated the efficacies of DLB biomaterials, such as stabilizing phenolic compounds, enabling active pharmaceutical ingredients, or enhancing the immune responses of antigens.

Use of Corn Protein Zein as a Biodegradable Sensor Platform to Detect Food Analytes

J. Kokini, Purdue University, Email: Jkokini@purdue.edu

This presentation will focus on the development of a zein based gold-coated nanophotonic platform used with Surface Enhanced Raman Spectroscopy to detect the Ara-h1 allergen peanut protein and the toxic acrylamide in fried foods. The platform is based on transferring nanostructures using soft lithography from a polymer film to zein with PDMS as an alternative. The results show that the platform is able to successfully detect both compounds.

Dairy Protein Based Biomaterials for Food and Health

R. Zhou, Jiangnan University, Email: zhoupeng@jiangnan.edu.cn

In foods, dairy protein works not only as a nutrient but also as a class of biomaterials to introduce functionalities and improve the overall qualities. Many such functions are obtained by protein-protein interactions and the interactions of protein with other ingredients in food matrix, such as polysaccharide, lipid, water, mineral, and small bioactive compounds. These protein-based intra- and inter-molecular interactions could occur via covalent and/or non-covalent bonding during processing and storage, and contribute to the overall quality of food. Furthermore, proteins also serve as the biomaterials in food matrix by working as interfacial stabilizers for lipid and solid additive (e.g., insoluble calcium salt) and as the vehicles for sensitive molecules with bioactivity and compounds with bitterness and astringency flavor.

Application of Emotion Measurement to Food Product Testing

H. Meiselman, Herb Meiselman Training and Consulting, Email: herb@herbmeiselman.com

With ten years of experience with the application of emotion measurement to food product testing, I want to discuss the following issues, and make recommendations for each one: 1. defining emotions -what to include 2. using lists of emotions - and not introducing new emotion words. 3. using positive and negative emotions in the right proportion 4. large or small numbers of emotions - how many is the right proportion? 5. which approach: questionnaires, mood picture boards, facial scaling, physiological measures? 6. which response format: CATA, scaled responses, best-worst scaling? 7. when to do emotion testing: before the food, during eating, right after the food? 8. where to do emotion testing: laboratory, CLT, home use test, restaurant, social media? Overall these reviews of current practice, and recommendations for emotion measurement, will help both the novice and the advanced researcher to address many variables in emotion measurement with food.

How Emotion Drives Consumption Behaviour

D. Thomson, MMR Research Worldwide, Email: r.debenedetto@mmr-research.com

This presentation describes how sensory stimulation triggers consumption behaviour. With ten years of experience with the application of emotion measurement to food, I want to discuss the following issues, and make recommendations for each one: 1. defining emotions - what to include 2. using lists of emotions - and not introducing new emotion words. 3. using positive and negative emotions in the right proportion 4. large or small numbers of emotions - how many is the right proportion? 5. which approach: questionnaires, mood picture boards, facial scaling, physiological measures? 6. which response format: CATA, scaled responses, best-worst scaling? 7. when to do emotion testing: before the food, during eating, right after the food? 8. where to do emotion testing: laboratory, CLT, home use test, restaurant, social media? Overall these reviews of current practice, and recommendations for emotion measurement, will help both the novice and the advanced researcher to address many variables in emotion measurement with food.
Using Emotions to Affect Perception and Behavior: Applied global research for phytonutrient supplement product development

C. Kuesten, Amway, Email: carla.kuesten@amway.com

Consumer usage behavior for supplements deserves focused attention in light of growing health care concerns and personalized health initiatives. The World Health Organization recommends consuming a minimum of five servings of fruits and vegetables per day; the vast majority of adults (60-87%) worldwide report consuming less. Maintaining adherence for preventative health care practices, such as watching dietary food intake, including adequate fruit and vegetable consumption and supplementing the diet with phytonutrients, is often a challenge for consumers and especially if the experience is less than appealing. The global research presented here approaches design of phytonutrient supplements by focusing on emotions elicited by supplement aroma options as well as consumption experiences over an extended 1-week usage. Results show discrimination based on emotional profiles. Findings suggest that the hedonic, sensory and emotional attributes represent different dimensions that can be used to understand, even influence, consumer choice and consumption behaviors.

Serving Up Science: The Path to Safe Food in Schools

K. Roberts, Kansas State University, Email: kevrob_77@hotmail.com

What does it mean to have a culture of food safety? How do you create that culture in the school environment? Serving Up Science is an immersion course that provides the training and education, specific to the school environment, that gives child nutrition professionals the tools they need to be a food safe school. This crash course in food science teaches the fundamentals of food science and food processing and how these principles apply to their jobs. Participants learn the science-focused reasons why they perform food safety tasks such as proper cooling, checking and recording temperatures, proper reheating and personal hygiene. Learning is achieved through a combination of traditional instruction, interactive discussions, laboratory exercises, and field trips to food processors and farms. This knowledge can be applied to a variety of school food situations—field trips, athletic events and school parties, as well as in the kitchen. Participants gain the confidence they need to be a food safety leader in their schools, raise the profile of food safety, and enlist other members of the school and community in creating a culture of food safety within schools.

Immersion in the Farm to Fork Continuum: Training Trainers of Food Safety

A. Schober, USDA Food and Nutrition Service, Email: amy.schober@fns.usda.gov

Food safety starts long before foodservice personnel receive foods from their delivery person. To understand the food safety risks for fresh produce, we immerse personnel into the produce industry and let them follow the journey from farm to fork. This presentation will share tips for immersion style training, as well as best practices for enabling your training participants to become trainers for other food service personnel.

Activity-Based Experiential Learning: The Food Safety Olympics for Major Cities Training

L. Dixon, Email: edixon@olemiss.edu

School food service professionals are physically and mentally active in their daily work, and they often desire dynamic, collaborative learning experiences when they gather for training as well. A new interactive educational module, The Food Safety Olympics, was developed as part of a training symposium for school nutrition professionals from school districts with student populations of over 75,000 (Major Cities). Six modules were developed for the Food Safety Olympics, including Food Allergies: Reading Labels, Food Allergies; Avoiding Cross Contact, Food Recalls, Clean vs. Sanitize, Persistent Pinking/Premature Browning and Risk Communication. This presentation explores the use of hands-on, interactive activities, case studies, mock scenarios, demonstrations and discussions to communicate the importance of creating a culture of food safety in school nutrition programs.

An Overview of Cold Chain Practice

S. Sathivel, Louisiana State University, Email: SSathivel@agcenter.lsu.edu

A cold chain management with respect to food is a temperature-controlled supply chain from harvest or slaughter to end use. Low temperature reduces the microbial growth and biochemical reactions in refrigerated foods and fresh produces. Temperature abuse may lead to foodborne illnesses. A cold chain should be monitored, controlled, documented, and validated. In this session, Dr. Sathivel will highlight cold chain management and also focus on monitoring, controlling, documenting, and validating of a cold chain for food.
104-001
FDA Guidelines for Medical Foods: FDA's Attempts to Limit the Development of Functional Foods
G. Burdock, Burdock Group, Email: rivera@burdockgroup.com
The Food and Drug Administration (FDA) has recently issued two different guidance documents for medical foods in an attempt to stem proliferation of the foods which are perceived by FDA as increasingly being used to circumvent drug-into-food prohibition and to market foods with claims. The first (issued in August 2013) is the second edition of the May 2007 draft guidance document “Guidance for Industry: Frequently Asked Questions About Medical Foods” and the other (issued in September 2013) is “Guidance for Clinical Investigators, Sponsors and IRBs: Investigational New Drug Applications (INDs) – Determining Whether Human Research Studies Can Be Conducted Without an IND.” Clearly, some guidance for medical foods is necessary, due to the fact that the medical food category has expanded to include foods that might not meet the original intent of the category. However, FDA has overshot its mark with unrealistic restrictions on medical foods and, essentially, raising the bar too high for most substances to qualify.

104-002
The Legal Framework Governing Medical Foods and Recent Enforcement Trends
J. O'Connell, Covington & Burling, Email: joconnell@cov.com
This presentation would cover FDA's authority to regulate medical foods, including the statutory definition and how FDA interpreted that definition through regulation, and provide an overview of the legal requirements with which medical foods must comply. It would also provide guidance on how to distinguish between medical foods and other potentially similar categories (dietary supplements, foods for special dietary use, drugs) based on labeling claims and a product's intended use, and it would describe recent FDA actions related to medical foods and identify possible trends for future enforcement.

104-003
Principles of Distinctive Nutritional Requirements for Medical Foods
S. Ohlhorst, American Society for Nutrition, Email: sohlhorst@nutrition.org
Meeting criteria for distinctive nutritional requirements is a key legal requirement to meet the medical food definition. Medical food is a category of foods for special dietary uses which are specially processed or formulated and presented for the dietary management of patients and may be used only under medical supervision. What constitutes distinctive nutritional requirements that result from a disease or medical condition? Can broad principles be established to identify distinctive nutritional requirements eligible for medical foods, or is it "case-by-case"?

104-004
Challenges to the Medical Food Category For Therapeutic Management of Chronic Conditions/Diseases
B. Burnett, Entera Health, Inc, Email: bruce.burnett@enterahealth.com
Until passage of an update to the Orphan Drug Act in 1988, Medical Foods (MFs) existed as FDA-approved drugs in the United States. An amendment in the Orphan Drug Act established MFs as a separate marketing category at FDA. MFs were then codified in federal law with passage of the Nutrition Labeling and Education Act (NLEA), but exempted from nutrient labeling. One regulation was passed (21 CFR101.9(1)(8)) based on the NLEA. This regulation required MFs to be: specially formulated (purified); for patients with chronic medical needs; intended to provide nutritional support for unique nutrient needs in the management of a specific disease or condition; and intended to be administered under medical supervision in patients receiving active, ongoing care to assure instructions on use. The FDA then proposed regulations to further define MFs, but withdrew these without comment in 2003. Since that time, the FDA has written FAQ guidance on MFs which it finalized in May 2016. This guidance did nothing to clarify the definition of MFs, the distribution channel for MFs other than restating medical supervision, and provided no guidance on clinical substantiation. FDA's drug division also issued guidance to IRBs in 2013 requiring that MF trials be performed under an investigational new drug application which has delayed, caused clinical trial cancellations and inhibited needed research to substantiate product claims. In addition, recent misinterpretation of FDA guidance by a drug compendium has sought to convert this class of therapeutics to over-the-counter products which would violate 21 CFR 101.9(8). This regulatory decision by a company has led to immediate loss of insurance coverage for potentially millions of individuals, most seriously those with inborn errors of metabolism. The lack of FDA action on MFs has led to confusion amongst physicians, pharmacists and payers as well as restricted patient access to these essential therapies. Industry is proposing best practice guidelines.

105-001
Prebiotics’ Impact on the Human Gut Microbiome: Latest Clinical Data
D. Gordon, ADM/Matsutani LLC, Email: canoe1@centurytel.net
How good is the data showing a positive physiological effect on human health with the consumption of prebiotics?

105-002
Adequate and Accurate Assessment of Impact of Prebiotics on the Gut Microbiome
D. Klurfeld, USDA/ARS, Email: David.Klurfeld@ARS.USDA.GOV
The presentation challenges current thinking about claims that can be made about dietary fibers and added prebiotics assessment and application.

105-003
Varieties of Prebiotics in Foods: Consumer Access and Acceptability
A. Kazaks, Bastyr University, Email: akazaks@bastyr.edu
Plants consumed as foods contain fibers that contribute to a prebiotic effect. The vast majority of the US population does not meet dietary recommendations for fiber-containing foods such as fruits, vegetables, and whole grains. Can use of added prebiotics through functional foods help increase the consumer's acceptability and intake of these potentially health-promoting constituents?

106-001
Developing Protein-Fortified Food: Strategies and Considerations
E. Smith, General Mills Inc, Email: erika.smith@gemills.com
Consumers seek great tasting, protein-fortified food, but many challenges exist in developing these products. This talk will focus on strategies to consider when formulating different food systems that include protein ingredient selection, claims requirements, and achieving good performance over shelf life including superior hedonics. Opportunities for the protein ingredient industry will be highlighted.

106-002
Blending Protein Ingredients: Practical Basis and Challenges
M. Porter, Cargill, Email: michael.porter@cargill.com
Many foods comprise mixtures of proteins from different sources to achieve functional and nutritional objectives. Increasingly, novel proteins with novel interactions are being developed. Protein ingredient developers need to understand these interactions to develop their ingredients for both "single" and "combined" uses. The talk will describe the results of functional tests on protein mixtures in meat, beverage, and nutrition bar model systems, with an emphasis on interactions between soy protein isolate and dairy proteins.

106-003
Mixed Milk-Plant Protein Systems: Exploring Functional Synergies to Develop More Sustainable Products for the Future
R. Ipsen, University of Copenhagen, Email: rii@food.ku.dk
The presentation will highlight research work done on the effect of blending milk proteins with plant proteins on functional properties in different applications.

106-004
Searching for Synergies in Gelation of Animal- and Plant-Protein Blends
L. Pouvreau, Nizo Food Research, Email: Laurice.Pouvreau@nizo.com
Proteins play an important role in the food for their nutritional value and their impact on the texture of food. A partial or complete replacement of animal proteins by plant proteins often leads to a non-desired change in texture. This talk explores protein blends as a means to enable incorporation of plant proteins in gel systems. Single source blends are ubiquitous in industrial application, as most protein ingredients contain at least two individual proteins. These are considered alongside multi-source blends of animal- and plant-derived proteins.
107-001
Comparing the Process Impact of High Pressure High Temperature and Thermal Sterilization of Different Vegetable Purees
B. Kebede, KU Leuven, Email: biniamtamiru.kebede@kuleuven.be
The aim of this work focuses on comparing the impact of thermal and high pressure high temperature (HPHT) sterilization techniques on chemical reactions in vegetables. Firstly, a headspace GC-MS analysis was used to fingerprint the volatile fractions. Using multivariate data analysis, chemical fingerprinting enabled selection compounds differently affected by HPHT compared to thermal processing. Secondly, in a kinetic study, mechanistic as well as quantitative insight into the effect of extrinsic processing variables on quality changes was obtained.

107-002
Modified Packaging Concepts for the Prevention of Non-Enzymatic Browning in Shelf Stable Fruits
P. Juliano, CSIRO, Email: Pablo.Juliano@csiro.au
Thermally preserved clear fruits show initiation and progression of non-enzymatic browning (NEB) during long-term ambient storage. Quality deterioration due to NEB is a current problem for the shelf stability and consumer acceptability of clear fruit polymeric pouches and jars after a few months of room temperature storage. This presentation will show the generation of NEB after retorting and high pressure thermal processing (600 MPa) of pear packs during storage at 4°C, 20°C, and 37°C. Evidence of NEB prevention by Sn addition into clear packages has been demonstrated with sensory and analytical color methods. The effects of addition of Sn metal pieces, SnCl2 salts and Sn coated polymeric films on NEB prevention and color retention during storage will be described. Measurement of key NEB reaction volatile markers were used as supporting evidence for the inhibition of Maillard browning. The presentation will conclude with a discussion on regulatory aspects of addition of Sn in various forms (e.g., coated films, diffusion packs) in comparison to current practice with metallic cans to remain with Sn amounts within permissible food content limits.

Co-authors: Rangika Weerakkody, Andrew Scully, Tanuj Singh, Netsanet-Shiferaw-Terefe, Kai Knoezer, Thambaramala Ganage

107-003
The Development of PEF Applications for the Production of Stabilized Fruit and Vegetable Products
I. Oey, University of Otago, Email: indrawati.oey@otago.ac.nz
PEF application for microbial inactivation of liquid foods such as fruit and vegetable juices or smoothies has been intensively studied and currently used in commercial production. Research in PEF application for solid plant foods has been advanced. Novel structure and functionality of fruits and vegetables could be created by PEF for example tailoring bioactive profile and sensory characteristics of fruit and vegetable products. This presentation will provide better understanding on how PEF could be used for the novel production of chilled and shelf stable fruit and vegetables.

107-004
Integrated Treatments to Enhance Safety, Quality and Shelf Life of Fresh Produce
S. Mukhopadhyay, USDA-ARS, Email: Sudarsan.mukhopadhyay@ars.usda.gov
Microbial safety of fresh produce continues to be a major concern in the US and worldwide. Current chlorine-based washing practice for decontamination of produce have limited efficacy and may produce potentially harmful toxic compounds which raises safety concerns. There is a push to develop a safe and effective strategy alternative to chlorine-based sanitizer treatment. Available technologies have the ability to inactivate microorganisms to varying degrees. However, the treatment intensities required for effective inactivation often results in adverse effects on the product quality. Integrated interventions providing additive or synergistic effect, can lead to improved control over pathogens and the maintenance of sensory and nutritional quality. The overall goal of the integrated approach is to achieve recommended level log reductions of pertinent pathogens through additive or synergistic actions, while maintaining quality and shelf-life. This presentation will discuss the inactivation efficacy of various integrated treatment protocols. Treatments utilizing safe and economic nonthermal UV-C light with various active GRAS antimicrobial washes will be examined. Also, the efficacy of combined treatment utilizing acid antimicrobial washes and antimicrobial coating will be evaluated. Impact of various treatments, on the quality and shelf-life of fresh produce will be discussed.

107-006
High Pressure Homogenization of Beverage Products: Principles and Applications
V. Balasubramaniam, Ohio State University, Email: balasubramaniam.1@osu.edu
Beverages represent a dynamic market segment within the food industry serving the needs of modern consumer’s healthy life style. Though high pressure pasteurized fruits and vegetable juices have been recently commercialized, batch nature of the high pressure technology has been a hurdle for wider adoption of the technology for high throughput commodity oriented beverage products. is desired. High pressure homogenization (HPH) is a pressure-based, continuous-flow Development of continuous flow through high pressure processing methods process wherein a pressurized fluid exits confinement by passage through a small opening into an area of lower pressure, where upon the fluid’s compression potential energy converts to kinetic energy and then to thermal energy. These mechanical effects can be put to work for mixing, dispersion, emulsification, particle size reduction and microbial inactivation, paving pathways for novel liquid foods formulations. By manipulating initial temperature and pressure, the rise in temperature in combination with applied pressure can be used to pasteurize or sterilize the product. The presentation will review basic principles associated with high pressure homogenization of beverage products including valve design, and pressure-thermal history. Presentation will highlight the HPH impact on food quality and bioactive compounds retention. Various potential benefits of implementing HPH in beverage industry will be highlighted.

107-007
Global Adoption of HPP and Pathway to Product Innovations
M. Walker, Naked Emerging Brands, Email: marcia.walker@pepsico.com
The adoption and commercialization of HPP is continuing to emerge globally in many food processing categories. HPP or High Pressure Processing has stood out as the leading technology with many commercial applications now on the market place around the world. Other nonthermal technologies have struggled in comparison to gain commercial success. Food processors are using HPP as practical solutions to produce not only microbiologically safe foods but also products with better quality and extend shelf life with enhanced health benefits. The market for HPP products has exploded over the last 10 years, making this once novel technology a commercially viable processing solution. Consumer demand for minimally processed products has positioned HPP processing as a means to deliver fresher, less processed, more nutritious high quality food products. The pathway from product development to commercialization is critical to the success of the HPP technology. This talk will focus on areas to be considered when validating a technology such as HPP including the ingredients, microbiology, regulatory, equipment and product development hurdles to be addressed in successfully getting a product to market.

108-001
Cognitive Function: Where Are The Trends Coming From And Where Are They Going Next?
S. Badaracco, Culinary Tides, Inc, Email: sbadaracco@culinarytides.com
Suzy will speak on the birth patterns of cognitive function trends using military and chaos analytics to examine the patterns. As a registered dietitian, toxicologist, and chef, she will cross analyze consumer survey and behavioral research, and clinical health research to explain where the trend originated from and what the trajectory is for participants to be able to strategically enter and navigate the trend successfully.

108-002
Cognitive Function: How To Play in the New Playground
M. Webster, Menu Matters, Email: menu mattersnow@gmail.com
Maeve will bring focus to the cognitive function trend by sharing quantitative research provided by Datassentials and other consumer and industry quantitative research sources. She will focus on specific marketing and product development strategies and ideas the can be utilized by participants in their individual companies.
109-001
Enzymes: A History of Safety
L. Gregg, Novozymes North America Inc, Email: lobg@novozymes.com
Ms. Gregg will provide a general introduction of the use of enzymes, their development, and their well-established safety record, based on history of safe use and a plethora of safety studies.

109-002
Enzyme Identity and Characterization
D. Shanahan, BASF Corp., Email: diane.shanahan@basf.com
Ms. Shanahan will discuss aspects of enzyme identity, characterization, as well as routinely used methodology to assess potential allergenicity of enzyme proteins; in addition, Ms. Shanahan will point at evidence in support of the safety of protein-engineered enzymes.

109-003
Enzyme Production and Safe Strain Lineages
V. Sewalt, Email: vincent.sewalt@dupont.com
Dr. Sewalt will discuss aspects of enzyme production strains that underpin the safety of food enzymes. This includes production host characterization, construction methodology, as well as the unique opportunity to establish and leverage safe strain lineages for the production of enzymes. Dr. Sewalt will also touch upon general aspects of the manufacture process of microbial enzymes that are essential to support GRAS status of enzyme preparations.

109-004
Putting the Pieces Together: A Case Study of Enzyme Safety and the GRAS Process
J. La Marta, Email: james.lamarta@dsm.com
Dr. La Marta will discuss the types of toxicology studies utilized to support the safety of microbial enzymes, their exposure assessment in the intended uses, and overall safety assessment. In addition, Dr. La Marta will summarize how the overall methodology described by the panel fits the GRAS process and is utilized by US FDA and international regulatory agencies as a framework for assessment of food enzyme safety.

110-001
S. Nielsen, Food Processing and Post-Harvest Handling Innovation Lab, Email: nielsons@purdue.edu

110-002
Food processing priorities to reduce food losses in Malawi
A. Mwangwela, Lilongwe Univ of Ag & Natural Resources, Email: agnesmwangwela@yahoo.com
Agnes will present her view on the food security challenges in sub-Saharan Africa and specific actions that can be explored to address such challenges.

110-003
Priorities for Reducing Post-Harvest Losses in the Developing World
S. Alavi, Kansas State University, Email: salavi@ksu.edu
Sajid will present an overview of the importance of reducing post-harvest losses and share the information gained from the recent Post Harvest Loss Congress in Rome, Italy.

110-004
Efficacy of Lactic Acid Bacteria in Reducing Listeria monocytogenes Biofilm on Abiotic Surfaces and Decreasing Its Persistence on Cantaloupes
K. Venkitanarayanan, Univ of Connecticut, Email: Kumar.Venkitanarayanan@uconn.edu
Listeria monocytogenes (LM) is a major foodborne pathogen capable of forming biofilms on a variety of food processing surfaces, which contribute to its persistence in processing plants, and subsequent contamination of foods. Although a variety of sanitizers, including hypochlorite and quaternary compounds have been used for controlling LM in processing plants, they are not completely effective in killing the pathogen. Thus, there is a need for novel strategies for controlling LM in food processing facilities. Lactic acid bacteria (LAB) constitutest a heterogeneous group of microorganisms that are found in diverse environments, including plants, animals, humans, and soil ecosystems. Although the antimicrobial properties of LAB against a wide range of pathogenic microorganisms have been well-documented, studies delineating their efficacy in controlling biofilms of pathogens in food processing environment are scarce.

This presentation will provide research findings depicting the antibiofilm effect of LAB against LM on abiotic surfaces. In addition, the efficacy of LAB in reducing LM on cantaloupes will be discussed.

111-002
Biopreservative Strategies for Controlling Non-O157 Shiga Toxin-Producing E. Coli in Fresh Beef
T. Taylor, Email: matt_taylor@exchange.tamu.edu
Much research has been completed and published detailing the antimicrobial utility of various physical and chemical food safety interventions for controlling the O157 and Non-O157 Shiga toxins-producing E. coli (STEC) in beef, both pre- and post-harvest. However, less is known regarding the ability of differing biopreservatives (fermentative non-pathogenic bacteria, bacteriocin-phages, antimicrobial fermentation) to reduce the numbers of STEC on fresh beef. Commercially available food safety interventions were obtained and applied to chilled beef previously inoculated with a cocktail of O157 and Non-O157 STEC. A lactic acid bacteria-containing intervention reduced the numbers of STEC on beef strip loins by 0.5 log CFU/cm² over 28 days of refrigerated vacuum aging (<0.05) as compared to control beef that was identically inoculated and handled but not treated. The application of bacteriophages to inoculated, chilled beef briskets did not result in multiple log-cycles reduction of STEC, presumably due to reduced metabolic activity of STEC during chilling of meat and likely inability of phages to directly contact STEC organisms attaching to beef surfaces. While previous research has shown such interventions to be capable of producing multiple log-cycles reductions in pathogens on further processed meat products against pathogens such as the STEC, Salmonella, and Listeria monocytogenes, researchers did not observe a multi-log cycle reduction of non-O157 STEC on fresh chilled beef during post-treatment handling. Nonetheless, although biopreservatives present opportunities for food safety preservation in beef, further research is required to optimize the capacity of current interventions to effectively antagonize and reduce targeted bacterial pathogens.

111-003
Biocontrol of Antibiotic Resistance: Plant-Derived Compounds as Potential Alternatives
A. Kollanoor Johny, University of Minnesota Twin Cities, Email: anupjohny@umn.edu
Antibiotic resistance is a serious concern for human and animal health, and is considered as underlying cause behind many emerging infections difficult to treat with current antibiotic regimens. Reports indicate potential association between the use of antibiotics in animals/humans and rapidity of resistance development in bacteria. Several foodborne pathogens have been reported to gain resistance to antibiotics in food animals before transmission to humans. In light of this heightened situation, alternatives to antibiotics, and/or interventions that can synergistically work with antibiotics are being explored. Plant-derived compounds (PDCs) have been investigated in the past few decades for their manifold uses in food industry, including their antibacterial potential. Specifically, the speaker will concentrate on the potential of PDCs to control and/or mitigate bacterial antibiotic resistance. Research results that indicate potential use of PDCs as alternatives to and/or potentiators of antibiotics will be presented.

111-004
Targeting Salmonella Through the Use of Direct Fed Microbials in Poultry Production
M. Amalaradjou, University of Connecticut, Email: mary_anne.amalaradjou@uconn.edu
The excessive and inappropriate use of antibiotics in medicine and agriculture has led to the emergence of antimicrobial resistant bacteria. In this regard, the food chain has been considered as the main route of transmission of antibiotic resistant bacteria between animal and human population. In light of this, the USDA framework for the National Organic program has prohibited the use of chemicals and all antibiotics in organic operations. With these significant changes, effective natural and safe strategies for intervention are required to maintain the food safety of these products to protect public health. In this context, use of probiotics in poultry production would be prudent as food safety continues to be a critical issue. This presentation will provide insights on the use of direct fed microbials in poultry production, role in Salmonella control, mode of action and probiotic mediated host health promoting effects. Briefly, probiotic use in poultry production has great potential in reducing the intestinal pathogenic load and thereby reducing the subsequent contamination in poultry production. Several mechanisms of action have been proposed including colonization resistance, competitive exclusion, production of antimicrobial compounds, and attenuation of virulence. Further, probiotics also offer potential health promoting effects and bird growth benefits by modulating the gut microflora and the host immune system.

112-001
Health-Promoting Synergies and Interactions of Bioactive Compounds and Nutrients in Whole Foods
R. Liu, Cornell University, Email: t242@cornell.edu
This presentation will discuss current research on health-promoting synergies and interactions of bioactive compounds and nutrients in whole foods in the prevention of chronic diseases and health aging, and focus on the mechanisms of action.

112-001 Impact of Whole Tomato and Lycopene on Molecular Targets of Prostate Cancer
J. Erdman, University of Illinois Urbana-Champaign, Email: jweerdman@illinois.edu

Both epidemiological and preclinical results suggest that higher consumption of whole tomato products reduce the risk of prostate cancer, especially more advanced or lethal cancer. Lycopene is presumed to be the primary bioactive component in tomatoes and a number of trial support this notion. This presentation will review and compare the support for lycopene and whole tomato and provide preclinical evidence for some specific molecular targets impacted following consumption of each.

112-002 Intersections of Food, Nutrition and Health
R. Clemens, USC School of Pharmacy, Email: Clemens@usc.edu

Both epidemiological and preclinical results suggest that higher consumption of whole tomato products reduce the risk of prostate cancer, especially more advanced or lethal cancer. Lycopene is presumed to be the primary bioactive component in tomatoes and a number of trial support this notion. This presentation will review and compare the support for lycopene and whole tomato and provide preclinical evidence for some specific molecular targets impacted following consumption of each.

113-001 Benefits of the CFS Program for Organizations and Professionals
H. Sandrock, Email: haf027@gmail.com

113-002 Steps for Becoming a Certified Food Scientist and Tips for Preparing
C. Lau, Email: chengboey.lau@mdlz.com

114-001 Development and Application of Whole Genome Sequencing
Y. Chen, Food and Drug Administration, Email: yi.chen@fda.hhs.gov

In a few short years since FDA implemented Whole Genome Sequencing it has moved from a research technology to a valuable tool in foodborne illness investigation. This talk will give a brief overview of the technology, and discuss how its use has evolved. The global network for pathogen traceback and outbreak detection, GenomeTrackR, has also evolved quickly. Several case studies outlining how FDA has used these tools in surveillance and in outbreak investigation will be presented.

114-002 Developing Tools for rapid and accurate post-sequencing analysis of foodborne pathogens
M. Holland, Noblis, Email: mitchell.holland@noblis.org

With WGS becoming cheaper and more readily available, the current challenge continues to be the enormous amount of generated data that require analysis and interpretation. Many bioinformatics tools have been developed to address this need; however, the rate limiting step is the time involved for aligning sequences to identify pathogens and elucidate their relationships. This presentation discusses an approach to rapidly align raw reads in a WGS sample simultaneously to thousands of reference bacterial genomes, the algorithm then uses the resulting single nucleotide polymorphisms (SNPs) to distinguish the sample from known references and identify the most likely strain. From an array of sample data, a phylogenetic tree can be constructed for tracking and potentially identifying the source of contamination or an outbreak.

114-003 Whole Genome Sequencing as a Tool for Source Tracking Listeria in Produce Facilities
T. Suslow, Email: tvsuslow@ucdavis.edu

With the release of the final Preventive Controls and Produce Safety Rules, the fresh produce industry is facing various challenges in meeting compliance expectations. A recent collaboration with several facilities in California to more thoroughly assess vulnerabilities to Listeria indicated the packing environment yielded the greatest number of positive cultures. To further explore source-tracking of these isolates, various molecular methods were applied including whole genome sequencing as the optimal approach to determining their genetic relatedness. This presentation will provide an overview of this produce commodity research and discuss results obtained from different analytic techniques and tools.

114-004 Introduction to Whole Genome Sequencing and Industry Perspective
M. Hayman, GMA, Email: mhayman@gmanline.org

This presentation will give a brief overview of the methodologies food industries commonly use for pathogen detection and investigation. We will then introduce whole genome sequencing, its uses in foodborne outbreak investigation and the food industry perspective.

116-001 Utilizing a Student-Centered Book Club to Create a Safe Environment for Practicing How to Explore and Communicate About Provocative Food-Related Topics
D. Bohn, University of Illinois, Email: dbrehart@illinois.edu

116-002 The Intersection of Food Regulations and Genomics Technology: Health Risk Assessments in the Era of WGS
E. Buenaventura, Bureau of Microbial Hazards Hlth Canada, Email: enrico.buenaventura@canada.ca

Advances in genomics and the promise of routine whole genome sequencing (WGS) means that food safety regulators will need to adapt very quickly and align approaches consistent with their respective regulatory framework. A brief overview of the Food Safety System in Canada and the current WGS strategy at the national level will be introduced. Examples of applicable Food and Drug Regulations will be discussed in the context of WGS information that enable compliance actions. Food safety regulators will need to gain experience/confidence in these new technologies before broad regulatory acceptance occurs. Current and future applications of WGS information in Health Risk Assessments will be the leading edge of this knowledge transfer for regulators. In Canada, we expect to use the weight of evidence approach to bridge the transition.

116-003 Developing Tools for routine and accurate post-sequencing analysis of foodborne pathogens
M. Holland, The Center for Food Integrity, Email: donna.moenning@foodintegrity.org

116-004 Related Topics
H. Spangler, Prairie Farmer/Penton Agriculture, Email: holly.spangler@penton.com

117-001 Genetically Modified Foods and Law
A. Pavel, Morgan, Lewis & Bockius, Email: tony_pavel@cargill.com

117-002 The Interception of Food Regulations and Genomics Technology: Health Risk Assessments in the Era of WGS
E. Buenaventura, Bureau of Microbial Hazards Hlth Canada, Email: enrico.buenaventura@canada.ca

118-001 Updating the Nutrition Facts Label
D. Balentine, FDA, Email: Douglas.Balentine@fda.hhs.gov

This presentation will review the Nutrition Facts Labeling Final Rules and the changes from the original Nutrition Facts label.

118-002 Sodium Reduction: FDA’s Voluntary Initiative
K. Heintz, FDA, Email: Kasey.heintz@fda.hhs.gov

This presentation will help participants understand the Voluntary Sodium Reduction Targets Draft Guidance, why it’s important, and areas where the agency is seeking comments.

119-001 Food Safety and Produce Safety Regulations
J. Erdman, University of Illinois Urbana-Champaign, Email: jweerdman@illinois.edu

119-002 Chemicals in Produce: How Do We Measure the Risk?
C. Lau, University of Illinois Urbana-Champaign, Email: chengboey.lau@mdlz.com

119-003 Whole Genome Sequencing as a Tool for Source Tracking Listeria in Produce Facilities
T. Suslow, Email: tvsuslow@ucdavis.edu

With the release of the final Preventive Controls and Produce Safety Rules, the fresh produce industry is facing various challenges in meeting compliance expectations. A recent collaboration with several facilities in California to more thoroughly assess vulnerabilities to Listeria indicated the packing environment yielded the greatest number of positive cultures. To further explore source-tracking of these isolates, various molecular methods were applied including whole genome sequencing as the optimal approach to determining their genetic relatedness. This presentation will provide an overview of this produce commodity research and discuss results obtained from different analytic techniques and tools.
Salted and dried mackerel is one of the most popular aquatic processed products in Asia. However, high sodium content in salted products significantly linked to high risk of cardiovascular diseases. Salt reduction in food industry nowadays seems an unstoppable trend, although less usage of sodium chloride may alter preservation, saltiness, flavoring enhancement, or other functional properties in processed foods. Therefore, practical solutions of salt reduction become considerably necessary. This study focused on application of a new alternative salt, ChitoSALT, enhancing extension of shelf life of lightly salted and dried mackerel (Scomber australasicus). In our previous study, ChitoSALT only contained 75% sodium chloride, but performed 100% salty perception. Here, we utilized 8% ChitoSALT, a new processed complex salt, to cure sliced Scomber australasicus for 1 hour and then dried by cold air drier at 23°C for 2 hours, meanwhile 8% sodium chloride only was applied as control treatment with the same processes. Sensory evaluations were determined to evaluate the saltiness, astringency, and overall liking. These results suggest that CNF could strengthen the salty intensity of sodium chloride and benefit the development of reduced sodium processed foods.

**Method:**
Commercial sodium alginate, methylcellulose, and carrageenan from different brands, commercial meat binder, Nalgin MV 120, Nalgin SA 1000, pectin RS 461, starch rice, and corn starch and other carbohydrates were used in this research to build FTIR model based on their absorbencies in the region 4000-400 cm\(^{-1}\). The restructured meat was homogenized with distilled water, then centrifuged, and injected into HPLC before filter the supernatant. The Amnexi HPX-87H Ion Exclusion Column was used. Eight times either liquid or solids samples spectra were measured using a Nicolet 380 spectrometer with Smart Orbit. Principle component analysis (PCA) and partial least squares were used to analyze the data using Delight Software.

**Significance:**
These results could be a reliable date for the food industry to screen the food binders used in their samples for all types of foodstuffs.

**Results:**
The HPLC results showed that the standard curve of lactic acid at concentration between 0.25 mg/ml to 10 mg/ml is \(y = 1707.4x + 8.7817\) and \(R^2 = 0.9999\). The FTIR results showed that the predicted concentration and actual concentration for pure lactic acid with \(R\) value was 0.8697. The predicted concentration and actual concentration for spiked lactic acid into homogenized samples with \(R\) value 0.9183. The PCA results showed the FTIR can be a very reliable technique for screening of food polysaccharides used in meat samples.

**E01-002**
**Determination of Organic Lactic Acid and Polysaccharide Food Additives in Restructured Fish by HPLC and FTIR**

**H. Huang,** University of Missouri, Email: huanghulu@umr.edu

**Introduction:**
The purpose of this study is to determine types of polysaccharides added into restructured meat according to FTIR spectra, while another purpose is to quantitate the organic lactic acid that add in restructured fish products by HPLC and also qualitative by FTIR fingerprints.

**Method:**
Commercial sodium alginate, methylcellulose, and carrageenan from different brands, commercial meat binder, Nalgin MV 120, Nalgin SA 1000, pectin RS 461, starch rice, and corn starch and other carbohydrates were used in this research to build FTIR model based on their absorbencies in the region 4000-400 cm\(^{-1}\). The restructured meat was homogenized with distilled water, then centrifuged, and injected into HPLC before filter the supernatant. The Amnexi HPX-87H Ion Exclusion Column was used. Eight times either liquid or solids samples spectra were measured using a Nicolet 380 spectrometer with Smart Orbit. Principle component analysis (PCA) and partial least squares were used to analyze the data using Delight Software.

**Significance:**
These results could be a reliable date for the food industry to screen the food binders used in their samples for all types of foodstuffs.

**Results:**
The HPLC results showed that the standard curve of lactic acid at concentration between 0.25 mg/ml to 10 mg/ml is \(y = 1707.4x + 8.7817\) and \(R^2 = 0.9999\). The FTIR results showed that the predicted concentration and actual concentration for pure lactic acid with \(R\) value was 0.8697. The predicted concentration and actual concentration for spiked lactic acid into homogenized samples with \(R\) value 0.9183. The PCA results showed the FTIR can be a very reliable technique for screening of food polysaccharides used in meat samples.
E01-004

Evaluation of Volatile Compounds and Sensory Quality of Silver Pomfret (Pampus argenteus) During Frozen Storage: The Effect of Freezing Method and Storage Time

C. Wu, Zhejiang University, Email: chwu0283@163.com

Introduction: Silver pomfret (Pampus argenteus) is a significant commercial marine fish species along the coast of China, Southeast Asia, the North Sea, the Arabian Gulf, and the Indian Ocean. Due to its high nutritional content, silver pomfret enjoys increasing market demand. However, silver pomfret is highly perishable during postmortem aging. Freezing is a commonly accepted preservation method used to extend the shelf life of seafood. The quality of frozen food is influenced by freezing method, storage temperature, transportation, etc. Flavor perception caused by volatile organic compound (VOCs) of fish is a crucial criterion that motivates the consumer to consume seafood. Thus, the aim of this study is to assess the effect of three freezing methods on the volatile compounds and sensory quality of silver pomfret during storage.

Method: The fresh silver pomfret samples were frozen either by domestic refrigerator freezing, (-20°C, T1), or plate freezing (-20°C, T2), or liquid nitrogen freezing tunnel (-30°C, 30 min, T3) and then frozen storage at -20°C with four frozen storage durations (0.5, 1, 3, and 6 months, respectively). Fresh fish meat was used as control. All samples were analyzed by HS-SPME-GC/MS and subjected to sensory evaluation. Principal component analysis was applied to the chemical data.

Significance: The current research will give guidance for the application of liquid nitrogen freezing in seafood or consumer concerns about buying or consuming frozen marine fish products.

Results: As expected, changes on the volatile composition of silver pomfret samples were found during storage. However, T3 samples have no significant differences in the volatile profile during initial 3 months, in contrast to other two freezing methods. Compounds such as hexanal, octanal, (2E,4E)-heptadienal, acetaldehyde, 1-octen-3-ol and heptanol decreased after 1 month of storage, and other compounds, such as benzene acetate, 2-pentanol, 3-methyl-1-butanol, dimethyl trisulphide, dimethyl tetrasulphide, pentadecane, 2,6,10,14-tetramethyl and hexadecanoic acid ethyl ester increased. Samples frozen by liquid nitrogen freezing had a better overall sensory acceptability than others, which was in line with VOCs analysis. It indicated liquid nitrogen freezing has advanced in maintaining the muscle quality of silver pomfret during storage.

E02-002

Hypo-Allergenization and Functionality of Soy Protein Following Targeted Enzymatic Hydrolysis and Optimized Maillard Glycation

C. Hinnenkamp, University of Minnesota, Email: hinn0053@umn.edu

Introduction: Food allergies obligate avoidance of a wide range of food products by a notable percentage of consumers, and pose complex challenges to food innovation and production. By extensively modifying the structure, approaches to reduce protein allergenicity have resulted in a loss of functionality. We have recently shown that limited hydrolysis and glycation combined can reduce allergenicity. However, conditions needed to be further optimized to achieve hypo-allergenization while maintaining protein functionality. Our objective was to reduce allergenicity while maintaining the functionality of soy protein through targeted enzymatic hydrolysis and optimized Maillard-induced glycation.

Method: Soy protein isolate samples were enzymatically hydrolyzed with either alcalase, pepsin, or a combination of both to a degree of hydrolysis below 8%. These hydrolysates were then partially glycated with dextran utilizing various reaction conditions. Loss in free amino groups along with the formation of Amadori compounds and browning were monitored. Allergenicity of the modified proteins was then determined using individual soy-allergic human sera samples as the primary antibodies following indirect ELISA and Western Blot techniques. Functionality was assessed by analyzing water holding capacity, gel strength, emulsification stability, and emulsification capacity.

Significance: Results indicated that targeted enzymatic hydrolysis and controlled Maillard glycation can reduce soy protein allergenicity while minimizing the impact on functionality. Further optimization of glycation of soy protein will lead to the development of a functional, hypo-allergenic soy ingredient.

Results: Reduction in immunoreactivity (ranging from 20 - 75%) was observed with hydrolysis alone. The alcalase/pepsin hydrolysate modified both the β-conglycinin and glycinin subunits and tended to have the greatest reductions in immunoreactivity amongst hydrolysates. Subsequent glycation was found to further reduce immunoreactivity (up to 10 - 15% more) with results dependent on hydrolysate, condition, and sera.

Functionality testing showed that hydrolysis could improve emulsification properties, while loss of gelling properties could be minimized under the appropriate conditions.

E02-003

Linking Microstructure, Expansion, and Texture of Pea Protein-Fortified Extruded Snacks

C. Philipp, University of Otago, Email: claudia.philipp@postgrad.otago.ac.nz

Introduction: Low-moisture extrusion has become an important processing technology to obtain protein-fortified, ready-to-eat snacks. Expansion properties of extruded food products strongly affect extrudate microstructure, density, and consequently, its textual quality and consumer acceptance. Typically, food microstructure is captured by invasive 2-D imaging techniques such as light and scanning electron microscopy. In this study we used X-ray micro-computed tomography (μ-CT) as a new, non-destructive technique to quantify and visualize the 3-D internal structure of extruded protein-starch blends. The research aimed to study the impact of protein content and selected extrusion processing conditions on extrudate structure and its link to extrudate expansion and texture.

Method: Rice starch-pea protein blends were extruded in a Clextral Evolum32 extruder at different moisture contents (23 and 26%), die temperatures (130 and 150°C), and screw speeds (400 and 600 rpm) with total protein contents (TPCs) ranging from 1 to 42% on a dry matter basis. μ-CT was used to analyze structural properties of extrudates. Further, physical extrudate characteristics including expansion ratio, density and texture were measured.

Significance: μ-CT and physical analyses showed that increased protein contents resulted in limited expansion, small pores, thick pore walls and, thus, higher breaking force values of the extrudates. Although the production of protein-rich expanded snacks still remains a challenge, μ-CT is a powerful, non-invasive, analytical tool to characterise extrudate structures that can helpfully understand the impact of proteins on structural properties of extruded materials.

Results: Structural properties of extrudates differed between blends depending on the protein content and showed strong correlation with extrudate expansion, density and texture (braking force). Highly expanded extrudates with a total protein content of 9.5% exhibited a very porous structure with large pores, while less expanded extrudates with higher TPCs were comprised of small pore sizes and thick pore walls resulting in higher bulk density and breaking force values. The total pore number per mm increased with protein content and was related to the mean pore size, which decreased with increasing total pore number. Void fraction gives an indication of the solid content and wall thickness and was positively correlated with extrudate expansion.

E02-001

Effect of Foxtail Millet Protein Hydrolysates on Lowering Blood Pressure in Spontaneously Hypertensive Rats

J. Chen, UC Davis & China Agricultural University, Email: scipanda@163.com

Introduction: It has been estimated that high blood pressure could affect one third of the worldwide population, and it has been the leading risk factor for cardiovascular diseases. Angiotensin-converting enzyme (ACE) inhibitors play an important role in regulating blood pressure in human body. Furthermore, fermentation and extrusion processing are used as new approaches to enhance the ACE inhibitory activity of the food production. Foxtail millet (Setaria itatica Beauv) has been confirmed to have beneficial functions including antioxidiant activity, lowering of cholesterol levels and hepatic protection. The objective of this study was to evaluate the in vivo blood pressure lowering the effect of the protein hydrolysates of foxtail millet.

Method: After one week of acclimation, thirty numbers of eleven week-old male spontaneously hypertensive rats (SHRs) were randomly divided into five groups, namely the SHR model control group, the captopril group, and the three foxtail millet protein hydrolysates groups, including raw foxtail millet protein hydrolysates, extruded foxtail millet protein hydrolysates, and fermented foxtail millet protein hydrolysates with Rhizopus oryzae.

Significance: The results showed that the ingestion of raw, extruded and fermented foxtail millet protein hydrolysates could be used to ameliorate hypertension and alleviate related cardiovascular diseases without causing side effects.

Results: Results showed that the blood pressure was lowered significantly after four weeks of treatment with 200 mg peptides/kg of body weight of protein hydrolysates in all the treatment groups. The serum ACE activity and angiotensin II levels in all the treatment groups were found to be significantly lower than that of the control. However, no significant difference in serum ACE activity and angiotensin II levels were noticed among the unprocessed, extruded and fermented foxtail millet samples. The percent heart weight decreased significantly for the three treatment groups. Moreover, the body weight, percent liver weight, and percent kidney weight were not significantly different for all the groups.
E02-004
Microencapsulation of Canola Oil by Spray Drying Using Simple and Complex Lentil Protein Isolate-Based Wall Materials
C. Chang, University of Saskatchewan, Email: chc290@mail.usask.ca

Introduction:
Omega fatty acids-rich oils (e.g., canola oil) have attracted much attention over the past decade as they provide potential benefits to human health. However, the susceptibility of unsaturated fatty acids to oxidation represents a major challenge for industry. The objective was to encapsulate canola oil employing simple (containing the mixture of lentil protein isolate (LPI) and maltodextrin (MD)) and complex (containing LPI, MD, lecithin and/or sodium alginate (SA)) wall materials by spray drying to improve its stability and applicability.

Method:
The emulsion and microcapsule properties as a function of oil payload (20%-30%) and LPI concentration (2%-8%) were first characterized by emulsion stability, droplet size, emulsion viscosity, surface area, and entrapment efficiency. Secondly, effect of wall materials (e.g., the combination of LPI and MD with/without lecithin and/or SA) on the emulsion and microcapsule properties was measured in order to select the most promising wall formulation. Finally, the physical properties (e.g., moisture content, water activity, color, vettability, and particle size) and oxidative stability (e.g., peroxide value and TBARS) during one month of storage at room temperature was investigated on the selected microcapsules.

Significance:
The combination of LPI, MD, and SA can be used as a universal platform to encapsulate omega fatty acids-rich oils with desired physical properties and oxidative stability for industry applications.

Results:
The microcapsules with 20% oil payload and 2% LPI had the lowest surface area (5.4%) and highest entrapment efficiency (73%) with preponderant emulsion properties (e.g., emulsion stability of 92.8%, droplet size of 17.1 micrometer, and emulsion viscosity of 6.6 mPa/s), therefore was carried forward in the design of more complex wall materials in an effort to improve their properties. Then, the combination of LPI, MD, and SA was determined as the best wall materials to produce microcapsules (surface oil of 2.4%, entrapment efficiency of 87.9%), and then compared with LPI-MD microcapsule in further testing. Lastly, LPI-MD-SA microcapsule exhibited lower moisture content (3.5%) and water activity (0.36), and much better oxidative stability (peroxide value of 5.02 meq active oxygen/kg and TBARS value of 0.82 MDA eq. mmol/mg oil after 30 days storage) than LPI-MD microcapsule and free canola oil, which were similar.

E02-005
Potential Utilization of Edible Insects in Extruded Rice Products to Address Malnutrition Issues in Developing Countries
J. Tao, Cal Poly Pomona, Email: jaytao@gmail.com

Introduction:
Although unconventional in the US, entomophagy, or the practice of eating insects, can provide nutrition relief to the many malnourished people in developing countries. Edible insects are part of traditional diets found in over 113 countries. Currently, there are two billion consuming over 2,000 edible insects. Many of these insects contain amounts of energy, protein, fat, vitamins, and minerals comparable to commonly eaten livestock. Rice flour, made from a major food crop around the world, was the vehicle used to deliver these edible insect ingredients. Next, the use of inexpensive single-screw cold-forming extrusion technology was employed as it is capable of high pressure build up and a suitable sized cell wall leads to the structure retaining its porous and evenly smooth surface and as such an overall round or convex shaped pellet, without unevenly smooth surface and as such an overall round or convex shaped pellet, without

Method:
With the popularity of crickets in both developing and developed countries and the nutrient density of locusts, these insects were of interest. Physicochemical properties such as water activity, moisture, and color were measured to estimate product stability. Sensory evaluations, using an untrained student panel, were conducted to predict consumer acceptability. The questionnaires included a preference and similarity test. Iron, the world’s most prominent nutrient concern, was especially groundbreaking as this nutrient has not yet been reported in current consumer acceptability. The questionnaires included a preference and similarity test. Iron, the world’s most prominent nutrient concern, was especially groundbreaking as this nutrient has not yet been reported in current

Significance:
While fortifying an under-utilized resource with a nutritionally dense ingredient, development of this edible insect rice product innovatively answers the call to reducing food insecurity in developing countries. Moreover, this study can further serve as a platform for further exploration in incorporating other various edible insect ingredients and staple foods.

Results:
Physicochemical properties, especially with low water activity ranges (0.16-0.27 aw), suggested an exceptional long shelf life. Positive sensory scores revealed the products to offer acceptable organoleptic properties, particularly with lower insect levels. Nutrient analyses established all formulations to be excellent sources of both iron and fiber. Together, these results demonstrated the success of incorporating rice with edible insect ingredients.

E03-001
Dielectric Properties of Seasoning Spices and Their Heating Rates During Radio Frequency Heating
S. Ozturk, University of Georgia, Email: soszturk@uga.edu

Introduction:
Multi-state outbreaks of salmonellosis in low-moisture food, including spices, have become a food safety concern. As a volumetric heating method, Radio Frequency Heating (RF) offers the possibility of pasteurizing low-moisture foods while maintaining the quality. The objective of this study was to determine dielectric properties of selected seasoning spices, and investigate their heating rates during RF heating as influenced by distance between the parallel electrodes.

Method:
Spices were obtained from grocery store including paprika, cumin, turmeric, curry powder, and pure and coarse ground black pepper with moisture contents (MC) ranging from 8.3-12.4% (wet basis) and water activity (aw) ranging from 0.45 to 0.78. Dielectric properties of the seasoning spices as influenced by MC, temperature, compaction density, and frequency were determined using a precision LCR meter and liquid test fixture at frequency ranging from 1 to 30 MHz. RF heating rates in samples were evaluated using a 27.12-MHz, 6-kW RF oven, with the gap between parallel electrodes adjusted as 8 and 9 cm. The temperature change in samples was recorded every 5 s using a data logger with a fiber optic sensor.

Significance:
The present work provides useful information to develop an effective RF heating strategy to pasteurize spices.

Results:
The results showed that the dielectric constant, ε', and loss factor, ε'' increased with increasing MC and temperature, but decreased with increasing frequency. Additionally, both ε' and ε'' increased with compaction density until the density reached a certain level, and then started to decrease. ε' values at 13.56 and 27.12 MHz ranged from 5.2 to 8.1 and 3.8 to 7.6, respectively. ε'' values at 13.56 and 27.12 MHz were determined as 0.2 to 1.55 and 0.1 to 1.21, respectively. The RF heating rates (°C/s) increased linearly with ε'' for all the samples. The heating rates increased with compaction density until reaching a peak point, then decreased, similar to the change of dielectric properties. When the gap of electrode increased, longer heating time was required to reach targeted temperature (80-90°C). For example, 60 and 95 s are required to heat curry powder in the RF oven with the electrode gap of 8 and 9 cm, respectively.

E03-002
Influence of Potato Starch Pellet Size and Shape on Puffing During Microwave Heating
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Introduction:
In theuffed foods industry the conventional technique used is for non-expanded pellets to be manufactured, pre-dried, and then expanded when needed. Microwave power is employed to produce light, crispy, and porous-textured snacks. Whereas the moisture and texture of the non-expanded pellets are factors that determine the quality of the powdered product, the shape and size of the pellets can also affect results.

Method:
In this experiment conducted included puffing of pre-dried potato starch pellets, of varying shapes and sizes, via microwave heating. The influence of sample sizes of different thicknesses (between 5 mm and 10 mm) and shapes (cube, rectangle and cylinder) were examined in detail. In order to better understand the relationship of food properties and sample morphology with the normal distribution of the peeled pellets was analysed by cross sectional 3D image analysis obtained via use of an X-ray micro-CT scan analyser. Monitoring the pellets while they were being expanded in a high power microwave oven allowed for the determination of the degree of puffing with respect to time. The behaviour of microwaved-expanded starch pellets was investigated: upon heating, moisture within the sample generates superheated steam, causing sudden release and puffing.

Significance:
This study on shape and size factors can be used in the design of high-quality expansion of starch puffing in microwave.

Results:
The maximum size of expansion was here achieved with pellet samples of a larger size that contained fewer edges. Air bubbles may easily be formed and expanded on an evenly smooth surface and as such an overall round or convex shaped pellet, without ruptures on the outer layer, was produced due to the presence of larger air bubbles and thicker cell walls. As such a good balance between an appropriate internal vapor pressure build up and a suitable sized cell wall leads to the structure retaining its porous form after heating. The procedure used for manufacture of the pre-dried pellets was also taken under consideration, as it can influence the initial moisture content of the pellet, which in turn can impact the degree of gelatinization, and thus the expansion of pellets during the microwave heating.
E04-004
Performance Analysis of a Novel Pneumatic Rice Polisher
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Introduction:
Energy intensive commercial abrasive-friction rice polishing system with heavy moving machinery induces considerable rice breakage. Jet polishing technique for metals using high speed air-abrasive particles is adopted for developing simple pneumatic rice polishing system; similar to gas-cyclone without moving parts. Tangentially fed rice moved down in helical path along the abrasive wall, polished and discharged at bottom while air discharged at top. Effects of different abrasive surfaces on degree of polishing (DP) and broken yield (BR), particle-trajectory, particle-abrasive surface interaction, grain rotation pattern, and progress of bran removal were studied.

Method:
Four surfaces containing coarse (CR, 483 micron), medium (MD, 254 micron), fine (FN, 122 micron) and very fine (VF, 89 micron) abrasive particles, rice feed rate 1.25kg/min and air velocity 30m/s were used. Grains were recycled 60 times. DP and BR were evaluated gravimetrically. Particle trajectory was traced using simulated rice (SR) and simulated abrasive surface (SAS). Abrasive-particle interactions were evaluated with density of striking marks on SAS using multiple SRs. Grain rotation inside transparent polishing body was observed using high speed camera. Progress of bran removal from single rice was studied using high-resolution photo-scanning.

Significance:
The simple and new polishing system could be a feasible substitute of energy intensive system in the existing rice mills.

Results:
DP and BR increased linearly (p < 0.05) with number of passes for all the surfaces. Higher DP (8.491 and 8.493%) with CR and MD were attributed to removal of both bran and endosperm layers while FN and VF reduced proportionally more bran (DP, 6.271 and 8.313%). BR was least (24.125 %) with VF and highest (33.978 %) with CR. High impact and shear forces with CR and MD induced broken and fines. Pitch of particle trajectory reduced in conical part where particles met surface with high strike density with more effective polishing. High speed photography revealed desirable rotation of rice particles for unbiased surface polishing. Polishing progressed from the tips followed by dorsal-ventral sides and finally lateral part of the kernels. Thus, the pneumatic polishing system is capable for control polishing of rice uniformly with lower broken yield.

E04-001
Controlling the Gastrointestinal Digestibility of Solid Lipid Nanoparticles Using Non-Ionic Surfactants
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Introduction:
The development of lipid-based delivery systems that can manage the lipolysis in gastrointestinal tract has been demanded for the food, nutritional supplement, and pharmaceutical industries. Solid lipid nanoparticles (SLN) have received attention as one of the promising systems due to their ability to protect core materials against physicochemical stresses. Here we show that controlling the content and the type of non-ionic surfactants covering SLN can optionally handle the lipolysis of particles in a mimicked intestinal model.

Method:
SLNs were prepared by the sonication method using tristearin as the lipid and Brj510 or Brj5100 as the surfactant. The changes in particle size and electrical charge for SLNs in mimicked digestion conditions with high salts, low pH, lipase, and bile were determined, and the tristearin hydrolysis in in vitro intestinal model was monitored using the titration method with NaOH solution.

Significance:
Our study could serve as the basis for developing a delivery system that can control the release of core materials in foods and drugs.

Results:
The maximum number of both surfactants stabilizing the SLN surface was maintained within each certain level (Brj510, ~3.4 nm-2; and Brj5100, ~2.9 nm-2) whereas the particle size of SLNs was decreased with increasing the surfactant contents. All SLNs except a sample prepared using the lowest concentration (5.331 mM) of Brj510 were relatively stable from the outside stresses such as high salt concentration, low pH (pH 3), and lipase conditions due to the steric hindrance effect of the surfactants. In the simulated intestinal condition, SLNs fabricated with Brj510 were lipolysed rapidly than those with Brj5100 at the same molarity of surfactant used. Based on the electrical charge of the SLNs, it could be attributed to the hindrance of Brj5100 from adsorbing bile salts at the interface. Moreover, while the digestion of Brj510-SLNs depended on their particle size, that of Brj5100-SLNs relied on the surface loads of the surfactant. These results demonstrate that the digestion rate of SLNs in the gastrointestinal tract can be determined by the contents and the types of surfactants used for preparation.

E04-002
Dietary Inulin Produces Dose-Dependent Effects on Energy Balance, Diet Preference, and Glucose Tolerance in Rats Fed High-Fat Diets
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Introduction:
Inulin, a prebiotic fiber, holds promise for treating obesity and diabetes through modulation of gut microbiota. However, less is known of the doses of inulin which are effective in producing health benefits and the underlying mechanisms of action. Therefore, we determined the dose-response effects of dietary inulin on energy balance, diet preference, and glucose tolerance in rats fed high-fat diets.

Method:
Sprague-Dawley (SD) rats (7-8 weeks old) were randomized to 4 high-fat (40% kcal dietary groups (n=8/group): (1) control (CON, 0% inulin), (2) 2.5% inulin (2.5IN, 2.5% (w/w) inulin), (3) 10% inulin (10IN, 10% (w/w) inulin), or (4) 25% inulin (25IN, 25% (w/w) inulin) and followed for 3 weeks. Daily food intake (FI), meal patterns, respiratory quotient (RQ) and energy expenditure (EE) were recorded using the computerized lab animal monitoring system. Body weight gain and body composition were measured weekly using the rodent nuclear magnetic resonance spectroscopy. Other measurements included conditioned diet preference test and intraperitoneal glucose tolerance.

Significance:
We found that dietary inulin produces dose-dependent effects in improving energy balance and glucose tolerance with the threshold being close to 10%. High dietary inulin levels further limit its bioavailability. We found that IPP may be transported additionally by the paracellular route due to its physicochemical characteristics.

Results:
Our results indicated that compared to CON: (1) 10IN and 25IN decreased FI by 25% and 33%, respectively, for 2 days, with a decrease in meal size and meal number, whereas 2.5IN was ineffective; (2) 10IN and 25IN decreased RQ, however, EE did not differ among treatments; (3) 25IN moderately decreased fat mass, lean mass, fat gain and lean gain, whereas, other treatments did not differ; (4) 2.5IN, 10IN, and 25IN diets were less preferred during conditioned diet preference tests; and (5) 10IN and 25IN improved glucose tolerance, whereas 2.5IN was ineffective.

E04-003
Elucidating the Intestinal Transport Routes of a Milk-Derived Antihypertensive Tripeptide: In Vitro, Ex Vivo, and In Vivo
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Introduction:
The food-derived bioactive tripeptide, Ile-Pro-Pro (IPP), has potential to treat prehypertension but has low oral bioavailability. The β-casein hydrolysate acts as a competitive inhibitor for angiotensin converting enzyme (ACE). It is reported to be transported primarily in the jejunal epithelial H+ coupled di/tripeptide co-transporter (PepT1). However, this transporter is saturated during protein digestion, which would further limit its bioavailability. We hypothesize that IPP may be transported additionally by the paracellular route due to its physicochemical characteristics.

Method:
Permeability of [3H]-IPP was tested over 2 h in vitro (Caco-2 monolayers), ex vivo (isolated rat jejunum in Ussing chambers), and in vivo (intra-jejunal instillations in rats). Fluorescence was tested in the presence/absence of Gly-Sar, a dipeptide substrate with high affinity for PepT1. All experiments were tested in the presence/absence of a pH gradient (either 6.5 or 7.4). The paracellular marker (14C)-mannitol was tested to confirm integrity of Caco-2 monolayers and isolated jejunum tissue.

Significance:
Previously it was widely reported that IPP used PepT1 as its main route of permeation in the small intestine. This indirectly shows that IPP permeates via both paracellular- and PepT1-mediated transport. As PepT1 is saturated during protein digestion, this would lead to reduce oral bioavailability of IPP and thus, reduced hypotensive action. However, paracellular uptake of peptides may potentially be improved using food components that act as permeation enhancers that temporarily open epithelial tight junctions. This could lead to improved oral bioavailability of IPP; resulting in a potential food-derived pre-hypertensive treatment.

Results:
Results show Gly-Sar significantly reduces the apparent permeability (Papp) and area under the curve (AUC) for [3H]-IPP in vitro, ex vivo and in vivo. This suggests that IPP utilizes PepT1 for uptake across intestinal epithelia. However, IPP uptake is not entirely dependent on PepT1, and may permeate through the paracellular route. The AUC of [3H]-IPP in rat serum was reduced from 321.6 to 195.9 in the presence of Gly-Sar, suggesting that a large proportion of uptake is due to the paracellular route. Surprisingly, a pH gradient was only required in Caco-2 monolayers to activate PepT1. Addition of Gly-Sar and a pH gradient showed no effect on [14C]-mannitol permeability.

E04-004
Impact of Dietary Fiber on In Vitro Digestibility of tapioca Starch and Glycemic and Insulinemic Responses In Vivo: Viscosity Effect
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Introduction:
Research has shown that dietary fibre (DF) can attenuate glycemnic response, and could...
therefore be an effective blood glucose management strategy and to help minimize the risk of developing Type 2 diabetes (T2D). This attenuation has been related to the ability of DF to alter luminal viscosity.

Method: In the present work, an in vitro digestion approach was used to establish if the addition of various types of DF, including yellow mustard mucilage (YMM), soluble flaxseed gum (SGF), fenugreek gum (FG), and oat gum (OG), had an effect on the digestibility of modified tapioca starch. Starch was digested in simulated intestinal conditions with porcine pancreaticin in the presence of each of the DF type. The digestion was carried out in a rheometer at 37°C and a constant shear rate of 60 s⁻¹. Each type of DF was present at one of three different concentrations that resulted in equivalent apparent viscosities at 60 s⁻¹. The decline of digesta viscosity with time was a measure of starch digestion progression. Additionally, a human clinical trial was conducted to investigate the effect of YMM, SGF and FG on postprandial glycemic response. Adults (n=15) at risk for T2D consumed modified tapioca starch based puddings supplemented with one of three types of DF at a concentration that would match their small intestinal viscosity as measured after the simulated digestion.

Significance: These results suggest that neither in vitro starch digestibility nor in vivo peak blood glucose and plasma insulin concentrations were affected by the nature of DF, but were rather affected by viscosity after simulated small intestinal digestion due to DF addition.

Results: Results showed that an increase of DF concentration slowed decline of digesta viscosity in vitro. It was also found that the presence of DF at different concentrations, but matched for simulated intestinal viscosity, resulted in similar rates of digesta viscosity decline. The human clinical trial showed that puddings supplemented with all three types of DF lowered peak blood glucose and plasma insulin concentrations compared to the control pudding but values were not different among the DF-containing treatments, despite their different concentrations.

E05-001

Detectable Rate of Pathogenic Vibrio Parahaemolyticus Decreased Significantly After Co-Culturing With Nonpathogenic Strains in Shrimp

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Introduction: The objective of this research was to discuss a strange but familiar phenomenon that pathogenic strains of Vibrio parahaemolyticus obtained from food samples during the process of isolation. Due to many factors, including competition, enrichment procedure may lead to bias. And poorly understood consequences may prove detrimental to the detectable rates of the pathogen.

Method: A series of experiments were designed to investigate the reason of it by using mixed culture assay of pathogenic and nonpathogenic V. parahaemolyticus. The cocktail was composed of 2 pathogenic strains (ATCC33847: tth+, tdh+, trh+; ATCC17802: tth+, tdh+, trh+), and 2 nonpathogenic strains (Gb: tth+, tdh+, trh+; M: tth+, ttdh, trh-) at two mixing ratios (9:1 and 1:1). After cultured in TSB or in shrimp, the pathogenic strains spread on plates were detected by colony hybridization and verified by colony PCR to calculate the detectable rate.

Significance: According to the results, we hypothesized a probable trend that co-culturing process with nonpathogenic strains might be a factor which led to a low detectable rate of the pathogenic strains in environmental samples and hence to a deviation in risk assessment.

Results: The results showed that the detectable rate of pathogenic strains decreased to a low level after cocktail inoculation both in pure culture and in shrimp. In addition, there was greater reduction of detectable rate of pathogenic strains in shrimp than in pure culture. Especially when mixing with GB in shrimp, no ATCC17802 was detected after 10 h.

E05-002

Isolation and Characterization of bacteriophages as Potential Agents Against Shiga Toxin–Producing Escherichia Coli (STEC) Strains

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Introduction: Shiga toxin-producing Escherichia coli (STEC) is a significant group of foodborne pathogens that can cause mild diarrhea to serious human illnesses. The gastrointestinal tracts of cattle and other ruminants are the primary reservoirs of STEC strains and may co-harbor bacteriophages as part of its microbiota. Bacteriophages are bacterial predators that can act as important limiting factors of bacterial populations in the environment. The aim of this study was to isolate and characterize STEC – specific bacteriophages as potential and natural biocontrol agents of STEC strains. The isolation of bacteriophage was conducted from twenty-two cow manure samples bacteriophages as potential and natural biocontrol agents of STEC serogroups. The aim of this study was to isolate and characterize STEC – specific predators that can act as important limiting factors of bacterial populations in the environment. The isolation of bacteriophage was conducted from twenty-two cow manure samples bacteriophages as potential and natural biocontrol agents of STEC serogroups.

Method: The isolation of bacteriophage was conducted from twenty-two cow manure samples (10 g/sample) and pure culture strains representing seven STEC serogroups (O26, O45, O103, O111, O121, O145, and O157). Salmonella spp. and Listeria monocytogenes. Enrichment, isolation using plaque assays, purification by double layer agar method, lyse centrifugation (4000 x g, 15 mins), filtration, and spot testing were sequentially performed prior to the characterization. Plaque formation, lysis time, host susceptibility and specificity against STEC and non–STEC strains, and multiplicity of infection (MOI) were determined. Furthermore, morphological features were viewed using transmission electron microscopy (TEM) and the presence of virulence factors encoding genes (stx1 and stx2) was examined using conventional PCR to facilitate precise and more comprehensive characterization.

Significance: This work established a protocol for isolating bacteriophages from environmental samples and selecting the most appropriate natural biocontrol agents against STEC strains.

Results: Results showed that 21 bacteriophages were isolated from cow manure samples – all of which were specific to various STEC serogroups but not to non–STEC strains. The isolates formed pinpoint plaques (approx. 1 mm), and had a lysis time of >20 mins. The MOI was calculated to be around 2 or a 1:1 bacteriophage to STEC cell ratio. Morphologically, the bacteriophage isolates had icosahedral head and sheathed–tail ultrastructures that closely described the members of Myoviridae. Molecular characterization showed selected phages were devoid of stx1 or stx2 gene while others generated amplions. Six–negative bacteriophages do not pose threats of possible horizontal virulence genes transfer, therefore they can be utilized as biocontrol agents against STEC strains.

E05-003

Serotyping and Antimicrobial Profile of Vibrio Parahaemolyticus Isolated From Environmental and Blue Crab Samples Collected From Maryland Coastal Bays

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Introduction: Vibrio parahaemolyticus is naturally found in marine and estuarine environments and is the leading cause of seafood associated gastrointestinal illness. The incidence of Vibrio infection has been increasing in the USA as has infections caused by a specific strain of V. parahaemolyticus, O3K6. Multiple resistance to antibiotics of some Vibrio strains isolated from seafood and aquatic environments is a major concern in fish and shellfish farming, aquatic organisms and human health. Little information is available on serotype and antimicrobial profile of V. parahaemolyticus recovered from Maryland estuaries. The aim of the present study was to determine the serotype and evaluate antimicrobial susceptibility profiles of V. parahaemolyticus isolated from crab, seawater and sediment samples collected from Maryland Coastal Bays.

Method: One hundred and fifty (150) PCR confirmed V. parahaemolyticus including 52 tdh+ (pl) and 98 tch+ (pl) strains were tested for susceptibility to twenty (20) different antibiotics. Antibiotic susceptibility tests were performed using the microbroth dilution method according to the guidelines of the current Clinical and Laboratory Standards Institute (CLSI). The O serogroups were determined using an agglutination test with V. parahaemolyticus antisera.

Significance: High multiple drug resistance of V. parahaemolyticus from crab and its environment increases the risk to public health. Therefore, frequent antibiotic sensitivity surveillance is needed.

Results: The most prevalent serotypes were O5 (33.3%), O3 (the pandemic strains, 18.7%) and O11 (14.7%). Forty one (41) percent of all tested V. parahaemolyticus strains were resistant to two or more classes of antibiotics. Cephalothin (CEP) showed the highest resistance (60.7%), followed by Ceftazidime (FOX) (31%), Ceftriaxone (AXO) (30%), Ceftazidime (TAZ) (29.3%), Cefepime (FEP) (24%), Cefotaxime (FOT) (21%) and Amoxicillin/Clavulanic acid (AUG2) (20%). All strains (100%) were susceptible to Ampicillin/Sulbactam (A/ S); 99% were susceptible to Levofloxacin (LEVO), Piperacillin (PIP), Piperacillin/Tazobactam (P/T4), and Tetracycline. Fifty (50) percent of the CEP resistant strains were crab isolates. No correlations were found between the serotype, pathogenicity and antimicrobial resistance profile. Our results indicate that the multiple drug resistance of V. parahaemolyticus in Maryland Coastal Bays was high; however this bacterium was susceptible to the two CDC recommended antibiotics (Tetracycline 99% and Ciprofloxacin 95.3%) for its treatment.

E05-004

Study of the Effect of Different Fats on Pathogen Survival in Cookie Dough

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Introduction: Cookie dough is recognized as a potential vehicle for Salmonella, and was associated with E. coli O157:H7 outbreaks in 2009 as a novel vehicle. It is believed that the nature of cookie dough of high fat and low water activity can provide protection for pathogens' survival during storage. It is important to study what role each ingredient plays in such effect. This study aims to determine the survival of foodborne pathogens in cookie dough during storage, and to assess the impact of each main ingredient and different fats used in cookie dough on survival of pathogens.
Method: Commercial cookie dough was artificially inoculated with \textit{S. Enteritidis} and \textit{E. coli} O157:H7 (106 CFU/g). Samples were stored at 4°C and -18°C and the number of surviving pathogens was counted for 8-week period. Cookie dough samples were also prepared with various fat, sugar and salt contents, and with four different fats including margarine, butter, coconut oil, and olive oil. These samples were inoculated with \textit{S. Enteritidis} and \textit{E. coli} O157:H7 (106 CFU/g) separately, and the survival of pathogens was determined for 8 weeks.

Significance: Our study suggests that each ingredient has different impacts on the pathogen survival. Changing some of ingredients could reduce the survival of\textit{S. Enteritidis} and \textit{E. coli} O157:H7. However, changing storage conditions and ingredients failed to completely eliminate pathogens. Good manufacturing practices and consumer education are essential to prevent future outbreaks.

Results: After 8 weeks, 2.42 and 2.35 log reduction for \textit{Salmonella} and 2.23 and 1.99 log reduction for \textit{E. coli} O157:H7 were observed at 4°C and -18°C, respectively. Cookie dough prepared with seven different recipes of cookie resulted in reduction of both pathogens, ranging from 0.73 to 1.95 log CFU/g. Overall, both pathogens had lower survival rate in 4°C storage, but \textit{S. Enteritidis} showed a trend of growth in \textit{Salmonella} observed in samples with higher fat. Besides, overall \textit{Salmonella} concentration was lower in sample containing coconut oil, and \textit{E. coli} O157:H7 was lower in samples containing olive oil.

\textbf{E06-002}

Exploring the Potential of a High-Shear Technique to Rapidly Discriminate the Bread Making Quality of Experimental and Commercial Flour Blends Through Principal Component Analysis

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Introduction: The Brabender GlutoPeak establishes insight into gluten quality and aggregation behavior. Ongoing research has shown the potential of relating GlutoPeak parameters to breadmaking quality. We explored the quality of 5 experimental and 7 commercial flour blends using the GlutoPeak instrument.

Method: The 5 experimental flour blends were created by blending hard and soft wheat flours (no additives) at fixed ratios (0.100, 25.75, 50.50, 75.25, and 100% hard wheat/soft wheat flour). A variety of standard commercial hard and soft wheat flour blends were sourced from different mills. The commercial flour blends included additives (amylase and ascorbic acid) at normal levels in an effort to assess any differences in prevailing Exploring the Potential of a High-Shear Technique to Rapidly Discriminate the Bread Making Quality of Experimental and Commercial Flour Blends Through Principal Component Analysis commercial flour quality and performance. Principal component analysis (PCA) was used to identify relationships among GlutoPeak parameters, gluten properties (secondary structure, thiol), and other flour quality testing methods (protein content, Farinograph parameters, SRV value, and bake tests).

Significance: Overall, the evidence indicates that wheat gluten secondary structure plays a role in driving both bread making quality and the rheological parameters measured by the GlutoPeak. Further work is necessary to determine the influence of standard commercial flour additives on GlutoPeak assessment of flour quality.

Results: The full data set displayed a significant correlation between bread volume and GlutoPeak torque (r = 0.802; p < 0.01). This did not extend to the GlutoPeak time parameter (r = -0.273, p > 0.05). Secondary structures identified in the GlutoPeak slurry including a-helices (r = 0.742; p < 0.01), 8-sheets (r = 0.610; p = 0.05), and 8-turns (r = 0.633; p < 0.05). showed strong relationships with bread volume. PCA plots of the experimental flour blends showed the GlutoPeak to be sensitive to anomalies in flour performance related to differences in secondary structural features. Separation of commercial flour blends in PCA plots was less efficient due to the presence of additives and similar geographical sourcing of wheat. While separation was achieved and differences were apparent based on flour application, it was difficult to draw definitive conclusions.

\textbf{E06-003}

Characterization and Potential Prebiotic Properties of Oligosaccharides From Coffee Infusion and Its Industrial Residue

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Introduction: Among all potentially functional components found in brewed coffee and industrial residues, oligosaccharides are one of the least studied components. Oligosaccharides are indigestible functional carbohydrates widely studied in human milk for their ability to selectively promote the growth of beneficial intestinal bacteria (prebiotic activity). No oligosaccharides were found in green coffee beans other than sucrose and only a handful of oligosaccharides have been described in roasted coffee beans. The objectives were to extract, purify, identify, and quantify coffee oligosaccharides using different analytical techniques and evaluate their potential prebiotic activity. In this work, results of an investigation detailed the overall distribution of oligosaccharides in brewed coffee and its residues.

Method: A combination of different analytical tools was applied in this work. Ground coffee beans or liquid coffee residues were first extracted by hot water. Lipids and proteins were mainly removed through Folch extraction. Coffee oligosaccharides were purified and enriched through C8 and graphitized carbon solid phase extraction column. The oligosaccharides' structures were identified and characterized through high-resolution mass spectrometers and quantified through gas chromatography-flame ionization detector.
Significance: This study revealed the presence and diversity of oligosaccharides in brewed coffee and coffee residues in details. The diversity of monosaccharides composition provided the basis for matching those oligosaccharides as potential prebiotics to specific probiotic bacteria. The combination of probiotics with synergistically acting prebiotics could improve bacterial survival and potentiate the efficacy of beneficial micro-organisms. This work could provide the basis for developing the next generation of selective synbiotics by matching these coffee oligosaccharides to specific probiotic bacteria that possess all the necessary enzymes for utilization.

Results: Oligosaccharide with a variety of degree of polymerization (DP), ranging from DP 3 to 16, and their constituent monosaccharides were identified, characterized and quantified. The concentration ranged between 4mg and 12 mg per g of coffee bean. The identified oligosaccharides in coffee exhibited diversity in both size and composition. The oligosaccharides found were mainly hexasaccharides (potentially galacto-oligosaccharides and manno-oligosaccharides) with side chains containing arabinose, xylose, and rhamnose. It was also discovered that the composition, structures and abundance of coffee oligosaccharides vary among different roasting and brewing conditions.

E06-004 Improving the Bread Quality of High Protease Activity Flour Using Hops (Humulus Lupulus) Extract G. Goulou, Yildiz Technical University. Email: azulkugorkem@gmail.com

Introduction: Preharvest wheat bug damage results in high protease activity flours. High protease activity (HPA) in flours causes sticky dough, which is unacceptable for the baking industry. The bread produced with HPA flours typically has low volume with poor crust and crumb characteristics. Hops, the raw material of beer production, are also a form of bakery product. Hops have antimicrobial effects, act as an antistaling agent, and give flavor to the bread dough in the Black Sea Region of Turkey. In this study, the breadmaking quality of HPA wheat flour (70%, 50%, and 25% levels) was adulterated with hops extract (0.025% and 0.05%).

Method: 0.25 g and 0.5 g hops pellets were boiled for 5 min with 1000 mL water and passed through filter paper to produce hops extract (HE). The effects of 0.025% and 0.05% HE on the protease activity of flours was monitored by using sodium dodecil sulfate polyacryrilamid gel electrophoresis (SDS-PAGE). The texture, volume, and color characteristics of breads were also measured in order to evaluate the effects of hops addition to breadmaking quality.

Significance: Hops extract was used as a natural ingredient in the breadmaking process. The results suggested that hops extract addition could be used to improve the bread quality of high protease activity flours obtained from bug damaged wheat at low levels.

Results: SDS-PAGE results showed that protease activity of the flour samples containing 50% and 70% HPA flour decreased with the addition of 0.05% and 0.025% HE. HE addition improved breadmaking quality in terms of volume, texture, and color of HPA flours. The positive effect of HE addition at 0.05% was more evident at lower damaged level (25%) HPA flour.

E06-005 Investigation of Inulin as a Source of Soluble Dietary Fiber for High Protein Breakfast Cereals: Lab and Pilot Scale Studies C. Sharma, Kansas State University. Email: chantansharma@ksu.edu

Introduction: Fiber is a valuable component in producing food products with greater health benefits, but it is also known to have been associated with poorer food texture and flavor characteristics. Inulin as a source of soluble dietary fiber was investigated with varying whey protein levels for extruded breakfast cereals.

Method: 3 soluble dietary fiber (inulin) sources, namely, chicory, roasted chicory, and artichoke at 15, 20, and 25% replacement levels along with 15 and 20% whey protein concentrate in a corn flour cereal base at lab (L/D = 30:1) and pilot scale (L/D = 19.5) extrusion conditions. Process and product parameters such as specific mechanical energy (SME), sectional length, expansion ratio, bowl life, textural and pasting properties, and consumer acceptability were evaluated.

Significance: These results suggest that artichoke may have significance for maintaining final product quality and overall acceptability as a soluble fiber source.

Results: Results showed that a highest but significantly different SME for artichoke incorporated blends with respect to lab (SME = 1188 KJ/Kg) and pilot scale (206 KJ/Kg) extruder conditions. Overall, a significant decrease in expansion ratio (0.05 to 0.22 g/cm3) as compared to control corn flour (0.05 g/cm3) was observed but artichoke incorporated treatment was having comparable expansion ratio (0.14 g/cm3) to whey protein incorporated treatment (0.13 g/cm3) at pilot scale. A significant increase in water absorption was observed with whey protein concentrate (0.24 to 0.55 - lab scale and 2.55 to 5.39 - pilot scale) irrespective of processing conditions but further decrease was observed with the addition of fiber. Average crushing force was found significantly increased with protein (0.51 to 0.88 kg for lab scale and 0.63 to 1.68 kg for pilot scale) and fiber sources irrespective of processing conditions. Lower average crushing force was reported for artichoke as compared to other soluble fiber and protein sources for both lab and pilot scale (0.70 kg for lab scale and 1.35 kg for pilot scale). From the rapid visco analyzer, lab scale extruder was found less efficient to cook the cereals to be qualified as instant. Highest overall acceptability of 7.0 was found with artichoke incorporated extruded breakfast cereals.

E07-001 Ability of ZnO to Produce Reactive Oxygen Species Upon Exposure to Low-Frequency Ultrasound H. Dolan, University of Maryland, Email: hdolan@umd.edu

Introduction: More than 30% of fresh produce in North America is lost during post-harvest handling, processing, transportation, and storage; 80% of those losses are due to microbial spoilage. Emulsion and washing with sanitizers are commonly used methods for thwarting microbial spoilage. However, both pose health concerns due to the use of hazardous chemicals, and neither effectively eliminates microbial spoilage. An alternative method, application of ultrasound and sonocatalytic coatings to fresh produce, does not require chemical treatment and could potentially enhance microbial inactivation. Application of this approach to the food industry has not been explored significantly. We hypothesize that exposing sonocatalytic materials to ultrasound can generate reactive oxygen species (ROS), which cause damage to the cell membrane, protein, and DNA structures, resulting in bacterial cell death. We have examined the effect of one sonocatalyst, ZnO, an FDA Generally Recognized as Safe (GRAS) substance, on the generation of ROS in sonicated deionized (DI) water samples.

Method: 1 mM ZnO samples were sonicated at 20 kHz and 500 W for 0-60 minutes at 50% amplitude. Hydrogen peroxide concentrations were measured using a ferrous ion oxidation xylene orange (FOX) assay and the color change quantified using absorption spectrometry.

Significance: We hypothesize that based on its ability to generate ROS, ZnO can be an effective antimicrobial agent and outperform existing sanitation technologies in killing off bacteria and other microbes. Additional applications can include coating of ZnO on metal surfaces to develop antimicrobial food contact surfaces.

Results: Results showed that deionized water produced 3.96 micromolar of hydrogen peroxide after 60 minutes of sonication. However, the presence of 1 mM ZnO in the solution significantly increased the production of hydrogen peroxide to 10.67 micromolar, indicating that ZnO is an effective sonocatalyst for generating ROS.

E07-002 Inactivation of Salmonella During Baking of a High-Protein Model Food W. Wang, Illinois Institute of Technology, Email: wwang98@hawk.iit.edu

Introduction: Forced hot-air processes are applied to commercial production of many low moisture foods including pet foods, which have been implicated with several outbreaks. Typically, these processes have limited efficacy with respect to the destruction of Salmonella, as dry heat is less effective than moist heat at pathogen inactivation. We evaluated Salmonella enterica serovar Agona 447967 inactivation in a model low-moisture food baked in a lab-scale oven.

Method: A carbohydrate-protein-fat (weight ratio of 60:25:6) blend was formulated with wheat flour, soy protein, and soy oil inculcated with S. Agona to a level of 9-log CFU/g, adjusted to 44% moisture content, and mixed to form a homogenous dough. Round ‘biscuits’ (57 mm diameter x 6 mm thick) were cut from the rolled dough and heated for 20 min in an oven at 100°C and 150°C with or without a pan of water achieving different temperature-humidity conditions, respectively. Product temperature was measured at the surface and geometric center. Processed samples were collected into sterile bags and immediately cooled in an ice-water bath. Salmonella was enumerated on trypticase soy agar with yeast extract plates and incubated at 37°C for 24 h.

Significance: It is important to consider monitoring both oven temperature and humidity during baking, as effectiveness of baking on Salmonella reduction in low-moisture foods can be significantly impacted by these two parameters.

Results: Dry-bulb temperature and absolute humidity combinations achieved in the oven were 100°C and 80 g/m3 (TLHL), 100°C and 165 g/m3 (TLHH), 150°C and 25 g/m3 (THHL), and 150°C and 300 g/m3 (THHH), which resulted in Salmonella reduction of 3.16-, 4.22-, 4.96- and 6-log CFU/g, respectively. There was no significant difference (p > 0.05) between reductions achieved by low-temperature-high-humidity and high-temperature-low-humidity conditions. However there was a significant difference (p < 0.05) between these conditions and low-temperature-low-humidity and high-temperature-high-humidity conditions. Temperatures and water activity levels at the product surface and...
The emergence of green consumerism has led to an increase in usage of food preservatives of natural origin. Essential oil is considered to be one of the potential antimicrobial additives having GRAS status. The deep green, heart-shaped leaves of the betel vine, which are popularly known as paan (Piper betle L.) in India, possess essential oil which can be used as antimicrobial agent in food. The current study aimed at modeling the efficacy of betel leaf essential oil nanemulsions (BLOE-NE) on spore inactivation kinetics of a selected predominant food pathogen using a modified Weibull model.

**Method:**
Minimum fungical concentration (MFC) of BLOE-NE was used to study inactivation kinetics of Aspergillus flavus spores. The survival curve was modeled by a modified Weibull model: log_10(N) = log_10(N_0) - (t/β)^α where N_0 is spore concentration at the t = 0. The scale parameter (β) corresponds to time that directs to 1 log10 reduction of surviving spores. The shape of the curve is characterized by β (dimensionless). A fluorescent assisted cell sorter (FACS) was used to assess the viability of spores treated with MFC of BLOE-NE. Morphological alteration of treated spores was visualized by scanning electron microscope (SEM).

**Significance:**
Antifungal activity of essential oil on a predominant food spoilage mold suggests its potential as natural food preservative. Modeling the effect of BLOE-NE provided an insight on kinetics of spore inactivation, whereas FACS and SEM analysis revealed its mode of action against the selected mold.

**Results:**
Time (δ) required for 1 log10 reduction of viable spores under influence of BLOE-NE was estimated to be 69 ± 4.9 hours. The curve exhibited slight downward concavity with β (1.49) > 1. The statistical indices of the model are satisfied by R² (0.977) and RMSE (0.3). The Forward and Side-scatter parameters of flow cytometer suggested differences in size and complexity of treated and untreated spores. Propidium iodide was used as fluorescent dye to distinguish between viable and non-viable spores. SEM also indicated morphological changes of inactivated spores such as shrinkage, leakage, and cytoplasmic coagulation.

**E08-001**

A Multidisciplinary Approach to Food Digestion Studies

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**Introduction:**
Over the last two decades there is an increasing demand for foods that deliver specific nutritional values. In addition, dramatic increase of food related diseases (e.g. obesity) requires development of novel food products that control satiety, glycemic response etc. Overall, digestion studies are gaining increasing attention in recent years, especially as the link between diet and health/wellbeing becomes more evident. However, digestion is a complex process involving a wide range of disciplines, e.g. medicine, nutrition, chemistry, materials science, and engineering. The aim of this work is to critically review the state of research in the field and highlight the importance of connecting the different approaches for achieving a better understanding of digestive processes.

**Method:**
We describe key processes occurring during food digestion and we present different approaches for achieving a better understanding of digestive processes.

**Results:**
While a significant body of work exists within each discipline, there is a lack of a multidisciplinary approach on food digestion studies, which will provide a holistic view of the process. We suggest an open, multidisciplinary platform to food digestion studies, focusing on the interactions between the food and the digestive tract.

**E08-002**

Impact of Resistant Starch on Microencapsulation of Iron by Spray Drying and Its Release In Vitro

Y. Lin, University of Georgia, Email: yl82408@uga.edu

**Introduction:**
Oral iron supplements such as ferrous sulfate and ferrous gluconate have been widely used to improve iron-deficiency anemia. However, direct oral consumption of high doses of iron may cause side effects including stomach irritation and nausea. Partially denatured whey protein isolate (WPI) can trap minerals and the presence of amino acids is known to increase iron bioavailability. On the other hand, studies have shown that prebiotics supplements alone with iron can increase the absorption of iron by promoting gut health. Resistant starch, as one kind of prebiotics, is also non-digestive promoting gut health. Resistant starch, as one kind of prebiotics, is also non-digestive acids is known to increase iron bioavailability. On the other hand, studies have shown that prebiotics supplements alone with iron can increase the absorption of iron by promoting gut health. Resistant starch, as one kind of prebiotics, is also non-digestive.

**Results:**
Overall we aim to raise awareness on the different approaches to food digestion studies and to set a framework for existing and possible future directions so as to achieve a holistic, better understanding on the topic that will lead to healthier food designs and options for the benefit of public health.

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Overall we aim to raise awareness on the different approaches to food digestion studies and to set a framework for existing and possible future directions so as to achieve a holistic, better understanding on the topic that will lead to healthier food designs and options for the benefit of public health.

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While a significant body of work exists within each discipline, there is a lack of a multidisciplinary approach on food digestion studies, which will provide a holistic view of the process. We suggest an open, multidisciplinary platform to food digestion studies, focusing on the interactions between the food and the digestive tract.

**E07-003**

Kill-Step Calculator: An Effective Food Safety System for Bakery Products

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**Introduction:**
According to the Food Safety Modernization Act (FSMA), each registered food manufacturing plant is required to demonstrate science based documentary evidence of preventive controls to FDA inspectors. The American Institute of Baking International (AIBI) developed a series of baking process lethality calculator’s based on D, and z values of Salmonella generated as a part of a series of kill-step validation research. The main objective of the baking process kill-step calculator is to provide bakery manufacturers with a scientific tool based on time-temperature curve to validate in-plant baking processes without risking facility contamination.

**Method:**
Time and temperature are critical for achieving a desired log kill (e.g. 5 log reduction) in any thermal process. The baking process kill-step calculator’s work by using product specific oven temperature and time data which can be obtained using a temperature data logger. Bakers need to enter the time in either seconds or minutes and the temperature in °F or °C. At least 20 product specific time-temperature (≥120°F) data should be entered into the kill-step calculator to determine the total process lethality for Salmonella.

**Significance:**
If the desired log reduction is achieved for the specific baking process and pathogen of concern, the process lethality report generated can be used as guidance and as a supporting documentation for FSMA validation and verification activities. AIBI anticipates that the baking process calculators will help the U.S., and global baking industries in demonstrating the effectiveness of the baking process ensuring the highest safety possible.

**Results:**
Upon entering 20 product specific time-temperature data, the baking process calculator automatically determines the total process lethality for Salmonella in terms of log reductions. Additionally, the calculator generates three graphs: product internal temperature, F value/min, and cumulative log reductions.

**E07-004**

Mathematical Modeling and Validation of Growth of Salmonella Enteritidis and Background Microorganisms in Potato Salad: One-Step Kinetic Analysis and Model Development

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**Introduction:**
Salmonella enteritidis (SE) is a foodborne pathogen frequently associated with raw eggs and egg-related products. It can contaminate potato salad. This study was conducted to evaluate the growth of SE in potato salad, and develop mathematical models to predict its growth.

**Method:**
The bacterial growth was investigated under constant temperature conditions between 8 and 37°C to evaluate the effect of temperature on growth rates and lag times. Duplicated experiments were conducted, with the data from one replicate used to develop kinetic models and determine kinetic parameters, and the other served as an independent data set for model validation. The growth of background microorganism (BK) was also examined. One-step-kinetic analysis method was used to directly construct both primary and secondary models and analyze the data by nonlinear regression for SE and BK.

**Significance:**
The results of this study showed that one-step kinetic analysis can be used to directly construct primary and secondary growth models and determine kinetic parameters. Since the models were validated, they can be used to predict the growth of SE and conduct risk assessment, and to predict the microbiological shelf-life of potato salad.

**Results:**
The results showed that both primary and secondary models can be used to analyze the growth curves, with the derived kinetic parameters closely matching the characteristics of SE and BK. The validation results showed that the root-mean-square error (RMSE) was only 0.39 log CFU/g for SE and 0.55 log CFU/g for BK, with the residual errors of predictions following logistic distributions.

**E07-005**

Use of a Modified Weibull Model to Describe Spore Inactivation of Aspergillus Flavus Using Betel Leaf (Piper betle L.) Essential Oil Microemulsion

S. Basak, Suradeep Basak, Email: suradeepbasak@gmail.com

**Introduction:**
The emergence of green consumerism has led to an increase in usage of food production. Essential oil is considered to be one of the potential antimicrobial additives having GRAS status. The deep green, heart-shaped leaves of the betel vine, which are popularly known as paan (Piper betle L.) in India, possess essential oil which can be used as antimicrobial agent in food. The current study aimed at modeling the efficacy of betel leaf essential oil nanemulsions (BLOE-NE) on spore inactivation kinetics of a selected predominant food pathogen using a modified Weibull model.

**Method:**
Minimum fungical concentration (MFC) of BLOE-NE was used to study inactivation kinetics of Aspergillus flavus spores. The survival curve was modeled by a modified Weibull model: log_10(N) = log_10(N_0) - (t/β)^α where N_0 is spore concentration at the t = 0. The scale parameter (β) corresponds to time that directs to 1 log10 reduction of surviving spores. The shape of the curve is characterized by β (dimensionless). A fluorescent assisted cell sorter (FACS) was used to assess the viability of spores treated with MFC of BLOE-NE. Morphological alteration of treated spores was visualized by scanning electron microscope (SEM).

**Significance:**
Antifungal activity of essential oil on a predominant food spoilage mold suggests its potential as natural food preservative. Modeling the effect of BLOE-NE provided an insight on kinetics of spore inactivation, whereas FACS and SEM analysis revealed its mode of action against the selected mold.

**Results:**
Time (δ) required for 1 log10 reduction of viable spores under influence of BLOE-NE was estimated to be 69 ± 4.9 hours. The curve exhibited slight downward concavity with β (1.49) > 1. The statistical indices of the model are satisfied by R² (0.977) and RMSE (0.3). The Forward and Side-scatter parameters of flow cytometer suggested differences in size and complexity of treated and untreated spores. Propidium iodide was used as fluorescent dye to distinguish between viable and non-viable spores. SEM also indicated morphological changes of inactivated spores such as shrinkage, leakage, and cytoplasmic coagulation.
Red beet hardness was significantly influenced by processing, sample size, digestion time, and texture method (p < 0.0001). For single and bulk (33%) compression tests, raw red beets showed the greatest percent decrease of hardness during 240 min digestion, followed by boiled and canned (90%, 52%, and 33% from initial values, respectively). Although red beet initial hardness was different between processed and raw beets (111.8 N for raw, 10.5 N for boiled, and 6.8 N for canned), they had similar hardness after 240 min in vitro digestion. Microstructural differences were seen between processing methods. Cell size increased after digestion, suggesting moisture absorption. Single compression was the optimal method for softening experiments due to the lowest standard deviation between trials, smaller sample size required, and shorter preparation time.

**E08-005**

**Using a Dynamic Gastric Simulation Model to Study the Effect of Supplementary Proteases in Improving Protein Bioavailability and Reducing Food Allergens**

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**Introduction:**
Supplementary digestive enzymes have been used to improve the bioavailability of nutrients in the human body. One subset of supplementary digestive enzymes includes proteases that degrade proteins into peptides and amino acids for the body to absorb. Additional benefit of incorporating exogenous proteases in the diet include the potential of reducing allergens. Testing proteases activities using an in vivo model is supreme, but the time and cost often limits this method. In vitro methods of digestion are often used as alternative methods to prescreen the efficacy of proteases in improving protein bioavailability and reducing allergens. Dynamic in vitro gastrointestinal models improve simulation through mimicking actual physiological processes including dynamic pH, gastric secretion and emptying, and contraction forces, that are present in the human stomach. The objective is to utilize a simple dynamic gastric simulation device in testing the efficacy of supplementary proteases.

**Method:**
A device, the Dynamic Gastric Simulation Model, was used to test the efficacy of Acid Stable Proteases, DS Proteases, Fungal Proteases, and Peptidase in generating primary amino acid and reducing allergens of peanut powder, solid shrimps, and gluten powder. A Nitrogen O-Phthalaldehyde method was used to determine primary amino acids released while Enzyme Linked ImmunoSorbent Assays were used to monitor allergens reduction. The average concentrations of amino acid generated and the reductions in allergens were compared using Fisher’s Least Significant Difference test at a statistical significance of P < 0.05.

**Significance:**
A simple dynamic gastric simulation device will improve gastric simulation while providing more cost effective approach to prescreen supplementary enzymes for their efficacy in generating more bioavailable nutrients and reducing allergens.

**Results:**
Compared to the control, adding supplementary proteases improved primary amino acid concentrations by 2-5 times. Furthermore, increasing protease concentrations from 0.20g to 0.30g improved the initial bioavailability of amino nitrogen by 2X with concentrations of 3.0 mg/L to 6.0 mg/L, respectively. In addition, all four tested proteases reduced peanut allergy by 90%, but the proteases did not significantly reduce casein or gluten allergens. The results indicated that supplementary proteases have benefits of generating greater protein bioavailability and potentially reducing various allergens.

**E09-001**

**Evaluating the Microbial Quality of Shrimp Vacuum Tumbled With Sonicated and Ultra-Sheared Chitosan and Chitosan Nanoparticles**

During Refrigerated Storage

A. Chouljenko, Louisiana State University, Email: achoaul1@lsu.edu

**Introduction:**
Chitosan (CH) is derived from chitin, a biopolymer found in crustacean shells. CH is well known for antimicrobial activity, but its efficacy in shrimp is limited by inadequate CH penetration into shrimp muscle due to its large particle size. The objectives of this study were to evaluate the penetration of sonicated and ultra-sheared CH and chitosan sodium tripolyphosphate (CH-TPP) nanoparticles into vacuum tumbled shrimp and to analyze the microbial quality of shrimp vacuum tumbled with CH and CH-TPP during refrigerated storage.

**Method:**
CH and CH-TPP solutions were prepared by adding 0.5% CH into 1% acetic acid (AA) solution and 0.167% sodium tripolyphosphate (TPP) into CH solution, respectively. Solutions were sonicated and ultra-sheared for 30 min. CH and CH-TPP were analyzed for molecular weight, degree of deacetylation (DD), and particle size. Deconvolution microscopy images of fluorescently labeled CH and CH-TPP in cross-sections of vacuum tumbled shrimp meat were obtained, in addition to aerobic plate counts (APC) of shrimp meat separately vacuum tumbled with CH and CH-TPP solutions and stored at 4°C for 24 days. APC controls were shrimp meat separately tumbled with distilled water (DW)
and processed solutions (AA and TPP (0.167% TPP in AA solution)), and shrimp meat were analyzed (α = 0.05).

Results:


H. Chen, University of Tennessee, Email: hchen2@vols.utk.edu

Introduction:
The risk of undesirable by-products from chlorine disinfection of produce products, as well as its limited efficacy, has led to a search for alternative sanitizers. Organic acids such as lactic acid, acetic acid, citric acid, and peroxyacetic acid are known antimicrobials as well as its limited efficacy, has led to a search for alternative sanitizers. Organic acids such as lactic acid, acetic acid, citric acid, and peroxyacetic acid are known antimicrobials and are potential produce disinfectants. However, benzoic acid, an inexpensive preservative, has never been studied as a disinfectant for fresh produce products. The objective of this study was to test the effectiveness of acidified sodium benzoate (NaB) reducing cocktails of *Escherichia coli* O157:H7 (H1730, F4546, K3995, K4492, and 932 strains), *Salmonella enterica* (Agana, Montevideo, Gaminara, Michigan, and Saint Paul serovars) and *Listeria monocytogenes* (ENV2010110804-1 (390-1), ENV2011100804-2 (390-2), 310, Scott A, and V7 strains) inoculated on cherry tomatoes.

Method:

Exponentially, the minimum inhibitory concentrations (MICs) and minimum bactericidal concentrations (MBCs) of NaB against *E. coli* O157:H7 ATCC 43895, S.
Enteritidis, and L. monocytogenes Scott A were determined at pH 7.0±4.0 using microbroth dilution method and agar plating method, respectively. The log reduction in tryptic soy broth (TSB) by 500 and 1000 ppm NaB at pH 2.0, 2.5 and 3.0 for 30 min was compared. For the washing treatments, inoculated tomato samples (~20 g) were dipped into each wash liquid for 3 min at 2°C.

Significance:
This study showed that acidified NaB could be developed as a potential sanitizer to replace chlorine in the produce industry.

Results:
Results showed that MICs of NaB were <500 ppm at pH 4.0 and 5.0, 1000 ppm at pH 6.0 and >10000 ppm at pH 7.0. The MICs were 1000, 4000, and >10000 ppm at pH 2.0, 4.0, 5.0, and 6.0±7.0, respectively. Treatment by 1000 ppm NaB at pH 2.0 reduced >5 log (CFU/ml) bacteria in TSB. After 3 min treatment by 3000 ppm NaB at pH 2.0, the respective reductions of E. coli O157:H7, S. enterica and L. monocytogenes cocktails inoculated on chromogenic media were 4.08±0.2, 4.08±0.7, 4.08±0.65 and 4.88±0.73 log (CFU/g), which was better or similar to the free chlorine (200 ppm, pH 6.5) washing treatment. Acidified NaB solution prevented the cross-contamination and its efficacy was not affected by 1% w/v organic matter.

E10-002
Quantification of Salmonella Transfer During Hand Peeling of Citrus Fruit
J. Jung, Rutgers University, Email: jiinfoodscience@gmail.com

Introduction:
Although the peel or rind of many fruits is discarded by the consumer and not eaten, cross-contamination from the surface of fresh produce to edible portions during cutting, slicing, or peeling may occur if the outer skin or rind of fresh produce is contaminated. This study quantified the transfer of Salmonella to the edible portions of citrus fruit from contaminated peels during hand peeling.

Method:
Citrus fruit chosen for this investigation were ‘Valencia’ and ‘Navel’ oranges, and ‘Satsuma’ mandarins from California, C. reticulata x C. paradisi [‘Minneola’ tangelo or ‘Honeybell’] grown in Florida, and ‘Marsh’ grapefruit from Texas. An avirulent Salmonella Typhimurium LT-2 was grown in 10 ml of tryptic soy broth supplemented with 100 µg/ml rifampicin at 37±2°C for 24 h and sub-cultured twice before centrifugation. The fruits were spot inoculated with the equivalent number of CFU of the inoculum onto the entire surface of each fruit. The peel, edible fruit portion, and gloves were collected in separate sterile bags after hand peeling. Transfer rates were determined between the whole fruit and the peel, edible portion, and gloved hands.

Significance:
This study quantified transfer of Salmonella from the surface of fresh citrus fruits to the edible portion of the fruit and hands during hand peeling. The bacterial transfer rate varies depending on the citrus varieties and inoculation sites on the citrus fruit. The data collected as part of this research will be useful in future quantitative microbial risk assessments for citrus products.

Results:
Bacterial transfer from the surface of the citrus fruits to the edible portion and gloved hands occurred, although majority of Salmonella remained on the peel portion. The log percent transfer of Salmonella to the edible portion on Satsuma mandarin was higher (~0.23±0.15%) than in the other citrus varieties, which ranged from 0.351 to 0.772%. The log percent transfer of Salmonella to the gloved hands was significantly higher for Minneola tangelo (0.02±0.15%) than for the other citrus fruits (P<0.0001). When Salmonella was inoculated at styler ends on all citrus varieties, significantly higher transfer (~0.32±0.20%) to edible portion occurred compared to the other inoculation sites (P=0.0001).

E10-003
Reducing Dry Matter Losses on Orange Peel Silage Using Chemical and Microbial Inoculants and Pelleted Citrus Pulp as an Additive
R. Kitagawa Grizotto, Agenzia Paulista De Tecnologia Dos Agrorn, Email: reginagrizotto@apta.sp.gov.br

Introduction:
Silage has been used to preserve orange peel even though there are problems due to their high dry matter and high quantity of effluent produced. The objective was to evaluate the fermentative parameters and dry matter (DM) losses of the orange peel silage using 0 or 20% of pelleted citrus pulp as a moisture absorber additive, and different doses of inoculants: sodium benzoate (0, 0.05%, 0.1%, 0.2%), potassium sorbate (0, 0.05%, 0.1%, 0.2%), calcium oxide (0, 0.5%, 1%, 2%) or L. buchneri (0, 1,10,100,5, 50, 150,5, 1.10,50,6 CFU).

Method:
160 experimental silos were made at factorial design 4x2x5, with 4 treatments, 2 DM levels, and 5 replicates. After 60 days under anaerobic conditions, all experimental silos were weighed to measure DM losses (gases, effluent) and opened. Samples were collected to chemical and microbiological analysis, and aerobic stability at 4, 8, and 12 days at 25°C±1°C. ANOVA MIXED procedure (SAS 9.0) was used to all results.

Significance:
This study elucidated how different chemicals and microbiological inoculants could control DM losses of orange peel silage with two levels of DM. The results will be helpful to the cattle-raising activity and to the fruit-growing sector offering them options to the correct use of the orange juice byproduct, avoiding disposing it in landfills and consequently environment pollution.

Results:
The inclusion of 20% pelleted citrus pulp effectively rose the orange peel DM to the range (25%-35%) considered adequate to the ensilage, with significant reduction on effluent (3 to 10 times less) and gas (3 to 5 times less) compared to the silage control. Sodium benzoate and potassium sorbate decreased the year's growing and the 3 log number of lactic acid bacteria showed aerobic fermentation into the silage. L. buchneri did not reduce the DM losses; probably the low orange peel pH around 3.8 has inhibited its activity. Calcium oxide significantly reduced the gas production. Sodium benzoate, potassium sorbate and calcium oxide have extended the aerobic storage. In conclusion, raising orange peel DM by adding pelleted citrus pulp associated to benzoate or sorbate could result in orange peel silage with better quality.

E11-001
'Simplicity is the Ultimate Sophistication': A Simple Method to Produce Calcium Alginate Micropellets Rapidly via Leeds Jet Homogenizer and Utilization of the Micropellets as a Mode to Encapsulate Flavonoids
Provincet University of Leeds, Email: filipe@leeds.ac.uk

Introduction:
Calcium alginate micropellets have been attractive drug and functional food delivery vehicles due to such great surface area exhibited by these 'small' particles which benefit the release and absorption of the encapsulants. The cross-bridging formation between calcium and alginate can be achieved simply by spraying/dripping methods, however such simple preparations generally produce relatively large particles of at least two microns in diameter. Here we present a rapid method to produce Ca-alginate gel particles with sizes <1 µm, via a jet homogenizer (developed by University of Leeds). The objectives of this study are to synthesize Ca-alginate micropellets, to control the particle size via electrostatic stabilization with lactoferin and ultrasound, and to utilize the particles to trap insoluble particles of rutin and tilirose.

Method:
Unlike many homogenizers that involve pre-mixing steps, this confined impinging jet has two separate feeders that allow in situ gelation as the 2 streams (alginate and calcium chloride) come in contact at extremely high velocities and high turbulence flow (Re >10000), thus small gel particles are formed. A few images of these gel particles were obtained using various SEM types. The mean average diameter (µ) and Zeta potential (ζ) of the micropellets with or without added lactoferin were measured using Zetasizer. TricPLICATE measurements were conducted; the mean and std were analyzed with SPSS. Using the intrinsic fluorescence of rutin and tilirose, Confocal Microscopy (CLSM) was employed to examine the entrapment of these flavonoids within the gel particles.

Significance:
This study delivered an alternative tool to produce drug micropellets instantly using Leeds jet homogenizer and can be further exploited for encapsulation.

Results:
There was a trend of reduction in µ and an increase of ζ when lactoferin was included during particle formation. This was presumably due to the electrostatic interaction of positively charged lactoferin (akin to a 'surfactant' in this system) which adsorbed onto the surface of the negatively charged Ca-alginate particles. The SEM images revealed gel particles below 50 nm forming clusters into microregions of size of 200-300 nm. CLSM images showed the entrapment of the flavonoids particles assembled in the nascent of the Ca-alginate particles.

E11-002
Amylose-Lipid Nano-Materials: Isolation, Characterization, and Use in Food and Non-Food Systems
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Introduction:
Amylose lipid complexes (ALC) exist naturally in cereal starches. ALC can be at nanoscale of less than 100 nm. The objectives of the study are (i) to isolate and characterise ALC from normal and high amylose maize starches (HAMS), and (ii) to apply ALC in food systems to create examples of a low fat spread and bioplastic films.

Method:
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at 1.5% SA and 60% ALC at 5% SA were produced with normal and HAMS respectively. The addition of 10% ALC in the fat spread reduced fat by about 25% without affecting the quality of the low fat margarine. The addition of 5% ALC in starch films increased the tensile stress, and the Young’s modulus; decreased the oxygen and water vapor permeability, but did not change the tensile strain. ALC formation can be enhanced with stearic acid and has potential as a nano-material to be used as a fat replacer in foods and as a nanofiller in biodegradable starch films.

**E11-003**

**Molecular Weight Distribution of Flour Proteins in Intermediate Wheatgrass (Thinopyrum intermedium): Impact on End-Use Quality**

**Parameters**

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**Introduction:** Thinopyrum intermedium, commonly known as intermediate wheatgrass (IWG) is a perennial crop shown to have both environmental and nutritional benefits. We have previously shown that in comparison to wheat controls, IWG lines had higher protein and dietary fiber contents. However, a deficiency in high molecular weight glutenins (HMWG), an important protein component responsible for dough strength, was seen for all IWG samples. Therefore, the objective of this study was to better understand the protein distribution of IWG lines and its relationship to bread-making quality parameters.

**Method:**

Sixteen IWG lines along with one bulk IWG sample and two wheat controls were analyzed for molecular weight distribution of flour proteins using size exclusion chromatography and subsequent evaluation of bread-making quality. Two-dimensional gel electrophoresis followed by MALDI-TOF and liquid chromatography coupled tandem mass spectrometry were performed on extracted gluten from bulk IWG sample and hard red winter wheat to determine molecular weight and identify the HMWG subunits. Dough rheological measurements were performed using farinograph and Kieffer following standard procedures.

**Significance:** These findings suggest that lower uHMWPW content in IWG samples results in poor dough rheology due to lack of proper gluten network formation. The difference in protein distribution coupled with higher fiber content in IWG may negatively affect the protein functionality and end-product quality. Investigating the effect of fiber content on dough rheology may help identify ways to utilize of IWG grain in commercial applications.

**Results:** In contrast to wheat controls, IWG samples had lower percentage of SDS-unextractable high molecular weight polymeric proteins (uHMWPW). This fraction of proteins in IWG lines showed a significant and a positive correlation with farinograph stability and Kieffer-resistance to extension, but lower than that of wheat controls. Relative quantity of soluble albumins and globulins were higher in IWG samples than that of wheat. The protein distribution and molecular weights of HMWG subunits in the IWG bulk sample were considerably different from HRWW.

**E11-004**

**Nanoporous Starch Aerogel: A Novel Material to Enhance the Water Solubility of Phytosterols**

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**Introduction:** The increased prevalence of diet-related illnesses and the emerging trend of “green” consumerism have led the food industry to prioritize the development of health-improving foods and beverages that utilize bioactives such as phytosterols, tocopherols, carotenoids, etc. However, many of the bioactives are water insoluble (lipophilic); meaning they have low bioavailability, and they have limited ability to function as food and beverage additives due to low solubility in water and easy degradation during storage. Therefore, effectively including lipophilic bioactives in foods and beverages is a major challenge.

**Method:** The objective of this study was to form nanoporous starch aerogels with high surface area to increase the solubility of the lipophilic bioactives. In the first phase, nanoporous wheat starch aerogels were formed by forming a starch hydrogel, then converting the hydrogel to alcoho by ethanol exchange, and finally removing the ethanol by supercritical carbon dioxide (SC-CO2). Aerogels were characterized for their morphology, BET surface area, BJH pore size, density, volume shrinkage, crystallinity, water solubility, and thermal stability. Processing parameters (temperature, wheat starch concentration and mixing rate during gelatinization; temperature, pressure, and CO2 flow rate during SC-CO2 drying) were investigated and optimized for the highest surface area and smallest pore size.

**Significance:** The developed starch aerogels are potential novel food grade materials that can be used to carry and dissolve lipophilic bioactives in beverages to prepare functional beverages, to increase the bioavailability and stability of the lipophilic bioactives, and to provide controlled release of the bioactive in a simple, clean, and inexpensive way.

**Results:** At the optimized conditions, starch aerogels had extraordinary properties; their average pore size was 20 nanometer, one gram of the aerogel had a surface area of 60 m2, and they were very light (0.05-0.29 g/cm3), and stable up to 280°C. They exhibited lower crystallinity but their water solubility did not change significantly (>0.05%). In the second phase, nanoporous aerogels were impregnated with β-stiosterol, a model phytosterol, using an innovative green SC-CO2 precipitation method. Phytosterol-impregnated aerogels were mixed in water at room temperature, and solubility of the phytosterols in water was determined. Impregnated phytosterols were 5 times more soluble than the crude phytosterol.

**E11-005**

**Physicochemical Properties of Cold Pressed Rice Bran Oil Nano-emulsion: Effect of pH and Salt**

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**Introduction:** Cold pressed rice bran oil (CRBO) has relatively high levels of functional and nutraceutical components such as phytosterols, vitamin E and gamma oryzanol. Those have known for their antioxidant and hypocholesteremic effects in humans. Emulsion-based delivery systems have shown to be particularly suitable for encapsulating lipophilic components. Recently there is an interest in nano-emulsions due to their benefits such as better stability and functional performance in food, cosmetic and drug processing. pH and salt concentration may affect the physicochemical properties of CRBO nano-emulsion.

**Method:** Therefore, the overall objective of this study was to examine the influence of pH (2-9) and ionic strength (0-400 mM NaCl) on physicochemical properties of CRBO nano-emulsion. Oil-in-water nano-emulsions (30% CRBO, 10 mM phosphate buffer) stabilized by glyceryl monostearate (GMS) (3%) were prepared using high-pressure homogenization. The physicochemical properties of CRBO nano-emulsion were studied by measuring the particle size distribution, electrical charge, creaming index and color.

**Significance:** These results have important implications for the formulation and production of CRBO emulsion-based products.

**Results:** The data showed that CRBO nano-emulsion remained relatively stable to droplet aggregation at high pH values (pH 7 to 8). On the other hand, a large increase in mean particle diameter was observed at low pH value (pH 6-2). At relatively low pH values (pH 4-2), a large population of highly aggregated droplets was observed. The data shows that pH 5-2 had a very high impact on b* value and it slightly impact on a* value. There was no significant difference in the particle size distribution or mean particle diameters of nano-emulsions containing different levels of salt at 0-50 mM. On the other hand, an appreciable increase in mean particle diameter was observed in the CRBO nano-emulsions when the salt concentration was increased from 75 to 400 mM. Increases of salt concentration (100-400 mM) caused the decrease in L* value and increase b* value. Conclusion, CRBO nano-emulsions were unstable at low pH (pH 6-2), high salt concentration (75-400 mM). The increases of yellowness (b*) were found when the increase of salt concentration and decreases of pH.

**E12-001**

**Imine–Chitosan Film Cross-Linked by Oil-in-Water Cinnamaldehyde Nanoemulsion Droplets: Formation, Characterization, and Antibacterial Activity**

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**Introduction:** There is increasing interest in the development of sustainable and green coating materials to protect the quality and safety of fresh fruits and vegetables. Chitosan, a cationic polysaccharide isolated from natural sources, has been utilized in the food industry for its film forming properties, antibacterial activity, and oxygen impermeability. However, the formation of chitosan film largely weakens its antibacterial activity. It is reported that incorporation of natural aldehyde could enhance the antibacterial activity of chitosan films. Unfortunately, those aldehydes should be dissolved in acetone, due to their low water-solubility. We hypothesized that nanoemulsion droplets could be a bi-functional reagent like glutaraldehyde when those aldehydes were encapsulated in nanoemulsion.

**Method:** The mixture of chitosan solution and cinnamaldehyde nanoemulsion was cast on Petri dishes and dried for 10 h at 60°C in a vacuum oven to remove water.

**Significance:** These results suggest that a Schiff-base reaction between cinnamaldehyde and chitosan occurred in the interfacial layer of nanoemulsion droplets during the evaporation of water. After crosslinking, chitosan film had higher stability against swelling under different pH conditions. The release of cinnamaldehyde could be controlled by different lipotropy environment, providing continuous antibacterial activity. Therefore, fabrication of chitosan and cinnamaldehyde nanoemulsion film may fit different requirements for food preservation.
Hydroxycinnamic acids can be modulated in sorghum by water stress. Sorghum is a rich source of phenolic compounds, mainly ferulic acid as a conjugate. Significance: until grain filling stage. After harvest, grains were analyzed for total phenolic content. From the 50th day on, after leaf development, irrigation was continued only for controls. Sorghum genotypes with and without tannin were sprinkler irrigated for 2 hours a week. Method: to study the formation of a chitosan-cinnamaldehyde Schiff base. SEM and AFM results showed that molecular chains of chitosan and cinnamaldehyde nanomulsion droplets were cross-linked and assembled. The highest release ratio of cinnamaldehyde happened when the ratio of aldehyde group and amino group was 1.0. Cross-linked chitosan films had synergistically antifungal activity.

Results: Our results showed that in the presence of cinnamaldehyde nanoemulsion, chitosan film could remain intact when the ratio of aldehyde group and amino group was 0.6. The obtained films had beige color and good protection against UV light. The intensity ratio of the u(NH) band at 1,560 cm-1 to the u (C=O) band at 1,637 cm-1 in the FTIR spectra of blank chitosan film and chitosan-cinnamaldehyde film decreased, indicating the formation of a chitosan-cinnamaldehyde Schiff base. SEM and AFM results showed that molecular chains of chitosan and cinnamaldehyde nanomulsion droplets were cross-linked and assembled. The highest release ratio of cinnamaldehyde happened when the ratio of aldehyde group and amino group was 1.0. Cross-linked chitosan films had synergistically antifungal activity.

E12-002
In Vitro Digestion of Protein-Based Nanohydrogels Incorporating Curcumin as a Lipophilic Model Compound: Effect of a Chitosan Coating
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Introduction:
One of the challenges of food enrichment with lipophilic bioactive compounds is related with their poor solubility in food matrices and their instability during digestion, leading to a poor bioavailability. These challenges are promoting research efforts to find more effective delivery systems based on natural biopolymers. Protein nanohydrogels can be used as carriers of bioactive compounds in food products, however, during gastric digestion, proteins are denatured by environmental conditions and hydrolyzed by enzymes. One of the strategies to improve protein nanohydrogels' stability and the controlled release of active ingredients during gastrointestinal (GI) digestion is the addition of a coating (polysaccharide layer). The behavior of lactoferrin (LF) – glycomacropeptide (GMP) nanohydrogels with and without a chitosan coating was evaluated during GI digestion.

Method:
A dynamic gastrointestinal system was used as in vitro digestion model to evaluate the stability and bioaccessibility of LF and GMP during the digestion process. Proteins were evaluated by high performance liquid chromatography during GI digestion.

Significance:
These results have important implications for the design of effective protein-based delivery systems for lipophilic bioactive compounds.

Results:
Results showed that at the end of digestion, LF and GMP were digested until levels of protein degradation of 76% and 53%, respectively, for the nanohydrogels with chitosan coating, whereas for nanohydrogels without coating the corresponding levels of protein degradation were around 86% and 71% for LF and GMP, respectively. Protein bioaccessibility results showed that nanohydrogels with chitosan coating 23% of LF and 40% of GMP remained intact until absorption. Size distribution and transmission electron microscopy confirmed that nanohydrogels with chitosan coating were more stable during digestion than nanohydrogels without coating. Based on these results, the bioaccessibility of curcumin encapsulated in LF-GMP nanohydrogels with chitosan coating was evaluated during gastrointestinal digestion. Curcumin in coated nanohydrogels presents a bioaccessibility of 72% while the corresponding value for curcumin in free form only reached a value of 66%. It was also observed that under simulated GI conditions, free curcumin lost around 66% of its antioxidant activity while when incorporated into LF-GMP nanohydrogels, only 30% of this activity was lost.

E12-003
Influence of Water Stress on the Profile and Levels of Free and Conjugated Hydroxycinnamic Acids in Sorghum
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Introduction:
Sorghum is widely used in animal feed and as a staple food for millions of people throughout the world. It is a promising cereal: it is easily produced and can withstand adverse conditions, such as dry and saline soils and high temperatures, which are uneconomical for other cereals. Sorghum has also been valued due to its gluten-free nature. Moreover, sorghum is an important cereal in developing countries, where it is produced to provide food security for millions of people. The gluten-free nature of sorghum makes it ideal for individuals with celiac disease or gluten sensitivity. However, sorghum has been shown to contain lipophilic bioactive compounds, such as hydroxycinnamic acids, which can be modulated by water stress.

Method:
Sorghum genotypes with and without tannin were sprinkled irrigated for 2 hours a week. From the 50th day on, after leaf development, irrigation was continued only for controls until grain filling stage. After harvest, grains were analyzed for total phenolic content. From the 50th day on, after leaf development, irrigation was continued only for controls. Sorghum genotypes with and without tannin were sprinkler irrigated for 2 hours a week. Method: to study the formation of a chitosan-cinnamaldehyde Schiff base. SEM and AFM results showed that molecular chains of chitosan and cinnamaldehyde nanomulsion droplets were cross-linked and assembled. The highest release ratio of cinnamaldehyde happened when the ratio of aldehyde group and amino group was 1.0. Cross-linked chitosan films had synergistically antifungal activity.

Results:
Our results showed that in the presence of cinnamaldehyde nanoemulsion, chitosan film could remain intact when the ratio of aldehyde group and amino group was 0.6. The obtained films had beige color and good protection against UV light. The intensity ratio of the u(NH) band at 1,560 cm-1 to the u (C=O) band at 1,637 cm-1 in the FTIR spectra of blank chitosan film and chitosan-cinnamaldehyde film decreased, indicating the formation of a chitosan-cinnamaldehyde Schiff base. SEM and AFM results showed that molecular chains of chitosan and cinnamaldehyde nanomulsion droplets were cross-linked and assembled. The highest release ratio of cinnamaldehyde happened when the ratio of aldehyde group and amino group was 1.0. Cross-linked chitosan films had synergistically antifungal activity.

E12-004
Metal-Organic Frameworks (MOFs) as Novel Delivery Vectors for Encapsulation and Controlled Release of a Natural Food Preservative, Allyl Isothiocyanate (AITC)
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Introduction:
Metal-Organic Frameworks (MOFs) are microporous solids that consist of metal ions that are connected by organic linkers. These hybrid materials are highly porous and possess remarkable inner surface areas, which make them suitable candidates as delivery vectors and controlled release agents of bioactive compounds such as natural food preservatives. Allyl isothiocyanate (AITC) is an outstanding antimicrobial agent. Nonetheless, its applications as a natural food preservative is challenging due to its high volatility, pungent flavor, and instability. This research studied potential application of metal-organic frameworks (MOFs) as novel delivery vectors for encapsulation and controlled release of gaseous AITC molecules by using moisture as an external trigger for AITC release.

Method:
We employed adsorption-desorption analysis, a GC headspace controlled release study, SEM, TEM, and XRPD analysis.

Significance:
The results of this study demonstrated that application of these MOFs as novel delivery systems for encapsulation and controlled release of AITC as a potent natural food preservative for food safety applications is technically feasible.

Results:
Considering AITC molecular size, and MOF's structural characteristics, three MOFs including HKUST-1, MOF-74(Zn), and RPm6-Zn were selected for this study. Adsorption-desorption analysis showed that all three MOFs are able to encapsulate and retain gaseous AITC until its slow release is triggered from the MOF. The loading capacities of AITC were 42%, 27%, and 14% (wt/wt % MOF) for HKUST-1, RPm6-Zn, and MOF-74 (Zn) respectively. Controlled release study at low (30-35%) and high (95-100%) relative humidity (RH) conditions showed that all MOFs can successfully retain encapsulated AITC molecules (>90% of AITC) within their pores under low RH conditions while they released AITC in a controlled manner at high RH conditions at 24±1 °C. The release percentages were up to 80%, 70%, and 96% for HKUST-1, RPm6-Zn, and MOF-74(Zn) in that order. SEM, TEM, and XRPD findings also indicated that while the transformation of porous 3D framework to nonporous structure by water molecules is the underlying mechanism of AITC release from RPm6-Zn microparticles, the replacement of entrapped non-polar AITC by polar water vapor molecules within the highly polar cavities of HKUST-1 and MOF-74(Zn) causes the release of AITC molecules from these two MOFs.

E12-005
SCFAs Produced by Dietary Fibers Vary With Prevotella vs Bacteroides Enterotypes
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Introduction:
Short chain fatty acids (SCFAs), as generated by dietary fiber fermentation in the gut, are an important target related to colon and whole body health. Gut microbiomes of different individuals have been grouped into enterotypes (Prevotella, Bacteroides and Ruminococcus dominant) based on their microbiota composition. However, the connection of the enterotypes and human health has yet to be established.

Method:
In this study, we used three dietary fibers, fructooligosaccharides (FOS) and sorghum and corn arabinoxylans (SAX, CAX) to study the SCFA production in Prevotella and Bacteroides enterotypes, and respective microbiota changes, using an in vitro batch fecal fermentation model.

Significance:
This study reveals that dietary fiber selection for certain desired SCFA outcomes would be different depending on the enterotype, and provides a future direction to study health-related effects of fermentable dietary fibers of different composition and structure.

Results:
We found that the predominant species in the two microbiomes varied among sorghum genotypes. Tannin sorghum contained higher contents compared to those without tannin. Four hydroxycinnamic acids were found: caffeic, p-coumaric, ferulic, and sinapic acids, at both free and conjugated forms, except for sinapic acid which was only present in the free form. These acids were present at much higher concentration in the conjugated compared to the free form. Ferulic acid was prevalent followed by p-coumaric. Sinapic and caffeic acids were at very levels. The profile and levels of these acids varied with the genotype. Under water stress, there was a decrease on free and conjugated acids in tannin sorghum. No significant difference was observed for sorghum without tannin, except for one genotype in which sinapic acid was the only detected in the water stress sample.
all three different types of dietary fiber; while in the Bacteroides enterotype, a variety of OTUs got the opportunity to grow. In Bacteroides enterotype, different OTUs were enriched by each fiber (Lactobacillus by FOS, and two different Bacteroides by SAX and CAX). SCFA production by the two enterotypes on the three fibers was substantially different. Propionate was initially 2.3-fold higher in the stool of the Prevotella compared to the Bacteroides enterotype, and had up to a 4-fold higher increase in the former with the fiber treatments. Furthermore, the total amount of SCFAs generated by SAX and CAX matched at 24 h in each microbiota, but the fermentation rate varied with the simpler SAX structure fermenting fast in both enterotypes and the more-complex CAX fermenting as fast as SAX in the Prevotella enterotype but much slower in the Bacteroides enterotype. Overall, the dominant fiber-utilizing bacteria and the type of dietary fiber together determined the SCFA profiles generated by fermentation.

### E13-001

**Detection of Codling Moth Infested Apples Using Multivariate Analysis of Acoustic Emissions**

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**Introduction:**

Incidents of Codling moth infestation in apples have been a major concern in North America for decades. The insect larvae bore deep into the fruit, making it unmarketable. An effective noninvasive method to detect damaged apples is necessary to ensure that fruits are Codling moth-free in post-harvest processes. Acoustic emission (AE) is the phenomenon of radiation of acoustic (elastic) waves in solids that occurs when a material undergoes irreversible changes in its internal structure. Previous studies showed that AE system with piezoelectric sensor was applied to detect bacterial metabolic activity. The piezoelectric sensor can also be used to determine the AE produced by the metabolic activity of insect or microorganisms inside the infested apples. The objective of this study was to distinguish infested apples from healthy apples based on the AE differences using multivariate analyses.

**Method:**

In this study, an acoustic emission (AE) system with a contact piezoelectric sensor which has a frequency sensitivity of 35 - 100 kHz, a sampling rate of 1 MHz, a signal record length of 100.25 ms was used to collect AE signals from insect-damaged and healthy apples. Gold delicious apples were infested with Codling moth eggs and stored in a greenhouse (27°C) for 2 months. Noninfested apples were stored at the same conditions as control. Five AE features including amplitude, signal strength, absolute energy, peak frequency and frequency centroid were used. AE data acquired from 10 healthy and 10 infested apples were analyzed by calculating the area under the curve and analyzing this using linear discriminant, quadratic discriminant, and decision tree analyses.

**Significance:**

These preliminary data showed the potential application of AE with piezoelectric sensor to detect Codling moth infestation of apples using multivariate analysis.

**Results:**

The misclassification rates obtained from these classification and tree based methods ranged from 0.2 to 0.5. Ensemble methods namely adaptive boost and logitboost algorithms were applied to boost the classification. The ensembles achieved a classification error of under 5% using 10 or more trees. The lowest error, 0, can be achieved using 27 or more trees.

### E13-002

**Determination of Boiled Candy Glass Transition Temperature by Genetic Algorithm (GA) and Capacitor Based Thermal Analysis (CTA)**

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**Introduction:**

The glass transition temperature (Tg) is a very important parameter for candy production. The measurement of Tg, however, is done by comparatively expensive and sophisticated equipment including differential scanning calorimeter (DSC), dielectric analyzer, and nuclear magnetic resonance. In this study, a Capacitor Based Thermal Analysis (CTA), which is much less expensive and less sophisticated analysis, was used to test the Tg of candy samples and the results were compared to DSC.

**Method:**

In this study, the Tg of several candies were measured by placing samples between two stainless plates, and monitoring capacitance and temperature as the samples were heated. The data of capacitance as a function of temperature were processed by a genetic algorithm, and nuclear magnetic resonance. In this study, a Capacitor Based Thermal Analysis (CTA), which is much less expensive and less sophisticated analysis, was used to test the Tg of candy samples and the results were compared to DSC.

**Significance:**

GA based CTA provides a much cheaper and less sophisticated methods for small or medium confection manufacturers to measure the Tg of their products, helping them supervise or control the quality of the products during or after processing. For other researchers, GA based CTA is a new method with computational algorithm involved to study the phase transition of other food materials.

**Results:**

The results showed that when the Tg of the candy was below ~15°C, the measurement from GA and capacitor based thermal analysis (CTA) was higher than that from DSC. However, if Tg of the candy was higher than 15°C, the two methods gave similar values. GA based CTA provides a feasible new way to measure phase transitions in candies with relatively inexpensive equipment, and less need for user interpretation of data.

### E13-003

**Determination of Chocolate Melting Properties by Contact Area and Capacitance Based Thermal Analysis (CTA)**

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**Introduction:**

The melting properties of chocolate are important to the quality of manufactured chocolate products. The measurement of these properties, however, is often done by comparably expensive and sophisticated equipment including differential scanning calorimetry (DSC) and X-ray diffraction. In this study, contact area based CTA, which use the contact area change during temperature scans as indicator, was used to study the melting properties of chocolates and compared with the results collected by DSC, seeking a possible alternative for chocolate melting properties study.

**Method:**

Chocolates with different fat content and particle size distribution (PSD) were made and measured by placing samples between two stainless plates, and monitoring capacitance and temperature as the samples were heated. The temperature when the capacitance of the cell reached the peak during temperature scans (20-60°C) and the peak capacitance value of each sample were exacted for analysis. Melting properties of the chocolates were independently studied by DSC as a reference. The effect of fat content and particle size distribution of the samples were determined by one-way ANOVA test.

**Significance:**

Contact area based CTA as introduced in this study is an alternative for expensive and sophisticated equipment, such as DSC and dielectric analyzers, for both chocolate manufacturers and researchers. The advantage of contact area based CTA is relatively cheap devices and easy to be operated. It provides more new information about the fat content and particle size of the samples.

**Results:**

PSD of the samples did not significantly influence their melting onset temperature (~25°C) and peak temperature (~33°C) measured by DSC. However, samples with finer particles had lower ending temperatures than those with coarser particles (range 36.59 to 37.28°C). Varying fat content in chocolate samples did not result in differences in the DSC melting curves. Samples with smaller particle sizes had lower temperatures at peak capacitance than those with larger particles, with peak temperatures ranging from 30.84 to 39.29°C, while higher peak capacitance values (range 2.61 to 2.84 10^11 F) were measured by contact area based CTA. Samples with higher fat content had lower peak temperatures (range 34.7 to 39.71°C) but higher peak capacitance values (range 3.29 to 4.3 10^11 F).

### E13-004

**Instrumental Evaluation of Chinese Rice Wine Sensory Attributes Using Near Infrared Spectroscopy Combined With Multivariate Calibrations**

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**Introduction:**

Chinese rice wine sensory attributes, including color, aroma, taste, and style, play a major role in product acceptability by directly influencing the success of a product in the market. Estimation of the sensory attributes is generally done by human sensory analysis. However, the use of human for sensory evaluation entails several drawbacks, such as fatigue, stress, and inconsistencies. Besides, it is time-consuming, expensive, and unfavorable for real time measurements. Thus, it is very significant for organizations to develop instrumental methods which can partially replace panels during routine work and achieve the objective measurements in a short time, and in a consistent and cost-effective manner. This study aimed to assess the feasibility of using near infrared (NIR) spectroscopy as an instrumental evaluation technique for predicting the sensory attributes (i.e., color, aroma, taste, and style) in Chinese rice wine.

**Method:**

The specific objectives were outlined as follows: (1) respectively score the color, aroma, taste, and style of Chinese rice wine samples by human sensory panel; (2) acquire and preprocess the NIR spectra data of the samples; (3) establish the relationship between human sensory scores of each sensory attribute (color, aroma, taste and style) and NIR spectra data by a separate model (synergy interval partial least squares, Si-PLS) for predicing the sensory attributes of Chinese rice wine. The performance of model was evaluated by the correlation coefficient (R²) and the root mean square error (RMSEP) in the prediction set.

**Significance:**

This work provided an instrumental test method for the industry for assessing the sensory qualities of Chinese rice wine in order to overcome the drawbacks of human sensory analysis and achieve objective measurements in a short time, in a consistent and cost-effective manner.

**Results:**

The optimal performance by the Si-PLS model for color was R²p = 0.8735, RMSEP = 0.274; for aroma, R²p = 0.8316, RMSEP = 0.0893; for taste R²p = 0.8791, RMSEP = 1.22; and for style
E13-005
Self-Referencing Sensors for Measuring Glucose, Insulin, and ATP
Transport in Pancreatic Tissue: Tools for Studying Herbal-Based Treatments
for Diabetes

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Introduction:
Approximately 347 million people worldwide have diabetes. The burden of this illness is more accentuated in low and middle-income countries, in which approximately 80% of diabetes deaths occur. The situation is particularly alarming in China, where nearly 12% of the adults (about 113.9 million people) are diabetic. For thousands of years, traditional Chinese medicine has developed a holistic approach that includes herbal-based remedies for treating the symptoms of this disease. Studying the mode of action of herbal-based treatments for diabetes entails the use of analytical tools that allow for direct monitoring of bioactive flux of molecular markers. The purpose of this study was to develop and implement electrochemical micro-biosensors for measuring the flux of glucose, insulin, and ATP in pancreatic islets of diabetic mice in vitro.

Method:
Pt/n microelectrodes were modified with a nanocomposite of reduced graphene oxide, nanoparticle, and Nafion, constituting a highly efficient transducer layer on the surface of the electrode. Glucose-selective microsensors were fabricated by immobilizing glucose oxidase on nanocomposite-modified electrodes via covalent binding with bovine serum albumin and glutaraldehyde. Insulin-selective microsensors were elaborated by electrodepositing a ruthenium oxide film on nanocomposite-modified electrodes. ATP-selective microsensors were constructed by immobilizing glycerol kinase and glycerol-3-phosphate oxidase on nanocomposite-modified electrodes using a stratified encapsulation approach with laponite hydrogel and glutaraldehyde.

Significance:
The self-referencing microsensors demonstrated herein were proven suitable for exploring the underlying mechanisms by which traditional Chinese remedies alleviate the symptoms of diabetes.

Results:
All microsensors showed excellent performance for quantification of glucose, insulin, and ATP with a linear range which spanned physiological concentrations and a response time of approximately 1 sec. Biophysical-test experiments were conducted for islets from diabetic and control mice using the non-invasive micro test (NMT) technique. Glucose, insulin, and ATP flux were determined before and after dosing the pancreatic islets with a traditional herbal-based remedy and real time physiological response recorded using each sensor.

E14-001
ChitoSALT, an Innovative Salt Enhancer, Increases Salty Taste of Almond Products

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Introduction:
Consumers, health professionals and government policies are focused on reducing salt in food products. However, reduction of sodium chloride could change saltiness, preservation, and flavor enhancement or other functional properties in processed foods. Therefore, practical solutions for salt reduction become necessary. The objective of this work was to apply the spray drying technique to develop a new form of salt application, combining chitosan and sodium chloride complex (ChitoSALT) to decrease sodium chloride usage in almond products.

Method:
We investigated not only ChitoSALT’s impact on saltiness perception, but also its physical properties. We utilized three different inlet temperatures (140°C, 160°C, and 180°C) and three different pressures (50 kPa, 100 kPa, and 200 kPa), respectively, to prepare ChitoSALT. The spray-dried ChitoSALT was evaluated by particle size, whiteness, bulk density, and saltiness taste by sensory evaluation of the almond products.

Significance:
Our studies suggest that the sodium reduction level of ChitoSALT could reach to 30%. The newly developed formulated salt enhancer ChitoSALT could have the potential to benefit the development of reduced sodium processed foods.

Results:
Results showed that under 100 kPa and 180°C spray drying conditions, ChitoSALT provided saltier perception than table salt in almond products (P < 0.05). A sodium reduction level of ChitoSALT could reach to 30%. The physical properties of ChitoSALTs had 10μm average particle size, much smaller than table salt with 300μm average particle size. In addition, ChitoSALT showed lower hygroscopicity compared to spray-dried sodium chloride. Results showed that high inlet temperature spray-dried ChitoSALTs increased saltiness perception.

E14-002
Evaluation of Methods of Preparation and Sensory Attributes of Orange-Fleshed Sweet Potato Based Beverages as a Health Drink for a Target Group in Nigeria

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Introduction:
Orange-fleshed sweet potato (OFSP) is a good source of pro-vitamin A. It is Processed OFSP and develop beverage from the processed OFSP for a health drink that can be incorporated into school feeding.

Method:
The OFSP Mama’s Delight variety roots, freshly harvested at 5 months after planting from sweet potato were processed into OFSP extract using four extraction methods: none sulphiting and blanching; sulphiting only; blanching only; and a combination of sulphiting and blanching. Though the deep orange color of the OFSP was retained in all the extracts, there were significant differences (p < 0.05) among the various extraction methods. The extracts were used to prepared OFSP based beverages to contain 0.4% Acacia gum and 6.7% sugar.

Significance:
The research implies that OFSP may be better utilized as fresh drink to support school feeding program and provides a ready market for local farmers and traders, since OFSP can be easily grown.

Results:
Total carotene content was well retained in the final beverage. Though the deep orange color of the OFSP was retained in all the extracts, there were significant differences (p < 0.05) among the various extraction methods. Sensory evaluation scores showed that blanching at 10 minutes gave most acceptable beverages. The physicochemical properties showed that storage at ambient condition (27°C) reduced in pH from 6.50 to 3.36 at 72 hours. This increase in acidity was attributed to possible fermentation due to microbial activity. There was corresponding reduction (7.60 to 2.20*Brix) in Total Soluble Solute (TSS). The viscosity of the beverage was stable for 48 hours and then dropped from 88.40 to 82.70 mp at 72 hours, hence it was good for only 24 hours when stored under ambient condition. The decrease in viscosity was probably due to the reduction in TSS, which contributed to the body of the beverage. The pH of OFSP based beverages kept under refrigerated condition remained greater than 4.5% and organoleptically alright for consumption until 28 days (4.70%) but drastically reduced to 3.56% at day 35. The same observation was seen in other parameters (TSS from 6.30 to 5.60*Brix, viscosity from 76.50 to 76.10%, and specific gravity from 1.030 to 1.020).

E14-003
Insights Into Managing Amino Acid Deficiencies in Food Products: Formulating Complete Proteins from Incomplete Sources

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Introduction:
Formulating foods with a good nutritional profile may be a daunting task, especially for foods rich in proteins where the focus has been on balancing the amino acid content during formulation to meet guidelines set by the FAO for essential amino acid profile in foods. While cereals and pulse proteins are lacking in lysine and high in sulfur-containing amino acids such as methionine and cysteine, the opposite is typically true in pulse proteins. Therefore a blend of cereal grains and pulse proteins may be advantageous to achieving a recommended essential amino acid profile.

Method:
For this study, samples of pulse protein concentrates (pea (min. 55% protein), lentil (min. 55% protein), and fava bean (min. 60% protein)) were sent out for amino acid analysis. The amino acid profiles were used in simulated blend with cereal crops to identify possible blends that gave a complete protein as recommended by the FAO guidelines. Cereals such as wheat, barley, corn, oats, rice, quinoa, yre, millet, buckwheat, amaranth, triticale, and sorghum were analyzed using information available from the USDA.

Significance:
Oat blends are advantageous to the industry due to the availability of gluten-free oats and pulses, which enable options for food product developers to pick the right pea protein and oat blends for their particular application. Comments on the effect of AAS on PDCAAS and advice on how companies could obtain and maintain complete protein profiles will also be included. This body of work will inform the industry how to reformulate for complete proteins whereby additional comments on antioxidant factors and their effects on protein quality will be provided.

Results:
Simulated blends between pea and cereal blends were found to produce a number of complementary blends, with pea protein inclusion rates around 20-30%. In the case of buckwheat, a 10% inclusion of pulse proteins was enough to produce a complementary blend, while in oats, a broad range of blends with pea protein were found to be complementary.

E14-004
Multicomponent Weight Management Intervention for School Children in Qatar

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Introduction:
Childhood obesity is rapidly rising in Qatar and other affluent Persian Gulf countries where over 40% of children are either obese or overweight. Hence, new approaches and programs are needed to stem the rise of childhood obesity. This study reports the findings of an integrated intervention incorporating lifestyle education, physical activity, and behavioral psychology nudging techniques for weight management among 9-12 year-old schoolchildren in Qatar.

Method:
One hundred school children (boys and girls) with BMI above the 95th percentile were chosen out of 450 eligible children in 4 randomly chosen intervention schools. Consented participants completed an intensive weight loss camp involving physical activity (PA), lifestyle education (LE), dietary control, behavioral nudging techniques, and social activity. The camp was followed by four months of after-school club on LE and PA. Participants were subjected to anthropometric (weight, height, BMI, waist circumference, blood pressure) measurements, lifestyle questionnaires (diet and physical activity), and psychometric assessment (self-esteem and subjective well-being). Statistical analysis was conducted using SPSS where a paired t-test was used to assess changes in quantitative variables pre- and post-intervention, while an independent samples t-test was used to compare changes in gender groups. A chi-square test was used in the analysis of qualitative variables.

Significance:
Afterschool clubs showed effectiveness in maintaining or further enhancing weight loss achieved in the camp and in engaging parents. The synergistic effect of the camp and after school/community clubs suggests promising potential for adoption of the program by the school system in Qatar.

Results:
Data show that over 45% of children in the sample were either overweight or obese. Participants reported little or no PA and a diet characterized by low intake of fruits and vegetables and high intake of calorie-dense foods. All participants lost weight, with an average of 12% reduction in BMI-SDS, but girls showed higher BMI SDS reduction than boys. This percent BMI SDS reduction is 3-5 times the minimum BMI SDS reduction (3%) required for health benefits in adolescents and 5% in adults. The camp also resulted in a significant improvement in self-esteem (p=0.001). A significant correlation between club attendance and weight loss (p = .028) was observed.

E14-005
Utilizing a Numerical Model to Understand DHA and EPA Retention Rates of a Fatty Fish After Three Different Cooking Methods
L. Cheung, Osaka Gas Co Ltd, Email: l-cheung@osakagas.co.jp

Introduction:
Changes in temperature distribution inside foods during cooking can influence the nutritional content, bioactivity, and sensory properties of the final product. We previously reported that final center temperature (75–95°C) did not significantly affect the eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) contents of cooked Pacific saury, a staple of the Japanese diet. These results were hypothesized to be due to heat-induced evaporation of surface moisture and dehydration of the skin, where EPA and DHA contents are highest. The temperature distribution and evaporation rate along the radial from the saury centre to the surface with highest heat exposure during deep-frying, grilling, and pan-frying was modeled using a dynamic numerical model. Additional parameters estimated included surface moisture loss and thickness of the dehydrated layer.

Method:
The model accounted for convection, conduction, radiation (using an adapted version of the Stephan-Boltzmann law), and water evaporation, and was constructed using environmental temperatures (T∞) of 200°C for deep-frying (frying oil), 350, 400, 600, or 800°C grilling (air), and 250°C for pan-frying (frying pan). The thickness of the dehydrated layer was estimated by enumerating the surface nodes (five from a total of 41) with temperatures exceeding 100°C. Heat transfer coefficients (h) for heating mediums were varied 20% with constant T∞. Thermocouple-measured skin temperature was used to determine the proportion of total surfaces exceeding 100°C during cooking.

Significance:
The developed model can explain the lack of association between DHA and EPA contents and final center temperature of cooked saury, and has potential application as a valuable tool for predicting heat-induced physical changes in other foods.

Results:
The deep-fry model predicted that total dehydration of the skin layer occurred before center temperatures reached 75°C for all h values assessed, the lag time of which increased with heat transfer efficiency. Variations in T∞, which differs locally inside the grill due to non-uniformly emitted radiant heat, resulted in large differences in the surface dehydration properties of grilled saury. Contact resistance was found to be an important parameter affecting surface dehydration during pan-frying. The proportion of surfaces exceeding 100°C increased throughout grilling, and remained at ca. 100 and 50% during deep-frying and pan-frying, respectively.

E15-002
Biomimetic Molecularly Imprinted Polymers: A New Quorum Sensing Capturing Agent to Prevent Bacterial Biofilm Formation
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Introduction:
Bacterial biofilms are prevalent in dental and medico-technical environments, and are especially problematic in the food industry. Biofilm formation is a complex process involving self-organization of cells into a three-dimensional matrix, which is composed of extracellular polymeric substances that serve as a physical barrier against deleterious external factors. This study developed and evaluated a novel strategy to control both monospecies and multispecies biofilms in food processing environments. Compared to planktonic cells, biofilms are up to 10-500 times more resistant to antimicrobial agents and disinfectants, thus constituting a threat to public health and food industry. The formation of biofilms is mediated by quorum sensing (QS). QS is a mechanism by which bacteria can assess their population density through the secretion and sensing of autoinducers (AIs) and regulate the expression of certain genes in a cell-density dependent manner. Attenuating QS via sequestration of AIs represents a promising strategy to control biofilm development. However, conventional sequestration agents (i.e., antibodies) are unstable and their large-scale production is difficult to achieve. To address these disadvantages, molecularly imprinted polymers (MIPs), known as “artificial antibodies,” that were developed to specifically capture AIs. The overall objective of this study was to develop a MIP and evaluate its inhibitory effect against bacterial biofilm formation.

Method:
S. aureus ATCC 29213 was selected as it is a model organism for the study of both biofilms and QS. As one of the major AIs produced by S. aureus, N-3-oxododecanoyl-L-homoserine lactone (3-oxo-C12-AHL) was served as the template for molecular imprinting. The overall objective of this study was to develop a MIP and evaluate its inhibitory effect against bacterial biofilm formation.

Significance:
This study developed and evaluated a novel strategy to control both monospecies and multispecies bacterial biofilm formation and can be potentially applied to inhibit other QS-regulated bacterial behaviors.

Results:
The binding capacity of MIPs was 3.81 mg/g, which was 1.22 times higher than the control group. It indicated highly specificity of MIPs towards 3-oxo-C12-AHL. The results showed that MIPs could significantly (P<0.05) prevent biofilm formation at the early and middle stage (i.e., 4-12 h).

E15-003
Controlling the Production of Off-Offor Guaiacol by Alicyclobacillus Acidoterrestris in Apple Juice or a Microbiological Medium
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Introduction:
The presence of the off-offodor compound guaiacol in juices spoiled by Alicyclobacillus Acidoterrestris can lead to not only anisakiasis but also hypersensitivity after seafood intake. Rapid detection of this hazardous parasite is quite essential for food safety. Some previous studies showed that internal transcribed spacer 1 (ITS-1) can differentiate most relative species of Anisakis. In this study, a specific, rapid, and sensitive A. pegreffii detection method is proposed by using loop-mediated isothermal amplification (LAMP).

Method:
L3 stage larvae of A. pegreffii were collected from Zhoushan, Zhejiang Province, China. A single larva was fixed in 70% ethanol and preserved in 70% ethanol until processing for DNA extraction. The LAMP primers were designed for the ITS-1 gene by a multiple sequence alignment of nucleotide sequences available in GenBank. The LAMP reactions in vitro were optimized and conducted in a total volume of 25 μL. Specificity of the LAMP method was analyzed by using other Anisakis sp. as controls. The LAMP were carried out on bench-top and paper-based device. The paper-based device was a piece of nitrocellulose membrane folded into two layers. The pattern on it was designed with AutoCAD software and fabricated with wax-printing method. LAMP reaction buffer was pipetted onto the device and mixed with the preloaded DNA sample. All LAMP reaction was performed at 63°C for 55 min, 80°C for 5 min. The fluorescence was observed and analyzed with a fluorescence microscope.

Significance:
The proposed method has the potential to evaluate food safety and monitor seafood processing and cooking settings, prevent diseases, and maintain sustainable development for the aquatic food industry.

Results:
Some studies targeted 18S-28S including ITS and cytochrome oxidase subunit (COI) gene to detect or identify Anisakids. The result showed that ITS-1 is a good target for differentiate A. pegreffii from others. Among all tested Anisakis sp., only A. pegreffii was detected with designed primers. LAMP was conducted in a volume of 25 μL on bench-top, while 12.5 μL on the paper-based device and the limit of detection was < 105 copies. It was found that it took less time on the device (within 30 min).

E15-001
A Zoonotic Parasite Detection Method Based on Loop-Mediated Isothermal Amplification and a Paper-Based Device
Y. tang, Shanghai Ocean University, Email: tyy0731@sina.com

Introduction:
The larvae of Anisakis pegreffii (A. pegreffii) can lead to not only anisakiasis but also hypersensitivity after seafood intake. Rapid detection of this hazardous parasite is quite essential for food safety. Some previous studies showed that internal transcribed spacer 1 (ITS-1) can differentiate most relative species of Anisakis. In this study, a specific, rapid, and sensitive A. pegreffii detection method is proposed by using loop-mediated isothermal amplification (LAMP).

Method:
A Zoonotic Parasite Detection Method Based on Loop-Mediated Isothermal Amplification and a Paper-Based Device
Y. tang, Shanghai Ocean University, Email: tyy0731@sina.com


**acidocteostres**, is one of the major causes for consumer complaints and product rejection. This type of spoilage represents a serious problem facing the beverage industry. The objectives of this study were to test how temperature, pH, substrate (vanillin) and antimicrobial compounds (ε-polylysine and lauric arginate) affect bacterial growth and guaiacol production in yeast starch glucose broth (YSG) broth and apple juice.

**Method:**
Vanillin was added to *Alicyclobacillus* culture in YSG broth or apple juice and guaiacol concentration was determined in container's headspace by selected ion flow tube mass spectrometry (SIFT-MS). Incubated products, having pH 2.7-6.7, were held at temperatures in the range of 20-45°C. Vanillin concentration was varied from 0.25-2 mg/L. Minimum inhibitory concentrations (MIC) of ε-polylysine and lauric arginate were determined using the method described by the Clinical and Laboratory Standards Institute (CLSI, 2006); these were tested separately at 37°C and pH 3.7.

**Significance:**
In Conclusion, *Alicyclobacillus acidocteostres* growth and guaiacol production were inhibited by storage at 20 or 25°C, pH 6.7 and addition of ε-polylysine or lauric arginate. Guaiacol production can be decreased, but not prevented, by decreasing the substrate concentration in food.

**Results:**
Incubation temperature didn't influence the maximum count of bacteria or guaiacol produced, but did influence bacterial growth rate which determined the time until guaiacol production occurs. Bacterial growth was inhibited at 20 and 25°C in apple juice but not at 37 or 45°C. pH 6.7 completely inhibited bacteria and pH 2.7 delayed bacterial growth, thus influencing guaiacol production; but the bacterium grew well at pH 3.7 and 4.7. Guaiacol was produced when the bacteria population reached ~105 CFU/mL. The addition of vanillin concentration to guaiacol production was highly linear. MIC values for lauric arginate and ε-polylysine were 9.4 and 75μg/mL, respectively. Both of these compounds inhibited vegetative cell multiplication and spore germination and no guaiacol was produced.

**E15-004**

**Effect of Compatible Solutes on Biophysical Characteristics of the Cell Membrane of *L. bulgaricus* 3**
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**Introduction:**
Compatible solutes are small organic solutes accumulated at high intracellular concentrations to cope with the detrimental effects of high external osmolarity. Under salt stress, lactic acid bacteria needs to transport compatible solutes from the environment to relieve the salt stress. During this process, the stability and permeability of the cellular membranes play a fundamental role in adaptation to different kinds of stresses. However, little is known about the permeability and stability properties of the lactic bacterial envelopes.

**Method:**
In this research biophysical properties of the cell membrane and some general characteristics of the response of *L. bulgaricus* 3 to hypotonic conditions with or without compatible solutes were studied. The scanning electron microscopy and confocal laser scanning microscopy (CLSM) methods were used to analyze the cell morphology and live bacteria ration. The cell membrane stability, permeability and fluidity were analyzed by zeta potential, flow cytometry, and fluorescence spectrophotometer.

**Significance:**
These indicated that under salt stress conditions, the compatible solutes can protect strains morphology and viable number of bacteria. Compatible solutes could protect strains from salt stress through keep its membrane stability, integrity, and fluidity.

**Results:**
The results showed that the diameters and live bacteria ratio of *L. bulgaricus* 3 with compatible solutes addition similar with no-salt-stress conditions and significantly different with that of no compatible solutes addition strains under salt stress. For the changes of stability, permeability, and fluidity of cell membrane, the *L. bulgaricus* 3 with compatible addition had great different with that of no compatible addition strains under salt stress conditions and similar with that of no salt and no compatible solution addition strains.

**E16-003**

**Impact of Water on Survival of *Lactobacillus* During Freezing Drying and Spray Drying**
P. Gong, Harbin Institute of Technology, Email: gongpimin@outlook.com

**Introduction:**
Drying is an effective means of long-term preservation of lactic acid bacteria. During drying, either freezing drying or spray drying, dehydration is one of the important factors that cause cell death. The objective of this work is to study the relationship between water and survival of *Lactobacillus* in different drying process.

**Method:**
*Lactobacillus* were dried in 12% (w/w) skim milk by spray drying or freezing drying. To obtain the different water content dried samples, we set different freeze-drying times and different sampling heights in spray drying tower. Water content, water activity, viable cells number, loss of specific acidification activity, glass transition temperature (Tg), and mobility of water protons were determined.

**Significance:**
The relationship between water content and survival of *Lactobacillus* during drying revealed dried that *Lactobacillus* were kept alive when we controlled water content above the critical water content.

**Results:**
Both in the spray drying process and freeze-drying process, there was a certain water content considered as critical water content for maintaining lactobacillus alive. Before dried to 10% water content, a sharp decline in the number of viable cells appeared, and most cells lost viability and acidification activity. Critical water content was related to dry process. Most cell death occurred in deceleration dry phase, or when all free water lost. However, at the same water content thermal drying caused much more cells death than freeze-drying.

**E16-004**

**Importance of Stability of Protein-Polysaccharides Conjugates’ Emulsions via Maillard Reaction on the Functional Properties of Spray Dried Oil Microcapsules**
K. Li, Monash University, Email: krystel.li@monash.edu

**Introduction:**
Lipid oxidation remains the main reason behind a short shelf-life of dairy powders, particularly in infant formula. It is therefore important to shield the bio-active (oil + milkfat) by encapsulating it within a secondary material. Emulsion stability has been reported as being one of the main requirements for production oil/fat microcapsules with low levels of free surface fat and hence superior encapsulation efficiency.

**Method:**
This study encompasses the use of sodium caseinate (NaCas)-lactose complex; conjugated via the Maillard reaction, as encapsulating materials, while investigating the effect of pH on the stability of the protein-polysaccharide oil-in-water (O/W) emulsion. Subsequently, the functionalities of the spray-dried oil microcapsules such as encapsulation efficiency, insolubility, wettability, extent of browning, and microstructure were analyzed.

**Significance:**
These results therefore demonstrate the ability to obtain highly functional oil/fat microcapsules, with an oil loading as high as 80%, entrapped by sodium casein-lactose conjugate at pH 11.

**Results:**
The results demonstrated that better NaCas-lactose interactions were achieved at pH 11, with enhanced adsorption of the conjugates on the oil droplet particles and subsequently better emulsifying properties and stability. Additionally, better oil entrainment by the cross-linked protein and lactose was achieved when the NaCas-lactose mixture was adjusted to 11 (95.2 ± 3.7 %) as compared to a pH of 7.5 (73.1 ± 2%). Spray-dried emulsion at pH 11 shows improved solubility, exhibiting a lower insolubility index of 24.0 ± 1.3 mg as opposed to 27.9 ± 2.0 mg for spray-dried emulsion at pH 7.5, owing to lesser extent of casein aggregation in the former and hence lesser insoluble material. This study also demonstrates that oil microcapsules with an oil loading as high as 80%, demonstrated similar functional properties than those at 40% at pH 11.

**E16-005**

**Spray-Drying of Milk Powder: The Atomization Stage Induces a Formation of Surface Fat**
M. Foerster, Monash University, Email: martin.foerster@monash.edu

**Introduction:**
A dominance of surface fat on spray-dried milk particles is typically encountered in the dairy industry, resulting in detrimental effects on the powder solubility, stickiness, and oxidative stability. This necessitates post-processing steps, such as lecithination. In literature various potential mechanisms have been proposed as explanation for this component segregation, but a systematic investigation is yet to be done. The object of our work was to gain an understanding about why and when the surface fat is formed.

**Method:**
Individual droplets of model milk emulsions with two different fat contents were dried in a single droplet drying rig. Changes over time were tracked by interrupting the drying process via cryogenic flash-freezing and subsequent freeze-drying. Furthermore, spray drying with various atomization techniques was performed, and cryogenic flash-freezing allowed to distinguish between the atomization and drying stage. The dried particles and flash-frozen droplets were investigated in terms of their surface composition via X-ray photoelectron spectroscopy, their internal component distribution via confocal laser scanning microscopy and their size via scanning electron microscopy. These results were compared with information about the emulsions’ oil globule size, stability, and viscosity properties.

**Significance:**
This knowledge it can help to further efficient fat encapsulation during spray drying of milk. An outline of how to improve internal emulsion cohesion for better encapsulation will be given, using the utilization of carrageenan as an example.
Results:
During single droplet drying, surface fat was observed immediately after droplet generation (surface with 18 and 97 vol% fat for a total fat content of 0.5 and 44 vol%, respectively). The fat overrepresentation remained unchanged on the very surface as drying proceeded, though more and more protein diffused towards the surface (protein increase from 43 to 59 vol% at the surface for the low-fat feed). Also, during spray-drying the surface fat already occurred during the atomization stage, rather than during the following drying stage as frequently suggested in literature. We propose that the emulsions are least stable against disintegration along the oil-water interface of the fat globules. The emulsions hence preferably disintegrated there, leading to the observed immediate fat overrepresentation at the droplet surface.

E17-001
Antimicrobial Efficacy and Mechanism of Ultraviolet Light Exposed Gallic Acid Against Escherichia Coli O157:H7 in Fresh- Produce Wash Water
Q. Wang, University of Maryland, Email: wangqy0503@gmail.com

Introduction:
Sanitation of fresh-produce wash water is important to prevent cross contamination. The disadvantages of common chemical sanitizers for fresh produce are limited efficacy in the presence of organic content of the wash water and formation of potentially toxic by-products. To address these needs, we investigated a novel approach of synergistic interaction between gallic acid (GA), a GRAS compound, and UV-A (365 nm) light to inactivate E. coli O157:H7 in wash water, and biofilm. The underlying hypothesis behind this approach is that, upon exposure to UV-A light, gallic acid will produce reactive oxygen species such as hydrogen peroxide that can effectively inactivate the microorganisms.

Method:
To achieve this, we exposed up to 10 mM GA to UV-A light for up to 30 minute. Inactivation of E.coli O157:H7 was measured using plate count. Biofilm activity was measured using the resazurin based assay.

Significance:
The demonstration of the effectiveness of synergistic interaction between UV-A and GA would give the opportunity to introduce this GRAS compound in the fresh produce sanitation and enable the food industry to use GRAS compounds for an eco-compatible sanitization of wash water.

Results:
The results demonstrated that while UV-A and GA without exposure to UV-A light caused only 0.56 ± 0.46 log CFU/mL and 0.91 ± 0.23 reduction in E. coli population after 30 min of treatment, co-presence of 10 mM GA and UV-A light caused a 4.95 ± 0.19 log CFU/mL reduction in microbial count within 15 minutes. The results showed that hydrogen peroxide was produced upon UV-A induced exposure of GA. This was also validated by the protective effect of catalase against UV-A/GA induced inactivation of E. coli O157:H7. In the presence of organic content at the levels of 500 and 2,000 mg/L COD, 10 mM GA caused 5.09 ± 0.10 log CFU/mL and 3.74 ± 0.10 log CFU/mL reduction in bacterial count, respectively after 30 min of UV-A exposure, indicating that organic load reduced the efficacy of GA. The optimal pH for the oxidation of GA to produce ROS. Moreover, UV-A exposed 10 mM GA decreased the biofilm activity to 26.17 ± 4.68%, indicating its effectiveness against the biofilm.

E17-002
Electrochemical Detection of Escherichia Coli in Aqueous Samples Using an Engineered Bacteriophage With a β-Galactosidase Gene
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Introduction:
An electrochemical method was developed for the detection of Escherichia coli (E. coli) using the engineered bacteriophage with β-galactosidase (β-gal) gene. Electrochemical detection of bacteria offers the advantages of instant quantification of pathogen in complex sample with minimal equipment. Bacteriophage has the high specificity and detection of bacteria offers the advantages of instant quantification of pathogen in complex sample with minimal equipment. Bacteriophage has the high specificity and detection of pathogen in complex sample with minimal equipment. Bacteriophage has the high specificity and detection of pathogen in complex sample with minimal equipment.

Method:
Here, the bacteriophage T7 which specifically targets T. coli BL21, was engineered to carry the β-gal gene. The engineered bacteriophage was able to release the bacteria-enclosed β-gal and overexpression of β-gal during the infection of E. coli. The phage-induced β-gal was detected by electrochemical methods using 4-aminophenyl-β-galactopyranoside (PAPG) as a substrate. The β-gal catalyzed PAPG to an electroactive species p-aminophenol (PAP) which can be monitored on the electrode. The electrochemical signal is proportional to the concentration of E. coli.

Significance:
This research will benefit the consumers and industries by the development of a more specific and sensitive approach to help ensure the food safety. This method has the potential to be extended to detect other bacteria using different specific bacteriophage engineered with other enzyme genes.

Results:
We demonstrated the application of our strategy in aqueous samples (drinking water and apple juice). Using this method, we were able to detect E. coli at the concentration of approximately 10^5 CFU/mL in drinking water (or apple juice) in 3 hours, and approximately 10^2 CFU/mL after 6 hours of incubation.

E17-003
Light-Scattering Sensor for Detection and Identification of the ‘Indicator Bacteria’ Enterobacteriaceae Family for Process Verification and Hygiene Monitoring
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Introduction:
The Enterobacteriaceae (EB) family and its most known members, coliforms, are used as “indicators” of hygiene monitoring, sanitization practices, and process verification of food products. The traditional detection methods rely on bacterial growth on selective media that contain different types of sugars as energy source, such as glucose for EB and lactose for coliforms. However, differentiation within the family based on biochemical attributes are ambiguous and emphasizes the need for reliable identification techniques.

Method:
We used, a laser scatterometer, BARDOT (bacterial rapid detection using optical light scattering technology), which uses a red diode laser (635 nm) beam to generate scatter patterns of colonies directly on plate to differentiate the members of EB family. The media selected for this study include violet red bile glucose agar (VRBGA), rapid Enterobacteriaceae (REB), glucose bromocresol purple agar (GBPA) and modified Kingler iron agar (mKIA). A total of 5,280 scatter images were acquired for the 12 genera on four different growth media from two experimental replicates using BARDOT. Bacterial species of selected genera were cultured in Luria Bertani (LB) broth, incubated at 37 for 12-16 h, serially diluted in PBS, and subsequently plated on agar plates. Plates were incubated at 37 until the colony diameter reached to 1 mm for acquisition of scatter patterns.

Significance:
BARDOT can potentially be used for rapid differentiation and identification of members of EB family and the coliforms for process verification, hygiene monitoring, or food safety.

Results:
Scatter images were analyzed using image classifier and results were expressed as percentage positive predictive value (PPV). For all 12 genera, PPVs on VRBGA, REB, GBPA, and mKIA were 92.3%, 91.4%, 86.4%, and 85.5%, respectively. We selected REB as an optimal growth medium for this study, since REB was highly selective, resulted in high PPV, and generated optically transparent colonies to capture the scatter patterns. Though, the PPV for other EB selective media, including VRBGA was high (92.3%), the members of the Enterobacteriaceae family produced high amounts of chromogens that interfered with laser propagation through colonies. Therefore, REB, yielding a high PPV (91.4%) was used for the differentiation of EB and coliforms for BARDOT technology.

E17-004
The Efficacy of X-Ray Doses on Murine Norovirus-1 (MNV-1) in Pure Culture and Half-Shell Oysters
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Introduction:
Raw and/or ready-to-eat (RTE) seafood products, including oysters, are popular in several parts of the world; however, these products are highly associated with foodborne illness, including HuNoV.

Method:
In this investigation, we determined the efficacy of X-ray doses on reducing a human norovirus (HuNoV) surrogate (murine norovirus-1; MNV-1) in pure culture and half-shell oyster. The pure culture (phosphate-buffer saline, pH 7.4) and half-shell oyster samples were inoculated with propagated MNV-1 virus stock solution. Oyster samples were then air-dried at 22°C for 30 min (to allow viral attachment) and then packaged in sterilized bags prior to X-ray treatments. Samples (pure culture and half-shell oyster) were treated with 0.0, 1.0, 2.0, 3.0, 4.0, or 5.0 Kgy X-ray.

Significance:
X-ray could be a suitable non-thermal processing alternative to current disinfection techniques for the oyster industry.

Results:
Treatments with 4.0 Kgy X-ray achieved the reductions of 3.7 log PFU ml-1 and 2.7 log PFU g-1 in pure culture and in half-shell oyster, respectively. Exposure to 5.0 Kgy X-ray reduced the population of MNV-1 by of 4.0 log PFU ml-1 and to below the detection limit (<2.0 log PFU g-1) in pure culture and in half-shell oyster, respectively.

E18-001
Development of Online Detection System for Simultaneous Assessment of Edible Quality and Internal Defects in Apples by NIR Transmittance Spectroscopy
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Introduction:
Apples are one of the most important fruits in international trade. Detection of internally
defective apples can reduce economic loss. Knowledge of the internal quality attributes of apples may enhance the competitiveness and profitability of the industry and assure consumer acceptance and satisfaction. This work presents a prototype online detection system that uses near infrared transmittance technology as a novel approach to detect quality attributes without destroying samples.

Method:
The online detection system was designed and developed to improve spectra signal quality, lower heat damage, and reduce mechanical damage. Special detection software was developed for real-time inspection based on multithread programming technology. In this experiment, internal defects in apples caused by core rot fungi were collected and cultivated. We tested the preparation of samples and achieved good performance.

Significance:
The results showed that the nondestructive online detection prototype based on the NIR transmittance technique was feasible to simultaneously inspect the edible quality and internal defects of apples. The present research provides the foundation for the future development of an automatic system based on transmittance spectroscopy, which is extremely important from an economic point of view.

Results:
We achieved internal quality information in a nondestructive way by use of this online system. Partial least squares-discriminant analysis (PLS-DA) models were developed to identify internal defects samples. The results obtained from PLS-DA models, in validation, gave a positive predictive value of classification about 91%. Moreover, predictive models were performed applying fast PLS regression algorithm to predict the soluble solid content (SSC) in apples. Very good results were obtained for SSC with R2 and RPD equal to 0.90 and 3.00, respectively.

E18-002
Influence of Carbonic Maceration on the Drying Kinetics of Apple Slices
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Introduction:
Pre-treatments are commonly used techniques to accelerate the drying of food materials as well as keeping quality high. For this purpose there are plenty of number of studies performed, and at differing levels they have got success. However, few numbers of studies focused on the carbonic maceration as a pretreatment in drying process of food. None of them is about the drying of apple slices being one of the popular dried fruits. In current study it was aimed to investigate the effect of carbonic maceration applied to apple slices before drying process in terms of drying kinetics.

Method:
For this purpose, carbonic maceration was applied at differing conditions (3 levels of pressure, 2 levels of time, and 2 levels of temperature) and then pre-processed apple slices were subjected to the drying conditions at constant temperature (60°C) and at air flow rate of 1.5 m/s. Drying time was determined according to the target moisture content of 7%. Drying curve was used to calculate the effective diffusion coefficient for each drying trial based on Fick’s second law of diffusion. Three most common empirical models (Page, Midilli Equation, two-site exponential model) were used to define the drying processes and compared their prediction performances.

Significance:
Carbonic maceration as a pretreatment before the drying process of apple slices reduced drying time, meaning shorter exposure time to the thermal process, higher quality, lower energy requirement.

Results:
Results indicated that more than 30% reduction in drying time was achieved by applying carbonic maceration before drying process at 2 bar and 45°C and 24 hours compared to the control sample dried without pretreatment. Effective diffusivity was found to differ in the range of 4.80×10⁻⁸ – 8.20×10⁻⁸ m²/s being higher than that (4.50×10⁻⁸) calculated when apple slices were directly dried. Midilli equation explained the variation in moisture ratio as a function of time with higher success compared to Page and Two-term-exponential investigated.

E18-003
Particulate Flow as a Function of Moisture and Temperature and Implications in Food Extrusion
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Introduction:
Innovations in food extrusion technology are enabling its rapid expansion and particle size changes, and the implications increased moisture may have on energy requirements through the extrusion process.

Results:
The results showed that corn meal exhibited lower energy requirements than wheat farina, with an increase in moisture content having a greater impact on energy requirements of wheat farina than on corn meal. An energy increase of 25% was shown for basic flow energy for farina, while less than 1% increase was shown for corn meal. However, in tests such as compressibility, corn meal was impacted far more—the increase in moisture reduced compressibility from 20% to 11% (at 15kPa pressure), while the compressibility of farina was reduced from 3.5% to 2.5% (at 15kPa pressure). Flow factor also reduced with increased moisture, which, along with an increase in wall friction angle, indicates that flow is reduced is moisture increases in a particular system.

Significance:
Although initial results indicated moisture yields increased energy requirements and resistance to flow, additional testing at further-increased moisture will be explored to fully understand the impact of moisture on the raw materials as composition and resistance to flow, additional testing at further-increased moisture will be explored to fully understand the impact of moisture on the raw materials as composition and particle size changes, and the implications increased moisture may have on energy requirements through the extrusion process.

E18-004
Pasteurization of Shell Eggs Using a Novel RF Heating Process
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Introduction:
The USDA-FSIS estimates that 110,000 illnesses could be prevented in the U.S. if all shell eggs were pasteurized; however, only about 1% of eggs are currently pasteurized. The main reason for this is that the commercial, hot water process requires 60 min to complete. The objective of this project was to determine if radio frequency (RF) energy can be used to reduce the time required to pasteurize shell eggs without causing damage to the heat sensitive albumen.

Method:
A unique RF treatment apparatus was designed and assembled in-house. The device consisted of an electrode attached to the large end of the egg and another to the small end. The impedance of shell eggs were measured in the frequency range of 10-70 MHz to determine the best frequency to use. The power density within the egg was modeled with finite element analysis software to locate potential hotspots. Egg yolks were injected with Escherichia coli (ATCC 35218) to approximately 7.5 log CFU/ml. A combination process first heated the egg in 35.0°C water for 3.5 min using 60 MHz RF energy. This resulted in the yolk being preferentially heated to 61°C. Then, the egg was heated for an additional 20 min with 56.7°C water.

Significance:
The novel RF pasteurization process is much faster than the existing commercial process. This should lead to an increased percentage of eggs being pasteurized, which in turn will reduce the number of foodborne illnesses.

Results:
Impedance measurements showed that 60 MHz frequency provides a good electrical match between the egg and the RF power supply. Finite element modeling indicated that the highest power density was located directly below the shell in the vicinity of the electrodes. Therefore, the RF treatment chamber was bathed in water at 35.0°C to cool the shell and albumen. The two-step RF hot water immersion process was then performed, while the population of E. coli by more than 6.8 log and the appearance of the albumen was good. The total time for the process was 23.5 min. By contrast, processing for 60 min was required to reduce the E. coli by 6.6 log using just hot water.

E18-005
Water Crystallization During Freezing in Highly Concentrated Systems
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Introduction:
Freezing of foods typically refers to the phase transition of liquid water to solid ice as the temperature decreases. It is a well-established technique for food preservation (frozen foods) and/or a necessary processing step, e.g. during freeze-drying. Controlling ice crystal formation during freezing is critical in determining the properties and quality of the frozen products. Freezing and freeze-drying are energetically expensive processes. While processing highly concentrated systems would significantly reduce energy and water costs, freezing of such systems is challenging due to, among others, the low availability and mobility of water. In this work we present a study of water crystallization at a range of solids contents (30-70%) and conditions (temperature, viscosity, aeration).

Method:
Crystallisation kinetics were determined using an optical method comprising a temperature controlled, modified peltier stage and a microscope/camera unit. Recorded images were digitally processed. For concentrations >40%, no primary nucleation was observed and crystal growth was induced by addition of nuclei into the supercooled liquid. A first-principle based mathematical model was further developed to help in the study of the growth kinetics. Crystal morphology was observed under an optical as well as an electron microscope.

Significance:
Overall this work highlights the challenges associated with water crystallization during freezing of systems with high solids contents and illustrates the potential to control crystal formation (kinetics and morphology) by varying crystallization conditions in order to achieve the desired structures.
E19-001
Deletion-Basezen Escpa CRISPR-Cas Targeting in Lactobacillus Gasseri E. Stout, Email: eadekam@ncsu.edu

Introduction: Lactobacillus gasseri is a lactic acid-producing commensal bacterium found in the genital and gastrointestinal tracts of healthy humans. Due to its long history of safe consumption, it is Generally Recognized As Safe (GRAS) and is frequently used as a probiotic supported by a number of substantiated health benefits. Many L. gasseri strains are lysogenic and contain CRISPR-Cas, an adaptive immune system composed of CRISPR repeat-spacer arrays and CRISPR-associated proteins (Cas) that protect against invasive mobile genetic elements (MGE). However, MGEs occasionally escape targeting by CRISPR-Cas due to DNA mutations that occur in sequences essential to the CRISPR protection process.

Method: To better understand CRISPR escape processes, a plasmid interference model was used to screen for CRISPR-resistant mutants in L. gasseri strains JV-V03 and NCK1342. Plasmids containing a target sequence, a protospacer adjacent motif (PAM), and an erythromycin resistance gene were transformed into both strains for targeting by the native CRISPR-Cas system in the host. Mutants able to escape CRISPR targeting were recovered to investigate their genetic mechanisms of survival and their frequency.

Significance: CRISPR-Cas has been a revolutionary discovery in both starter cultures and probiotics that could vastly improve the industry’s ability to manage bacteriophages detrimental to fermentation and fermented foods. Understanding CRISPR targeting processes will advance the use of CRISPR-based technologies for bacterial genotyping, phage resistance, vaccination against plasmid uptake, antimicrobial activity, and genome editing.

Results: No mutations were observed in the endonuclease regions of cas9 or in the protospacer-PAM region of the plasmid. Intriguingly, deletions in the CRISPR array were the dominant pattern of escape in both strains, accounting for 70% and 52% of the escapes found in JV-V03 and NCK1342, respectively. Analysis of sequence mutations revealed internal deletions in the CRISPR array, characterized by polarized excisions from the leader end that systematically included the targeting spacer. This establishes that internal deletions of targeting spacers within CRISPR arrays constitute a key escape mechanism whereby cells adapt to evade CRISPR targeting, while maintaining both the target sequence and the functionality of the CRISPR-Cas system. We speculate that internal deletions may occur via homologous recombination between identical repeats within CRISPR arrays.

E19-002
Discovering New Levansucrase Enzymes Through High-Throughput Screening With Genome Mining for the Efficient Production of Fructooligosaccharide Prebiotics A. Hill, McGill University, Email: andrea.hill3@mail.mcgill.ca

Introduction: With increased awareness of gut health, prebiotics are a growing niche in the food industry. Many probiotic supported by a number of substantiated health benefits. Many L. gasseri strains are lysogenic and contain CRISPR-Cas, an adaptive immune system composed of CRISPR repeat-spacer arrays and CRISPR-associated proteins (Cas) that protect against invasive mobile genetic elements (MGE). However, MGEs occasionally escape targeting by CRISPR-Cas due to DNA mutations that occur in sequences essential to the CRISPR protection process.

Method: A reference set based upon 39 enzymes was used to perform a BLAST analysis. 39 potential Ls genes were identified from the Genoscope metagenomic database by sequence homology (601 identified) which were organized into putative isofunctional groups (43 clusters). 69 genes, representative of biodiversity, were cloned in E. coli BL21 cells. Using sucrose as a substrate, enzymatic activity assays were used for screening, including: (a) total reducing sugars (glucose and fructose)-based Ls activity, (b) fructose-based Ls activity, and (c) levansucrase activity. High activity coupled with high glucose production represents a greater proportion of transfructozylating activity.

Significance: These findings are significant because they show that these GEMS for L. monocytogenes. are comparable in agreement between in silico predictions and in vitro results to published models of other organisms. Therefore, as with the other models—namely those for Escherichia coli, Staphylococcus aureus, Vibrio vulnificus, and Salmonella spp.—they can be used to determine new methods of growth control and disease treatment.

Results: Of the 58 carbon sources tested in vitro were present in the model, and therefore, these were the compounds from which comparisons could be drawn. Of these 58 compounds, agreement between in silico predictions and in vitro results ranged from...
E20-001
Farmed Catfish and Tilapia Consumption: Risky or Beneficial to Human Health?
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Introduction: Catfish and tilapia rank as the two cultured fishes most highly consumed in Nigeria. In the past, their consumption is said to be healthy and beneficial to human health than other animal protein and lipid source foods. Recently however, several health professionals are saying otherwise and thus leaving many consumers and the general populace confused. There is an urgent need to look critically into these issues and come up with the right inferences to inform consumers. The thrust of this work is to evaluate the fatty acid characterization of both cultured and wild catfish and tilapia.

Method: Lipids in the muscles of the cultured and tilapia were extracted using the Bligh and Dyer method of lipid extraction. Extracted lipids were then analyzed by gas chromatography. This was determined using AOAC Method. The descriptive statistics (mean, standard deviation, range) were conducted while statistical significance of differences (P ≤ 0.05) was determined by analysis of variance (ANOVA) with SPSS version 10.0.

Significance: From this research, farmed fishes are beneficial to human health therefore good to be consumed, profitable to be cultured, prospective for further researches and relevant for product development.

Results: The percentage of total saturated fatty acids (SFA) in the muscles of the cultured and wild catfish was 33.19% and 22.86%; the SFA in cultured and wild tilapia was 24.16% and 26.72% respectively. The percentage of total mono unsaturated fatty acids (MUFA) was 51.47% and 73.62% for the cultured and wild catfish while for cultured and wild tilapia it was 69.56% and 65.35%. The poly unsaturated fatty acids (PUFA) were 15.35% and 3.54% in the cultured and wild catfish respectively, this was not so for the cultured and wild tilapia with 6.27% and 7.90% values. The cultured catfish also had more omega-3 (PUFA) than the wild ones (10.32% to 1.41% respectively). Same trend was also observed with tilapia (2.54% to 1.94%). The omega-6 was lesser in the cultured fishes than the wild ones as well. The cultured specie contain essential fatty acids particularly eicosapentaenoic acids and docosahexaenoic acids for promoting good health and prevention of cardio-vascular diseases in humans.

E20-002
Fish Gelatin Addition Improves Nutrient Retention and Mass Transfer of a Fish Ball Without Altering Its Nanostructure During the Boiling Process
X. Feng, National University of Singapore, Email: a0113452@nus.edu.sg

Introduction: Boiling is the most common method to cook fish balls, which will lead to nutrient loss due to the permeation of proteins and peptides into the boiling solution. Applying fish gelatin to fish balls may prevent nutrient loss. The objectives of this research were to investigate the effect of gelatin addition on fish ball’s nutrient retention, mass transfer, nanostructure, and the underlying mechanism.

Method: Atomic Force Microscopy was applied to investigate the nanostructure of myofibril, while MALDI-TOF-Mass spectrum was used to analyze proteins and peptides in the boiling solution. The differences of results among different groups were determined by ANOVA (P ≤ 0.05) and Duncan’s multiple range test with SAS software.

Significance: The research reveals that adding fish gelatin to fish balls is effective to prevent nutrient loss of fish balls and improve mass transfer without altering nanostructure. It is a promising approach to enhance food sustainability and security, while preventing environmental pollution caused by fish processing waste.

Results: The MALDI-TOF-Mass spectrum showed that the boiling solution of the gelatin added fish balls had simpler proteins and peptides profile with lower Mw than the control group, which showed that gelatin prevented proteins and peptides from permeating the solution. By building the mass transfer model, it was shown that there was positive correlation between the concentration of gelatin added and the mass transfer coefficient of fish ball during boiling. For example, for power-law model, the mass transfer coefficient was 0.32 g/min/0.5 without gelatin addition, and it increased significantly to 0.51 g/min after 30 min boiling when gelatin was added at 3 g/100 g fish meat. Structurally, the dimension of myofibril decreased significantly after 30 min boiling, suggesting myofibril disintegration and degradation. The length of myofibril was greater than 15 μm before boiling and after 10 min boiling; however, the length was decreased to around 14 μm and 11 μm after 20 min and 30 min boiling. Interestingly, there was no significant difference between the control and gelatin treated groups for myofibril width and length, indicating that the added gelatin did not affect the nanostructure of myofibril during boiling.

E20-003
Health Beneficial Attributes of Bioengineered Probiotics Against Subclinical Infection of Listeria Monocytogenes in Pregnant Guinea Pigs
V. Ryan, Purdue University, Email: ryanv@purdue.edu

Introduction: Listeria monocytogenes (Lm) is a foodborne pathogen, found ubiquitously in nature, and has a high morbidity rate among immunocompromised individuals, the elderly, and especially pregnant women and their fetuses resulting in abortion and stillbirth. The Listeria adhesion protein (LAP) is present in both pathogenic and non-pathogenic Listeria (i.e., L. innocua) and has been shown to interact with host epithelial proteins and tether monocytes and lymphoblasts in vivo. In the host intestinal epithelium, we have demonstrated that bioengineered probiotics, Lactobacillus casei expressing LAP from either the pathogenic L. monocytogenes (LbCLP/Lm) or the nonpathogenic L. innocua (LbCLPL/i), prevented Lm attachment in vitro and cell culture experiments. In this study, we investigated the beneficial attributes of our bioengineered probiotics against subclinical listerial infection.

Method: Pregnant guinea pigs (gestational days 24-28) were fed wild type (WT) and bioengineered probiotics (~109 cfu/ml) daily for 17 days, given a subclinical dose (9×108 or 2.5×109 cfu/animal) of Lm, and sacrificed 72 h post challenge. Organs, tissues, blood and feces were collected for Lm presence and absence using an enrichment method, probiotic colonization, short-chain fatty acid (SCFA) content via HPLC/MS and cytokine array (Raybiotech). Data was statistically analyzed using unpaired t-test.

Significance: Due to the aforementioned high morbidity rate among a portion of the population, these bioengineered probiotics could confer safe protection against listeriosis and provide a platform for future research into the use of probiotics as a “probiotic vaccine”.

Results: In the bioengineered probiotic-fed groups, Lm was present in the maternal liver, spleen and mesenteric lymph node (MLN) and absent in the maternal blood, kidney, placenta, and fetal liver. WT probiotic groups and Lm control groups showed Lm presence in nearly all tissues tested. No probiotic bacteria were found in any extra-intestinal tissue. Bioengineered probiotic-fed groups showed a decrease in pro-inflammatory cytokines in contrast to WT and Lm control groups. There was no significant change in the concentration of SCFA in both feces and serum across groups. Taken together, these data suggest that LAP-expressing bioengineered probiotics confer anti-Listerial effects, participate in immune modulation and have a positive impact on overall health.

E20-004
Mineral and Vitamin C Concentrations of Amaranthus Leafy Vegetables and Their Potential Contribution to Human Dietary Needs
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Introduction: African leafy vegetables (ALVs) are sources of minerals and vitamins. Leaves of various Amaranthus species are some of the most popular ALVs. However, there is only limited data about their nutritional composition. Therefore, the goal of this research was to evaluate the concentration of minerals and Vitamin C in leaves of 15 species of Amaranthus and to calculate their potential dietary contribution per serving.

Method: Seeds were obtained from the USDA National Plant Germplasm System and AVRDC-The World Vegetable Center. Plants were grown in synthetic soil in an environmental growth chamber for 5 weeks. Minerals were quantified using inductively coupled plasma optical emission spectroscopy, and Vitamin C was evaluated using UV-Vis spectroscopy. Results are reported on a fresh weight basis (FW).

Significance: This research provides new knowledge of the nutritional value of Amaranthus leaves and offers consumers new choices for healthy food. The consumption of amaranth leafy vegetables should be promoted.

Results: The concentrations of Ca, K, Mg and P in amaranth leaves were 1.53-3.53, 5.48-8.84, 1.78-4.50, and 0.53-0.93 mg/g FW, respectively. The concentrations of Cu, Fe, Mn, Mo, Na, and Zn were 0.56-2.39, 8.41-22.40, 3.82-11.46, 0.08-0.47, 4.74-154.9, and 8.11-15.98 μg/g FW, respectively. Amaranthus acanthochiton had the highest concentrations of Ca, Mg and Zn, A. caudatus had the highest concentration of K, and A. virindis had the highest concentrations of P and Cu. Additionally, the concentration of total Vitamin C in amaranth leaves was from 0.70 to 1.36 mg ascorbic acid (AA)/g FW. A. tricolor, A. thunbergii and A. blitum had the highest concentrations of total vitamin C (1.31-1.36 mg AA/g FW). A serving of any of the Amaranthus leaves (1 cup: 30 g FW) would contribute from 13 to 34% of the daily value (DV) of Mg (DV = 400 mg; as established by the US Food and Drug Administration), and up to 68% of the DV of vitamin C (DV = 60 mg). In addition, A. acanthochiton would be considered a good source of Ca, Mn, and Mo (10%-19% of the DV), and an excellent source of Vitamin C (20% or more of the DV).
E20-005
Optimizing Nutritional, Rheological, and Sensory Characteristics of Durum Wheat Spaghetti Supplemented With Detoxified Grass Pea (Lathyrus Sativus L.) Flour
N. Ahmad, University of Agriculture, Email: navidahmad.ff@gmail.com

Introduction:
Durum wheat is deficient in nutritional profile especially in protein contents in comparison to most cereals. Contrarily, legumes have rich nutritional profile. To overcome this concern, durum wheat products (spaghetti) were enriched with legume flours to obtain a product comparable to conventional pasta in terms of quality contour.

Method:
Study was organized in two consequent experimental phases. In 1st phase, durum wheat spaghetti was supplemented at 5%, 10%, 15%, 20%, and 25% detoxified mattri flour (DMF). Level to assess sensorial threshold point and rheological attributes. Detoxification was done by steeping matri in water (60-70°C) and chromatograms were developed using silica gel plates. Toxin was quantified using spectrophotometer with comparison to standard solution. In 2nd experimental phase, xanthan gum (XG) was added at 1%, 2%, 3%, 4%, and 5% level to assess its impact on sensory, diastatic and more pronouncedly on cooking quality. Data were statistically analyzed by linear models analysis of variance (ANOVA) using completely randomized designs (CRD) and significant differences between treatments were determined by Tukey HSD all pairwise comparison test (α = 0.05).

Significance:
As matri is one of the least utilized legumes, and study revealed the efficiency and using potential of detoxified mattri flour (DMF) in preparing enriched cereal products instead of using this legume as an adulterant in other legumes.

Results:
In the first phase, chemical composition was eventually improved upon DMF supplementation. In fact, DMF supplemented spaghetti was inferior in quality in comparison to the control exposing intensive hardness, color, taste, and a lower viscoelasticity (sensorial threshold = 15% DMF). Cooking quality was also negatively affected accompanied with increased cooking loss and hardness. Non-gluten protein fraction increased cooking loss, product color and hardness compared to the traditional durum wheat pasta. In the second phase, xanthan gum (XG) improved the quality parameters of a reference sample taken from first experimental phase (spaghetti having 15% DMF). Cooking loss was contained with XG incorporation. Furthermore, hardness, taste and color were also improved to the 1st phase. Considering cooking quality and nutritional profile, spaghetti prepared from 15% DMF and 3% XG acquired premier values.

E21-001
Antioxidants and Phenolic Compounds of Pumpkin (Cucurbita Pepo) and Its Potential Functionality
S. Thomas, Tuskegee University, Email: sthomas0179@mytu.tuskegee.edu

Introduction:
Foods that are rich sources of antioxidants and phytochemicals have the potential to protect against certain chronic diseases (cardiovascular disease, cancer, hypertension, and diabetes). β-carotene has shown promising effects in decreasing risk factors for cardiovascular disease, cancer, hypertension, and diabetes. β-carotene has shown promising effects in decreasing risk factors for heart disease and macular degeneration. An underutilized and promising source of functional ingredient.

This study will continue to elucidate the bioactive compounds in pumpkin products and make recommendations on its potential effectiveness in disease prevention and use as a functional ingredient.

Results:
Preliminary results showed that the fat content of pumpkin seeds and flesh ranged from 27-29% and 1.91-2.5%, respectively. Moisture was 4.1% and 10.3% respectively; ash content was 5.5% and 6% (dry weight basis). β-carotene was 7230 μg/100g for the pumpkin flesh and 4527 μg/100g for the seed. Fatty acid content revealed high amounts of unsaturated fatty acids (oleic, linoleic, DHA, DPA) 24%, 29%, 5%, and 2% respectively for pumpkin seeds; lower amounts were observed in the pumpkin flesh. Pumpkin products contain high amounts of β-carotene and unsaturated fatty acids, which have been shown to exhibits health promoting capabilities and risk reduction efficacy.

E21-002
Characterization and Functional Properties of Glandless Cotton Seed Meal
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Introduction:
Cottonseed meal contains about 22.5% protein, this represents about 9.4 million tons of protein human consumption, and such amount of protein could provide the daily human requirement of protein (50 g/day). New Mexico State University is utilizing a variety of cottonseed with low gossypol content, placing this variety as an alternative for the extraction of protein for human consumption. The aim of this investigation was to characterize and determine the functional properties of glandless cotton seed meal (GCSM).

Method:
SDS-PAGE, Isolecetric Focusing (IEF), was used to study proteins extracted with different solvents to determine their molecular weights and solubility. The effect of pH and temperature on protein extraction yield and purity was evaluated. Three different temperatures (55°C, 60°C, and 65°C) and three different pH values (4.5, 5.0, and 6.0) were evaluated.

Significance:
Glandless cottonseed meal would have potential applications in food industry for improving quality of foods and developing a new high protein content product.

Results:
The results showed a GCSM protein pl of 5.1. GCSM proteins are not soluble in water or ethanol. Two high molecular weight proteins (44-66 KDa), two medium molecular weight (20-29 KDa) which may have enzymatic activity and three low molecular weight proteins (14-20 KDa) were observed on salt and 0.1 N KOH soluble proteins. Protein extraction temperature showed an effect (p < 0.05) on protein yield. The highest (p < 0.05) protein yield was obtained at 60°C and a 5.0 pH, while yield decreased (p < 0.05) at 65°C. Lipid content in GCSM had an effect (p<0.05) on protein purity, the higher the lipid content in the GCSM, the lower protein purity. The best solvent for protein extraction was 0.1 N KOH. The adequate temperature for protein extraction and pH value for protein precipitation, were used to optimize the protein isolation.

E21-003
Fortification of Navy Bean Extract Decreases Fermentation Time and Enhances Overall Quality of Yogurt
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Introduction:
Fermented milk products such as yogurt are one of the most popular probiotics. They offer health benefits due to functional properties of active probiotic bacteria. Unfortunately, it is difficult to keep bacteria viable and at high concentration as they do not grow rapidly in milk. Pulses, including beans, pea, and lentils, are good sources of prebiotics with the potential to increase quality of yogurt and benefit health. The aim of this study is to evaluate the effect of navy bean extract on the fermentation time and overall quality of yogurt.

Method:
Navy bean extracts were prepared to isolate maximum amount of raffinose oligosaccharides from navy beans. The bean flour (10g) was mixed in 100ml of distilled water and incubated overnight at 70°C. This mixture was centrifuged at 1500 rpm for 15 mins followed by separation of supernatant. 2.5%-10% of navy bean extracts were fortified in 2% reduced fat milk, pasteurized at 90°C for 10 mins, cooled to about 42°C and then inoculated with yogurt culture (Danisco YO-MIX 883 LYO 500 DCU). The mixture was fermented for 4 – 8 hours at 42°C and final product was analyzed for pH, total soluble solids, titratable acidity, and viscosity.

Significance:
Mixtures with navy bean extract decreases fermentation time and provide better quality yogurt product. The concept of utilization of prebiotics from legumes may satisfy human food and fiber needs and finds its application in probiotic food industries.

Results:
The results demonstrated that yogurt samples fortified with bean extracts reached the desired pH (4.5) within 4-5 hours compared to milk that was not fortified. Total soluble solids in fortified yogurt showed an increase from 5.3 to 6.06 degree brix. Titratable acidity samples were increased from 0.275% (control) to 0.725% with increase in bean extract concentration after 8 hour of incubation. Viscosity of the samples were increased from 0.7 to 1.5 centipoise. The results demonstrated that yogurt samples fortified with bean extracts reached the desired pH (4.5) within 4-5 hours compared to milk that was not fortified. Total soluble solids in fortified yogurt showed an increase from 5.3 to 6.06 degree brix. Titratable acidity samples were increased from 0.275% (control) to 0.725% with increase in bean extract concentration after 8 hour of incubation. Viscosity of the samples were increased from 0.7 to 1.5 centipoise.

E21-004
Inhibitory Potential of Anthocyanins From Purple and Red Corn Extracts on Colorectal Cancer Proliferation
C. Mazewski, University of Illinois Urbana-Champaign, Email: cmazews2@illinois.edu

Introduction:
Fermented milk products such as yogurt are one of the most popular probiotics. They offer health benefits due to functional properties of active probiotic bacteria. Unfortunately, it is difficult to keep bacteria viable and at high concentration as they do not grow rapidly in milk. Pulses, including beans, pea, and lentils, are good sources of prebiotics with the potential to increase quality of yogurt and benefit health. The aim of this study is to evaluate the effect of navy bean extract on the fermentation time and overall quality of yogurt.

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Introduction: The objective was to evaluate the anti-proliferative effect of anthocyanins extracted from purple and red corn on HCT116 and HT-29 human colorectal cancer cells in comparison to oxaliplatin and to investigate the mechanism of action.

Method: The four extracts in this study included red corn acidified water extract (RAW), purple corn acidified water extract (PRAW), and purple corn with additional ethyl acetate purification (PPR), and yellow corn pure water extract (PW). Analyses were conducted in at least two independent replicates and statistical differences were determined by Tukey-Kramer analysis (p<0.05).

Significance: Anthocyanins, which can be utilized as natural pigments in food products, were shown to provide various health benefits.

Results: Total monomeric anthocyanin concentrations for the extracts were 56.2±13.3, 190±33, 217.5±6.3, and 48.7±3 mg cyanidin-3-glucoside equivalent per g extract, respectively. Cytotoxicity of PW was tested on normal colon cells and no significant inhibition was seen at 10 mg/mL. IC50 values for RAW, PRAW, and PW on HT-29 cells were 2.53±0.18, 3.42±0.10, 5.57±0.35, and 6.31±0.21 mg/mL, respectively. IC50 values for RAW, PRAW, and PW on HCT-116 cells were 1.09±0.05, 2.51±0.21, 2.28±0.14, and 3.33±0.04 mg/mL, respectively, suggesting corn anthocyanin extracts exhibited anti-proliferative effects on colon cancer cells. All extracts exhibited increased BAX/Bcl-2 ratio, which determined apoptotic potential of the cells. For RAW, PRAW, and PW, BAX/Bcl2 ratio increased 1.2, 0.6, and 1.0 fold, respectively. Cytochrome C expression, involved in apoptosis activation, for RAW, PRAW, and PW increased 15%, 4%, and 61%, respectively, in comparison to 49% for oxaliplatin. The effect of anthocyanin extracts to act as tyrosine kinase inhibitors (TKI) was assessed because TKI often play a role in preventing tumor angiogenesis and cell proliferation. Free energy for the binding of the main anthocyanins from corn, including cyanidin-3-O-glucoside (CG3), pelargonidin-3-O-glucoside (Pi3G), and pelargonidin-3-O-glucoside (Pi3G), to a tyrosine kinase receptor protein was predicted by docking experiments. Free energy for binding of CG3, Pi3G, and Pi4G were -6.33, -6.71, and -6.91 kcal/mol, respectively, indicating all anthocyanins present in the corn extracts have an affinity to inhibit tyrosine kinases. The results suggest that corn anthocyanin extracts may suppress colon-cancer cell proliferation by acting as tyrosine kinase inhibitors.

E21-005 Nutraceutical Properties, Including Antioxidant Capacity, of 'Wichita' Pecan Kernels Are Affected by Soil Zinc Fertilizer Application Y. Wang, New Mexico State University, Email: wyq1992@nmsu.edu

Introduction: Pecans possess the highest kernel antioxidant activity (AC) among the tree nuts. In the western US, where soils are typically alkaline and calcareous, require frequent zinc (Zn) fertilizer applications to maintain normal canopy growth and development as well as nut production. Our objective was to investigate the relationships between the antioxidant content in pecan kernels with tree zinc nutrition.

Method: Trees were fertilized with Zn EDTA at one of three seasonal rates: 4, 2, or 0 kg ha-1 Zn. Treatment plots each consisted of 12 ‘Wichita’ pecan trees arranged in a randomized complete block design with four blocks. Nuts were harvested from all trees within each plot and subsamples were collected and homogenized for analyses of kernel Zn, oil content, and total unsaturated fatty acids. FAMEs were quantified by GC-MS. Tocopherols were analyzed by HPLC. AC was evaluated by both DPPH and ORAC assays. FAMEs were quantified from hexane extracts. Pecans contain very high levels of total unsaturated fatty acids and MUFAs were predominant over PUFAs. Total gamma fatty acids and MUFAs were predominant over PUFAs in pecan nut samples. Total gamma tocopherol content for all pecan samples ranged from 96-146 μg γ-tocopherol ·g-1, gamma tocopherol content for all pecan samples ranged from 96-146 μg γ-tocopherol ·g-1.

Significance: In conclusion, soil application of Zn fertilizer may affect human health-promoting components, including lipid and ascorbic acids. Synthetic metal chelators (e.g. EDTA) are often commercially used to reduce such oxidative reactions and to extend shelf life. Due to the increasing consumer demand for clean label food products, we aimed to demonstrate an active packaging strategy to remove synthetic metal chelators from product formulation while maintaining the oxidative stability of the product.

Method: Metal chelator iminodiacetic acid (IDA) was immobilized onto polypropylene film by photografting a vinyl monomer with reactive chlorine species followed by chemical immobilization of IDA. The resulting PP-g-IDA film was subjected to metal chelation assays as well as analyses of the antioxidant efficacy in simulated food models. All analyses were conducted at a total of at least four measurements of quadruplicate samples.

Significance: This work demonstrates the potential application of active packaging material with surface immobilized IDA as an alternative for synthetic metal chelators for preserving nutritive values and extending shelf life of food products.

Results: PP-g-IDA demonstrated high metal chelating capacities of 138.1 ± 26 nmol/cm2 and 210.9 ± 28 nmol/cm2 for ferric and cupric ions, respectively, under acidic conditions (pH 3.0). Infrared and X-ray photoelectron spectroscopy analysis of the grafted ligand suggested potential formation of tridentate and bridging metal chelating complexes, indicating high ligand specificity for the trace transition metals. PP-g-IDA demonstrated outstanding antioxidant efficacy both by controlling lipid oxidation and inhibiting antioxidant degradation. In emulsified oil systems (pH 3.0, stored at 55°C), PP-g-IDA extended the lag phase of both lipid hydroperoxide and hexanal formation from 5 days (controls) to 25 days, and was as effective as EDTA. In ascorbic acid solutions (pH 3.0, stored at 37°C), PP-g-IDA extended the degradation half-life of ascorbic acid from 5 days (controls) to 14 days.

E22-002 Antioxidant Active Packaging Material With Surface Immobilized Iminodiacetic Acid Metal Chelating Ligands Z. Lin, University of Massachusetts-Amherst, Email: zhuangsheng@umass.edu

Introduction: Transition metals, especially iron and copper, induce oxidative reactions of many food components, including lipid and ascorbic acids. Synthetic metal chelators (e.g. EDTA) are often commercially used to reduce such oxidative reactions and to extend shelf life. Due to the increasing consumer demand for clean label food products, we aimed to demonstrate an active packaging strategy to remove synthetic metal chelators from product formulation while maintaining the oxidative stability of the product.

Method: Metal chelator iminodiacetic acid (IDA) was immobilized onto polypropylene film by photografting a vinyl monomer with reactive chlorine species followed by chemical immobilization of IDA. The resulting PP-g-IDA film was subjected to metal chelation assays as well as analyses of the antioxidant efficacy in simulated food models. All analyses were conducted at a total of at least four measurements of quadruplicate samples.

Significance: This work demonstrates the potential application of active packaging material with surface immobilized IDA as an alternative for synthetic metal chelators for preserving nutritive values and extending shelf life of food products.

Results: PP-g-IDA demonstrated high metal chelating capacities of 138.1 ± 26 nmol/cm2 and 210.9 ± 28 nmol/cm2 for ferric and cupric ions, respectively, under acidic conditions (pH 3.0). Infrared and X-ray photoelectron spectroscopy analysis of the grafted ligand suggested potential formation of tridentate and bridging metal chelating complexes, indicating high ligand specificity for the trace transition metals. PP-g-IDA demonstrated outstanding antioxidant efficacy both by controlling lipid oxidation and inhibiting antioxidant degradation. In emulsified oil systems (pH 3.0, stored at 55°C), PP-g-IDA extended the lag phase of both lipid hydroperoxide and hexanal formation from 5 days (controls) to 25 days, and was as effective as EDTA. In ascorbic acid solutions (pH 3.0, stored at 37°C), PP-g-IDA extended the degradation half-life of ascorbic acid from 5 days (controls) to 14 days.
weeks. Samples were stored in four packaging systems (polypropylene sacks (PS), four-layered high density polyethylene bags (HP), HP bags with oxygen absorber (HPO), and HP bags vacuumed (HPV)).

Significance: The results indicate the potential of removing oxygen from hermetic packaging, instead of the conventional polypropylene sacks, will help in suppressing aflatoxin production and quality deterioration. Also, partially roasted blanched peanuts showed a potential for reducing aflatoxin content and also maintaining quality.

Results: The results show that storage in the PS had a significantly (p < 0.05) higher aflatoxin production from the other three packaging systems, with mean values: 11.44, 6.02, 5.54, and 5.82 ppb for PS, HP, HPO, and HPV, respectively. Aflatoxin production was significantly higher in the inoculated raw peanuts, with mean values of 12.06 (RI), 6.99 (RC), 5.12 (IPR), and 4.52 ppb (IPRB). In terms of quality, the peroxide value for RC was significantly higher than that of the other treatments, with mean values of 16.62 (RI), 9.22 (RC), 10.6 (IPR), and 9.37 (IPRB) meq/kg. In addition, peroxide value for propylene sponges was significantly higher than HPV, HPO and HPV with mean values of 14.91 (PS), 10.57 (HP), 9.99 (HPO), and 10.4 (HPV).

E22-004 Preparation and Characterization of PLA/Starch/Nanocrystalline Cellulose Films for Biodegradable Food Packaging P. Manepalli, Kansas State University, Email: manepalli.ph@gmail.com

Introduction: Poor degradability of conventional plastics make them one of the worst pollution menaces in modern times. Polylactic acid (PLA) based packaging is biodegradable and has additional benefits due to its high strength and modulus. Despite the low cost, abundant availability, and fast biodegradability of starch, starch based films have poor mechanical and barrier properties. The problem was sought to be overcome by blending starch with PLA and nanofillers, such as nanocrystalline cellulose (NCC). A compatibilizer, methylene diphenyl diisocyanate (MDI), was also used to improve the poor interfacial adhesion between hydrophobic PLA and hydrophilic starch.

Method: Up to 40% starch was melt blended into PLA along with NCC (1%) and MDI (4%) before being pressed into 0.05 mm films. Mechanical, morphological and thermal properties were characterized using Instron, X-ray Diffraction (XRD), Transmission Electron Microscope (TEM), and Differential Scanning Calorimetry (DSC). Water Vapor Transmission rates (WVTR) and Oxygen Transmission rates (OTR) of the films were studied to evaluate the barrier properties.

Significance: This study suggested that a PLA/Starch/NCC nanocomposite can be used as a biodegradable food packaging film.

Results: XRD and TEM study showed that the nanofillers were dispersed uniformly in the polymer matrix. Enthalpy of crystallization (∆Hc) decreased from 23.15 J/g to 14 J/g with addition of starch to PLA, indicating that starch granules might restrict the molecular motion of PLA matrix which resulted in decreased crystallinity. NCC/MDI addition had no significant effect on crystallinity of PLA/CS blends. Tensile study indicated increase in tensile strength with addition of NCC/MDI to PLA/CS blends. However, tensile strength decreased with addition of starch to PLA. OTR and WVTR increased with addition of NCC/MDI to PLA/CS blends, but decreased with addition of starch to PLA.

E23-001 Comparing High Pressure, Ultrasonic, and Traditional Heating for Extraction of Flavonoids From <i>Ginkgo Biloba</i> Leaves C. Wang, National Taiwan University, Email: f93628210@ntu.edu.tw

Introduction: Ginkgo biloba is commonly used in medicine, health-care food, and cosmetics. Flavonoids are the main active constituents in Ginkgo biloba L., which have been suggested to be biologically active, being appreciated for their beneficial effects on health. This study used high-pressure treatment to enhance extraction yields of flavonoids and lactones form Ginkgo biloba leaves and compared the yields with those obtained by ultrasonic or traditional heating methods.

Method: The effects of the different treatments on cell morphology of leaves were observed by scanning electron microscopy (SEM). The optimum extraction conditions for flavonoids and lactones from Ginkgo biloba leaves were studied using different variables, such as high hydrostatic pressure (100–600 MPa), dwell time (1-10 min), and solid/liquid ratios (1:50, and 2 min), flavonoids (21.7 mg/g), which did not differ significantly from those in two other treatments—traditional heating extraction at 80°C for 12 h and ultrasonic extraction at 50 Hz and 250 W for 30 min. Using SEM, we found that the high pressure can cause various degrees of physical damage to Ginkgo biloba leaves, such as cell distortion and disruption, increasing the mass-transfer effectiveness of the solvent and solute.

E23-002 Effects of High Pressure Processing Pasteurization on Raw Sheep's Cheese Throughout Storage J. Saraiva, Universidade De Aveiro, Email: jorgesaraiva@ua.pt

Introduction: Serra da Estrela cheese (Serra cheese) is a popular Portuguese traditional cheese with Protected Designation of Origin, manufactured from raw sheep milk, salt, and cardoon flower extract. As with other cheeses made from raw milk, Serra cheese might have in its composition several microorganisms, some of which may cause spoilage or be of a pathogenic nature. This is a major obstacle to exportation of this type of products, due to strict legislation in several countries. High-pressure processing (HPP) is being increasingly applied for cold pasteurization considering its capability to process microbially-safe products, with further advantages for consumers and food processors over thermal processing. This work aimed to study the effect of HPP on Serra cheese after pressure processing and during prolonged refrigerated storage (180 days) on endogenous microflora, proteolysis indexes, sensorial characteristics, and physicochemical parameters.

Method: Cheeses with 45 days of ripening were HPP at 600 MPa/6 minutes (P1), 450 MPa/6 minutes (P2), and 450 MPa/9 minutes (P3) at 8°C. Unpasteurized cheeses were used as controls.

Significance: These results show potential to make sheep's cheese microbiologically safe with increased shelf-life and a proteolytic index similar to unpasteurized cheese.

Results: The results revealed about 4 Log reductions in samples P1 and about 2 Log reductions in samples P2 and P3 of Lactococci, Lactobacilli, Enterococci and total aerobic mesophilic microorganisms, after pressurization and during storage. Small differences in viable cell numbers were detected between samples P2 and P3. The more intense HPP (P1) showed to cause a greater impact on microflora's viability, than the increase in the time under pressure (by comparing P2 with P3 samples). In HPP samples, Enterobacteriaceae and Pseudomonas spp. counts showed >5 and >4 log cycle reductions, respectively, to numbers below detection limits. Small changes in physicochemical parameters (pH value, water activity, and titratable acidity) were observed between unpasteurized and HPP processed samples during the storage. The proteolytic indexes, ripening extension index, ripening depth index, and free amino acid index, were lower in P1 samples relative to the control, the indexes being closer to those of the control at 45 days of ripening.

E23-003 Functional, Rheological, and Structural Properties of High Pressure Treated Lentil Starch Dispersions J. Ahmed, Email: jahmed2k@yahoo.com

Introduction: Among pulses, lentils (Lens culinaris) have attracted significant attention for their excellent dietary source of phytochemicals which possessing high antioxidant capacities. Additionally, pulses contain significant amounts of resistant starch (RSII) with potential health benefits. Lentil starch (LS) is considered as one of the important ingredients in the food industry. High-pressure (HP) processing can be used to improve the functionality, and engineered food formulation by controlling pressure-temperature-time and starch concentration. Unfortunately, there is a dearth of information on changes to granule morphology, crystallinity, functionality, X-ray pattern, and particle size after HP treatment. The objective of this work was to examine the effects of HP treatment (400, 500, and 600 MPa for 10 min) on the functional, rheological, thermal, and structural properties of lentil starch, and compared with untreated starch.

Method: The pressure treatment of LS slurries was carried out using a laboratory-scale high-pressure equipment (Avure Technologies, USA). The structure of starch was characterized by scanning electron microscopy, laser diffraction particle size analyzer, and X-ray diffraction. Rheology and pasting properties were measured using a rheometer and viscomatograph, respectively.

Significance: This research will be beneficial to anyone looking to develop pressure-treated LS based food products with desirable functionality. The process could be extended by incorporating temperature to elucidate more structural modification.

Results: The native starch granules had large oval to spherical shapes as observed by SEM. The granules retained their shapes after a pressure treatment of 500 MPa, whereas, the surfaces of starch granule significantly altered after a pressure treatment of 600 MPa. HP treatment on lentil starch showed an insignificant increase in particle size. Both FTIR and
X-ray diffraction confirmed the shift of crystalline to amorphous structure of LS at 600 MPa. Additionally, the starch gelatinized completed at 600 MPa, as evidenced from DSC and rheometry. The mechanical rigidity, G' of HP-treated LS increased with the intensity of the pressure, and the starch dispersions exhibited predominantly solid-like (G'>G'') behavior in the studied frequency range. HP-treated LS showed a significant change in pasting parameters. The hot and cold paste viscosity dropped at 600 MPa, and the final viscosity reduced more than 50%.

E23-004
High Voltage Atmospheric Cold Plasma (HVACP) Hydrogenation of Soybean Oil Without Trans-Fatty Acids
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Introduction:
Traditionally produced partially hydrogenated oils (PHOs) are characterized by high content of trans-fatty acids. PHOs are associated with a high risk of cardiovascular diseases, and recently have been removed by FDA from the GRAS ingredient listing. PHOs have a much higher melting point than unhydrogenated oils and are preferred for many food applications. High Voltage Atmospheric Cold Plasma (HVACP) can generate high energy radicals without additional heating, high pressure, or a metal catalyst. This study examines the capacity of HVACP treatment using hydrogen gas with soybean oil to achieve hydrogenation without trans-fatty acids. The goal of this study is to evaluate whether HVACP treatment of soybean oil in a hydrogen environment can achieve triacylglyceride hydrogenation at room temperature and atmospheric pressure without a metal catalyst.

Method:
A volume of 10 ml of soybean oil was exposed to highly energized plasma species for a time period of 1, 2, 4, 6, and 12 h of treatment. Experiments were conducted in triplicate. Changes in the oil chemistry were monitored using iodine value (IV), fatty acid composition, and viscosity. Optical emission spectroscopy was used to determine the reactive gas species produced.

Significance:
HVACP treatment is an environmentally friendly process that has the potential to produce partially hydrogenated soybean oil without trans-fatty acids which may replace the traditional hydrogenation process. The advantages of this technology are low temperature, catalyst-free, and low energy process. This technology is relevant to long-term sustainability of U.S. agriculture and food systems by ensuring an adequate demand for U.S. soybeans.

Results:
HVACP treatment of soybean oil using 5% hydrogen-95% nitrogen gas blend reduced IV from 133 to 92 in a 12h treatment, similar to a commercial PHO. The saturated fatty acids increased from 20.7% to 22.3%, monounsaturated fatty acids increase from 21.6% to 26.2%, and polyunsaturated fatty acids decrease from 57.7% to 41.5%. No measurable trans- fatty acids were detected.

E23-005
Impact of High-Pressure Extraction Technology on Antioxidant Activity of Prickly Pear Peels
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Introduction:
Currently, the food industry generates substantial fruit waste materials, which are used to feed livestock or sent to sanitary landfills. However, prickly pear peel residues can be used in many food applications. High Voltage Atmospheric Cold Plasma (HVACP) can generate high energy radicals without additional heating, high pressure, or a metal catalyst. This study examines the capacity of HVACP treatment using hydrogen gas with prickly pear peel to achieve hydrogenation without trans-fatty acids. The goal of this study is to evaluate whether HVACP treatment of prickly pear peel in a hydrogen environment can achieve triacylglyceride hydrogenation at room temperature and atmospheric pressure without a metal catalyst.

Method:
A volume of 10 ml of prickly pear peel oil was exposed to highly energized plasma species for a time period of 1, 2, 4, 6, and 12 h of treatment. Experiments were conducted in triplicate. Changes in the oil chemistry were monitored using iodine value (IV), fatty acid composition, and viscosity. Optical emission spectroscopy was used to determine the reactive gas species produced.

Significance:
HVACP treatment is an environmentally friendly process that has the potential to produce partially hydrogenated prickly pear peel oil without trans-fatty acids which may replace the traditional hydrogenation process. The advantages of this technology are low temperature, catalyst-free, and low energy process. This technology is relevant to long-term sustainability of U.S. agriculture and food systems by ensuring an adequate demand for prickly pear peels.

Results:
HVACP treatment of prickly pear peel oil using 5% hydrogen-95% nitrogen gas blend reduced IV from 133 to 92 in a 12h treatment, similar to a commercial PHO. The saturated fatty acids increased from 20.7% to 22.3%, monounsaturated fatty acids increase from 21.6% to 26.2%, and polyunsaturated fatty acids decrease from 57.7% to 41.5%. No measurable trans- fatty acids were detected.

E24-001
Application of Microfiltration to Turkish White Cheese Manufacture
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Introduction:
Ultrafiltration (UF) and microfiltration (MF) are the major membrane processes employed in the cheese industry. These membrane filtration processes are used to produce cheese from milk retentates. UF has been applied to cheese production over the past 45 years, whereas MF is a more recent technology. UF and MF are the major membrane processes employed in the cheese industry in order to produce cheese from milk retentates. It is observed that UF has negative impacts on cheese quality due to the concentration of whey proteins in the ultrafiltered milk. However, fewer whey proteins are concentrated in microfiltered retentate due to the larger molecular weight cut off ranges of MF membranes. The aim of this study was to investigate the chemical composition of Turkish white cheese obtained from MF retentates of pasteurized milk.

Method:
For this purpose, polyethersulfone membrane (MP005) with a pore size of 0.05 μm was used. Microfiltration equipment used was a laboratory scale SEPA CF-II membrane test unit equipped with a flat plate. Concentration factors of 1.59, 1.71, 1.85, and 1.93 were achieved. White cheese was obtained from the retentate streams enriched upon microfiltration. Chemical compositions of the permeate and the retentate streams and white brined cheese were analyzed with respect to dry matter, protein, fat, and ash contents.

Significance:
MF technology is promising as an environmentally friendly technology to be used in cheese making, especially for low capacity local cheese making plants.

Results:
Concentration of the cheese milk using the MP005 membrane did not cause substantial differences in the composition of white brined cheese obtained from microfiltration retentates in comparison with the control. In addition, chemical compositions of all white brined cheese samples including the control were in accordance with values reported in the literature for white brined cheese. It was found that the concentration of cheese milk by using the MP005 membrane has a potential of decreasing the amount of cheese waste that needs to be processed and/or treated on site. Also, a decrease in the volume of the material to be processed to cheese is expected to decrease operating costs.

E24-002
Effect of Amylose Content on Branching Enzyme and Amylomaltase Chain Transfer
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Introduction:
Thermostable branching enzyme (BE, EC 2.4.1.18) from Rhodothermus obamensis in combination with amyloglucosidase (AM, EC 2.4.1.25) from Thermus thermophilus was used to modify starch structure exploring potentials to extensively increase the number of branch points in starch. The effect of amylose on enzyme catalysis was investigated using amylose-only barley starch (AO) and waxy maize starch (WX) in well-defined ratios.

Method:
All products were analyzed for amylopectin chain length distribution, α-1,6-glucosidic linkages content, molecular weight distribution, and digestibility by using rat intestinal α-glucosidases.

Significance:
The combination of BE-AM-BE with high AO provided somewhat more resistant α-glucan products as compared to BE alone. The combinatory enzyme catalysis provides a strategy to generate potential novel soluble _α-glucan_ ingredients with low dietary digestibility asset.

Results:
For each enzyme treatment series, increased AO content resulted in increased rate of α-1,6-glucosidic linkage formation but as an effect of the very low initial branching of the AO starch, the final content of α-1,6-glucosidic linkages slightly decreased with increasing AO content. However, a specific increase in short chains was produced at high AO levels. The molecular weight distribution showed a distinct decrease as compared with WX and AQ, indicating the presence of minor hydrolytic activity as well as cyclization of the substrate. For all samples, increased amylose as substrate showed decreased α- and β-amylolysis. Surprisingly, hydrolysis with rat intestinal α-glucosidases increased with increasing α-1,6-glucosidic linkage content and decreasing MW indicating that stearic hindrance towards the α-glucosidase was directed by the molecular size rather than the branching density of the glucan. Our data demonstrate that increased amylose content in the substrate starch efficiently produces more complex structure configuration and that amylose generates a higher MW and more resistant product than amylopectin.
E24-004

Use of Beef Collagen in Beef Hot Dogs

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Introduction:
The use of protein ingredients as a meat substitute in meat products is becoming increasingly popular due to its lower cost compared to meat ability to increase protein levels, improve product texture, increase cook yields, or enhance product flavor. Beef collagen (BC) is an allergen-free, functional protein ingredient which can replace some or all of the traditional binders and other Group 2 protein ingredients like mustard (declared an allergen in Europe and Canada) in meat products. BC can be used to replace starch to provide cost savings. The objective of this study was to evaluate quality characteristics of beef hot dogs by utilizing BC with or without mustard to maximize added water.

Method:
Three treatments of beef hot dogs were formulated: Control with 0.6% mustard (added water = 8.78), TRT 2: 0.6% mustard + 0.4% BC + 1.37% additional water (added water = 8.78), TRT 3: 1.01% BC + 2.83% additional water (added water = 10). Hot dogs were evaluated for cook yield by measuring difference in weight in before and after cooking. Texture profile analysis using a Texture Analyzer equipped with a 1/4” stainless steel probe on hot dogs warmed on a roller grill, interior color using a Hunterlab color reflectance meter and purge over 12 weeks of refrigerated storage. Three replications of statistical analysis were performed using ANOVA (P<0.05) with StatView for Windows.

Significance:
BC is a cost-effective, functional, allergen-free ingredient that can replace mustard or meat in beef hot dogs while improving yield and reducing purge. SRB is a cost-effective, functional, non-GMO, non-allergen, minimally-processed ingredient that can replace modified food starch (MFS) or meat while improving yield and reducing purge.

Results:
Cook yields were significantly (P<0.05) higher for TRT 2 and TRT 3 compared to control. The hardness, gumminess, and chewiness values were significantly (P<0.05) higher for TRT 2 and TRT 3 compared to control. The hardness, gumminess, and chewiness values were significantly (P<0.05) higher for TRT 2 and TRT 3 compared to control. Purge after week 2 and 4 was significantly (P<0.05%) lower for TRT 2 but not significantly (P>0.05) different for TRT 3 compared to control.

E24-005

Use of Stabilized Rice Bran as a Replacer of Modified Food Starch or Meat in Smoked Sausage

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Introduction:
Until recently, rice bran, a by-product of rice milling, was considered unfit for prolonged storage and consumption. Due to unique stabilizing technology that activates the enzyme lipase, rice bran is no longer viewed as waste material. Stabilized rice bran (SRB) is an allergen-free, functional ingredient which can replace some or all of the traditional binders and allergens in meat products. SRB can be used to replace lean meat to provide cost savings. SRB was USDA approved as “rice bran” in the binder/extend category for comminuted meat and poultry products where binders are permitted not exceed 3.5% of product formulation.

Method:
Four treatments of pork and turkey smoked sausage were formulated: Control: 1.9% MFS, TRT 2: 1.9% SRB replacing 1.9% MFS, TRT 3: 1.9% SRB replacing 1.6% MFS and 2% additional water used to replace 2% added water (SRB 72%) and rice bran (SRB 4% additional water used to replace pork 72s. Smoked sausages were evaluated for cook yield by measuring difference in weight before and after cooking, texture profile analysis using a Texture Analyzer equipped with a 1/4” diameter stainless steel probe, interior color using a Hunterlab color reflectance meter, and purge over 12 weeks of refrigerated storage on vacuum-packaged smoked sausages. Three replications of statistical analysis were performed using ANOVA (P<0.05) with StatView for Windows.

Significance:
SRB is a cost-effective, functional, non-GMO, non-allergen, minimally-processed ingredient that can replace MFS or meat while improving yield and reducing purge in smoked sausage products. SRB offers a more consumer-friendly, recognizable label ingredient that can replace MFS or meat while improving yield and reducing purge.

Results:
Cook yields were significantly (P<0.05) higher for TRT 2, TRT 3 and TRT 4 compared to control. The hardness, gumminess, and chewiness values were significantly (P<0.05) higher for TRT 2, but not significantly (P>0.05) different for TRT 3 and TRT 4 compared to control. Interior color was not significantly (P>0.05) different for any treatments compared to control. Purge was significantly (P<0.05%) lower for all treatments compared to control.

E25-001

First Assessment of Food Safety Practices in Select Food Service Providers in Qatar

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Introduction:
Qatar experienced fast economic growth, leading to increased population and a sharp rise in income levels and changes in food consumption habits, such as eating out frequently, fast food consumption, and home catering or delivery. Despite the increasing number and diversity of the food service industry, there is no food surveillance system in the country. Therefore, this study was carried out to investigate the level of food safety knowledge among food service providers (FSPs) in Doha, Qatar.

Method:
Face-to-face-interviews with managers at participating FSPs were conducted using a 40-question survey. The questions included the date of establishment, number of employees, training, knowledge of food hygiene and safety, etc. An audit checklist was also developed to find out if the FSPs implement principles of international food safety regulations and guidelines. The data was analyzed using chi-square test.

Significance:
This first assessment of FSPs’ food safety practices demonstrated that managers’ training, employee’s education level, and employees’ training are key important factors which directly impact the food safety in FSPs. These findings should help in identifying the need for on-site training of FSP employees for effective food safety practices in restaurants and school cafeterias in Qatar.

Results:
The results indicated that the average age of FSPs was 11 years, with the oldest and newest being established in 1982 and 2015, respectively. The average age of food safety managers interviewed was 33 (range: 26 to 60). The majority of managers were of Egyptian (22%) or Indian (18%) origin. Most managers (66%) had college degree and 68% of them were trained on HACCP. Surveys revealed that FSP managers’ training and education level highly influenced the probability of better food safety training of employees while managers with lower education level had no formal training on food safety for themselves or their employees. Casual sit-in and fine dining restaurants consistently kept records (100%), followed by fast food (36%), and catering establishments (14%). The latter had no records on cooking procedures, did not even own a thermometer on site, and had the lowest employee personal hygiene score.

E25-002

Industry's Perception of Economically Motivated Adulteration and Related Risk Factors

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Introduction:
The US has one of the safest food supplies in the world. Numerous safeguards in place protect our food supply, including federal regulations and the food and beverage industry’s dedication to food safety. One of the issues that the food and beverage industry continuously battle is the prevalence of Intentional Adulteration. The Food Modernization Act (FSMA) specifically addresses Intentional Adulteration and its sub-category of Economically Motivated Adulteration (EMA) by requiring all facilities that supply food to the US to assess the vulnerabilities within their operation to prevent acts on the food supply that could cause public harm. The purposes of this study were (1) to better understand industry’s perception of Economically Motivated Adulteration, (2) to assess how industry determines ingredients at risk for EMA, and (3) to examine the extent to which a tool that assesses ingredient vulnerability would be useful to industry.

Method:
This study surveyed individuals working for food and beverage companies in departments associated with the selection, purchase, or processing of ingredients. The survey consisted of 21 items that assessed how the participants’ company’s view of EMA was impacted by FSMA and their perception of ingredient safety as it relates to EMA. The survey was reviewed by an advisory group of industry decision makers and field tested with a similar population to ensure reliability and validity. The data was then analyzed for major themes.

Significance:
These results can be used to understand how FSMA is impacting food industry operations.

Results:
Results show 50% of participants describe their operation as “somewhat vulnerable”, whereas 50% say their operation is “Somewhat Secure” to “Very Secure.” 100% indicated they consider some ingredients to be higher risk for EMA. Participants named specific ingredients such as “Spices, fruit juices, and vanilla” or provided general descriptors like “Ingredients that are bought and stored in bulk, where a tiny amount of cheaper product/ingredient can potentially lead to a large difference in price.” Factors that impacted the perception of risk of EMA included “the originating location of the ingredient” (100%), “supplier reliability” (83%), “availability of identity tests” (83%), and “volume of ingredient” (67%).

E25-003

Influence of Various Soaking Treatments to Minimize the Residual Level of Endothall and Deltamethrin Pesticides in Spinach

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Introduction:
Agricultural crops retain toxic residues when treated with pesticides to enhance agronomic production and upon consumption may initiate serious health disorders. The...
current project was intended to check the effectiveness of different soaking solutions to eliminate residual pesticides in contaminated spinach (*Spinacia oleracea*). Moreover, the concentration of pesticides residues retained in dipping solutions was also determined.

**Method:**
Spinach samples were soaked in acetic acid, citric acid, and sodium chloride solutions with different concentrations and their efficiency in dissolution of pesticide residues was evaluated. Afterwards, samples were extracted and resultant supernatant was filtered through Whatman filter paper. Filterate was passed through column containing anhydrous sodium sulfate and activated carbon for color clean-up. Afterwards, eluents were evaporated by rotary evaporator up to 2 mL then dried under gentle nitrogen stream. Finally, the endosulfan and deltamethrin residues were determined from prepared samples through gas chromatography equipped with electron capture detector. The collected data was statistically analyzed through standard statistical procedures to determine the level of significance using completely randomized design and least significance difference test.

**Significance:**
The study concluded that dipping solutions can be effectively used to minimize the residual pesticides in spinach. Therefore, washing treatments were significant to address food safety issues induced by pesticide residues before consumption of vegetables.

**Results:**
Among all the soaking solutions, the efficiency of acetic acid solution (at 10%) in the dissipation of endosulfan and deltamethrin was highest. The efficiency of sodium chloride solution (at 10%) followed by citric acid 1.13±0.02 (80.88%) and sodium chloride 1.22±0.04 (79.48%) from spinach. However, percent reduction of deltamethrin residues were 0.23±0.03 (74.07%), 0.25±0.01 (71.85%) and 0.28±0.02 (68.89 %) by acetic acid, sodium chloride and citric acid solutions (p<0.10), respectively. In conclusion, the chemical reagents washing treatments can be used along with water to substantially minimize toxic residues.

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**E25-004**

**Microbial Safety and Overall Quality of Cantaloupe Fresh-Cut Pieces Prepared From Whole Cantaloupe After Wet Steam Treatment**

D. Uuku, FST-ERRC-ARS-USAID, Email: dilke.uuku@ars.usda.gov

**Introduction:**
Fresh-cut cantaloupe have been associated with outbreaks of *Salmonellosis* disease and the minimally processed fresh-cut fruits have a limited shelf life because of deterioration caused by spoilage microflora and physiological processes.

**Method:**
In this study, we evaluated the effect of minimal wet steam treatment in reducing microbial populations on cantaloupe rind surface designated for fresh-cut pieces processing. Whole cantaloupe rind surfaces were inoculated with *Salmonella, Escherichia coli* O157:H7 and *Listeria monocytogenes* at 4.5, 5.1 and 3.6 log CFU/cm², respectively and were stored at 5 and 22°C for 7 days before minimal wet steam treatment for 30 s, and of control pretreatments. Effica was minimal at 0.007 (6.63%) in steam treatment in reducing attached bacteria and minimizing transfer to fresh-cut pieces were investigated at day 0, 3, and 7 of storage. Changes in color (CIE L*, a*, and b*) of fresh-cut pieces due to treatments were measured before and immediately after treatments and during storage. Mean values of bacterial cell numbers on treated and untreated cantaloupe were compared to determine significant differences at (p<0.05) using the Bonferroni LSD method.

**Significance:**
Minimal wet steam treatment of cantaloupe rind surfaces designated for fresh-cut preparation will enhance the microbial safety of fresh-cut pieces, by reducing total bacterial populations and will drastically reduce the incidence of foodborne illness

**Results:**
There were no visual sign of any damage on all treated cantaloupe surfaces immediately after treatments and during storage. All inoculated bacterial pathogens on cantaloupe rind surfaces were negative in treated fresh-cut pieces even after enrichment process. Presence of yeast and mold was detected on the control fresh-cut pieces at day 3 of storage but not on fresh-cut pieces from treated whole melons. Changes in color determined between control and treated samples were insignificant, suggesting that steam treatment did not change the color of the fresh-cut pieces.

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**E25-005**

**Species Specific Detection of Adulteration Using High Resolution Melting Analysis**

J. Musetti, Dupont, Email: james.musetti@gmail.com

**Introduction:**
Economically motivated adulteration, a subset category of food fraud, was defined in 2009 by the FDA as the fraudulent, intentional substitution or addition of a substance in a product for the purpose of increasing the apparent value of the product or reducing the cost of its production, and can often encompass public safety effects through the unknown addition of allergens, toxins, and hygienic risks. According to the FDA database which tracks scholarly records of adulterated foods, dairy products are the second most reported category of adulterated food products. Water buffalo milk represents the second most produced milk worldwide and higher value dairy raw products make it subject to economically motivated adulteration by means of dilution with cow milk. It is of interest to consumers, manufacturers, and governing bodies to have a simple, fast, accurate, and sensitive method to detect adulteration by cow’s milk.

**Method:**
In this investigation a real-time PCR assay was developed to specifically detect and relatively quantify cow milk adulteration in water buffalo milk utilizing high resolution melting analysis. A duplex real-time PCR reaction was performed targeting mitochondrial DNA in both species of interest and the resulting amplified products were analyzed after a melt cycle was performed.

**Significance:**
Results of this study indicate the feasibility of real-time PCR and high resolution melting analysis in the detection of adulteration in dairy products with cow milk. This technology could be used to detect adulteration in a variety of foodstuffs.

**Results:**
Results of the statistical analysis of the standard curves created for duplex PCR assay presented a efficiency of 100.69 ± 1.01, and a slope of -3.31 ± 0.02 with 95% confidence (n = 18). This indicated that the assay was specific, efficient, and validated the use of real-time PCR for analysis. High resolution melting resolution analysis was used to determine a correlation between relative fluorescence at a predefined temperature and adulteration to relatively quantify adulteration. The result indicated a strong correlation, r²=0.997. The use of high resolution melting analysis allowed for the discrimination of dilution of water buffalo milk with cow milk down to 0.1%.

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**E26-001**

**Applications of Polysaccharide-Polypeptide Nanocomplexes as a Pickering Emulsion Stabilizer**

Y. Jiang, Rutgers University, Email: yike909@gmail.com

**Introduction:**
Polysaccharide-protein/polypeptide complexes have been widely applied in food science, nutraceutical, cosmetic, and pharmaceutical areas. An emerging application of the polysaccharide-protein/polypeptide complexes is stabilizing Pickering emulsions. Unlike the classic emulsions, which are emulsified by amphiphilic emulsifiers, Pickering emulsions are stabilized by solid particles, and therefore could avoid the potential adverse effects associated with these emulsifiers, such as irritancy. Until now, most of food grade Pickering stabilizers are proteins or polysaccharides. Less attention was paid to polysaccharide-protein/polypeptide complexes. Herein, we used our recently developed chitosan (CS)-caseinophosphopeptides (CPPs) nanocomplexes to stabilize a Pickering emulsion.

**Method:**
CS-CPPs nanocomplexes composed of different CS:CPPs ratios were prepared. Their particle sizes were characterized by dynamic light scattering. Their morphologies were monitored by atomic force microscope (AFM). Their surface hydrophobicities were determined by measuring their air-water contact angles. These nanocomplexes were then used to stabilize Pickering emulsions, and their ability as the Pickering stabilizers was compared in terms of concentration ranges that can form emulsions and the content of oil that can be stabilized. The stabilities of these Pickering emulsions were investigated at different pH (2-8) and ionic strength (0-0.3M NaCl). The rheological properties of these Pickering emulsions were also characterized.

**Significance:**
The present study provides a new perspective for application of polysaccharide-polypeptide complexes in food science. It also offers a method to utilize these nanocomplexes as a multi-platform nutraceutical encapsulation system, since nutraceuticals can be encapsulated in the nanocomplexes and/or in the oil phase.

**Results:**
We prepared 3 kinds of CS-CPPs nanocomplexes which have different CS:CPPs ratios. The particle size of these nanocomplexes increased with the content of chitosan, due to formation of aggregation, which was confirmed by the AFM images. The surface hydrophobicity of the nanocomplexes also increased with the content of chitosan, which was attributed to the hydrophilic nature of chitosan molecules. Pickering emulsions were formed with all 3 kinds of nanocomplexes. However, the ability of these nanocomplexes as Pickering stabilizer decreased when chitosan concentration increased. These emulsions showed good stability against ionic strength change, but low pH may affect their stability. These Pickering emulsions showed gel-like properties reflected by G’>G’’.

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**E26-002**

**Generation of Hyper-Antioxidative Curcumin Containing Nano-Vesicular Emulsion Systems**

Z. Haque, Mississippi State University, Email: zh5@msstate.edu

**Introduction:**
This study is intended to check the effectiveness of different soaking solutions to eliminate residual pesticides in contaminated spinach (*Spinacia oleracea*). Moreover, the concentration of pesticides residues retained in dipping solutions was also determined.

**Method:**
In this investigation a real-time PCR assay was developed to specifically detect and relatively quantify cow milk adulteration in water buffalo milk utilizing high resolution melting analysis. A duplex real-time PCR reaction was performed targeting mitochondrial DNA in both species of interest and the resulting amplified products were analyzed after a melt cycle was performed.

**Significance:**
Results of this study indicate the feasibility of real-time PCR and high resolution melting analysis in the detection of adulteration in dairy products with cow milk. This technology could be used to detect adulteration in a variety of foodstuffs.

**Results:**
Results of the statistical analysis of the standard curves created for duplex PCR assay presented a efficiency of 100.69 ± 1.01, and a slope of -3.31 ± 0.02 with 95% confidence (n = 18). This indicated that the assay was specific, efficient, and validated the use of real-time PCR for analysis. High resolution melting analysis was used to determine a correlation between relative fluorescence at a predefined temperature and adulteration to relatively quantify adulteration. The result indicated a strong correlation, r²=0.997. The use of high resolution melting analysis allowed for the discrimination of dilution of water buffalo milk with cow milk down to 0.1%.

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emulsifier, tween-20 (20% w/v of WPI) was secondary and the continuous phase was 10 mM phosphate buffer at a pH of 8.0. Nano-particulation was by single-pass Ultra-high Pressure Homogenization (UHPH) at 140 and 210 MPa at 25°C.

**Significance:**
The study shows how CU can be dramatically hyper-activated as antioxidant and made deliverable in the aqueous environment of food and nutraceutical systems.

**Results:**
The study revealed remarkable stability of the NVV. Curcumin (CU) (0.22%, w/v) was introduced into the NVV as cargo by dispersing with WPI in the continuous phase for three hours with gentle stirring. The coarse emulsion was subjected to UHPH at to generate the cargo loaded NVV. Physicochemical properties and antioxidative efficacy of the loaded NVV were analyzed and compared to WPI based NVV alone for 16 days of storage (4OC). At UHPH pressure of 210 MPa, CU-NVV exhibited significantly (P<0.05) reduced mean globular particle diameter (dvs) compared to NVV for the entire storage period, evident by a 28% reduction of dvs after 16 days. It also showed 3 and 13% increase in surface energy and zeta potential, respectively, relative to the NVV alone after that period of storage. Showing a change in the surface topography. The CU-NVV samples at both levels of UHPH pressure exhibited significantly (P>0.05) greater short and long-term antioxidative properties (antioxidant activity [AA] and persistence [AP], respectively, throughout the study, as determined from their efficacy to quench peroxyl and alkoy radicals in vitro. Even after 16 days of storage, the CU-NVV generated at 210 MPa showed 609 and 575% greater AA and AP, respectively, compared to the NVV. The CU-NVV also showed 7500 and 14134% augmentations in AA and AP, compared to the control (the buffer on its own) as well as 36 and 90% enhancements with respect to Trollox (standard antioxidant) after the storage period.

**E26-003**
**Oxidative Stability and Ferrous Sulfate Encapsulation Efficiency of Water-in-Oil Emulsions in the Presence of a Fat Crystal Network**
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**Introduction:**
Water-in-oil (W/O) emulsions are one of the most popular delivery systems for encapsulation, protection, and delivery of water-soluble bioactive compounds or nutrients into oil-based food products. The formation of a fat crystal network in the continuous oil phase is used to provide desirable texture and physical stability to W/O emulsions. However, there is currently a poor understanding of how fat crystal network impacts the oxidative stability and encapsulation efficiency of W/O emulsions. In the present work, the effect of fat crystal formation on the physical stability, oxidative stability, and encapsulation efficiency of W/O emulsions was investigated.

**Method:**
20 wt% W/O emulsions were prepared using 2 wt% polyglycerol polyricinoleate (PGPR) as an emulsifier. Rice bran oil in the presence and absence of 30 wt% rice bran stearin was used as the continuous oil phase. Ferrous sulfate (FeSO4) at different concentrations (0.1, 0.25, and 0.5 wt%) was added to the water phase as a model hydrophilic compound.

**Significance:**
The W/O emulsions created in the present work may be useful for the encapsulation and delivery of hydrophilic bioactive compounds in oil-based foods.

**Results:**
W/O emulsions in the presence of stearin had better stability and smaller mean droplet diameter (~250 nm) than those in its absence. The presence of rice bran stearin significantly improved oxidative stability of W/O emulsions with had lower hydroperoxide compare to the emulsions without rice bran stearin. However, the results were found that increasing in ferrous sulfate concentration in water dispersed phase led to decreasing in oxidative stability. Addition of rice bran stearin significantly improved the encapsulation efficiency of the W/O emulsions and delayed the release of ferrous sulfate from the inner water phase. Moreover, the encapsulation efficiency was also improved by increasing the ferrous sulfate concentration in the inner water phase. The effect of pH and ionic strength on the encapsulation efficiency of the W/O emulsion in the presence of rice bran stearin was also studied. Ionic strength was found to affect the encapsulation efficiency much more than pH.

**E26-004**
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**Introduction:**
Curcumin is known to exhibit remarkable antioxidant, antimicrobial, and anti-inflammatory efficacy, as well as protection against certain cancers. However, poor water solubility and bioavailability limit its applications as a nutraceutical component in food systems.

**Method:**
This study investigates the generation of bovine serum albumin (BSA) (0.25-2.0%, w/v) stabilized oil/water nanoemulsions at various (0.05-0.25) dispersed phase fractions (q) consisting of peanut oil, with the continuous phase being 10 mM phosphate buffer (pH 7.0). Intense energy-dependent disruption was applied by ultra-high pressure homogenization (UHPH) at 210 MPa to produce nano-vesicular vehicles (NVVs) for carrying the otherwise sparingly soluble curcumin as cargo within the hydrophobic milieu of the dispersed phase. Mean globule size (dvs), emulsifying activity index (EAI), emulsifying stability index (ESI), surface load (l) and zeta potential (l) of the NVVs were determined.

**Significance:**
These data provide useful information for stabilization and effective delivery curcumin in NVV systems for application in food systems and nutraceuticals.

**Results:**
At constant q, increasing BSA tended to increase ESI, decrease dvs, and EAI as a whole, while maintaining a constant BSA concentration, increasing q tended to decrease ESL, increase dvs and EAI. There was no significant difference (P>0.05) in zeta potential among all treatments indicating a consistent interface. Globular sizes and physical stability of emulsions depended on the combinations of BSA and q. At lower concentrations of BSA, the NVV showed large variation in dvs and indicating inherent instability. This was particularly true at 0.25% that gave the largest globules and greatest instability. Increasing the BSA concentrations to 1.5-2.0% resulted in decreased variations of dvs. Several NVV systems including 2.0% BSA with q 0.05-0.15 and 1.5% BSA with q 0.2 showed small globules (<120 nm), great stability and less surface load at the interface. Introduction of the cargo into the 2.0% BSA-stabilized NVV with q of 0.15 by dissolving curcumin in the dispersed phase at 100°C prior to UHPH resulted in increase in dvs to 150-160 nm and the C. Curcumin-loaded NVV showed enhanced stability with it being the best when pH was increased to 7.4 as reflected by consistent turbidity and zeta potential.

**E27-001**
**Comparative Study of the Stability of Purple and Red Corn Pigments Extracted by Different Methods in a Commercially-Available Beverage**
E. de Mejia, Univ of IL Urbana Champaign, Email: edemejian@illinois.edu

**Introduction:**
Lower stability of natural pigments during storage compared to synthetic dyes is one of the obstacles for their use by the food industry. The objective was to compare the stability of pigment extracts from purple and red corn using different extractions and purification methods.

**Method:**
Extracts were dissolved in commercially available colorless Kool-Aid Invisible (KAI) beverage stored for 12 weeks at 4°C and 22°C. Three independent replicates were conducted and differences determined by Tukey (p < 0.05).

**Significance:**
Pigments extracted from colored corn can be used as natural colorants in beverages.

**Results:**
Purple corn extracted with acidified water followed by resin-prepurification, with and without ethyl acetate extraction (PAWE and PAW), respectively, showed higher color and anthocyanin stability than purple corn extracted with only water followed by resin-prepurification (PW). Red corn acidified water extract (RAW) was more stable than purple corn counterpart PAW. However, total monomeric anthocyanins in PAWE and PAW were 217.5 and 190 mg C3G/g extract, respectively, almost four times as much as in RAW (56.2 mg C3G equivalent/g extract) (< 0.05). The order of anthocyanin stability was RAW> PAWE > PAW > PW, which was the same as the stability of color. Chroma of RAW, PAWE, PAW, and PW extracts stored for 12 weeks at 22°C in KAI decreased 33.8%, 35.2%, 48.5%, and 57.2%, respectively (p < 0.05). The first-order rate (week-1) for total anthocyanin decay of RAW, PAWE, PAW, and PW were 0.049 (R2=0.92), 0.069 (R2=0.92), 0.091 (R2=0.96), and 0.138 (R2=0.84), respectively. HPLC revealed that the concentration of predominant anthocyanins from purple corn extracts, including condensed forms, cyanidin-3-O-glucoside, and cyanidin-3-O-(6''-malonyl-glucoside) decreased significantly over time. Cyanidin-3-O-glucoside of RAW, PAWE, PAW, and PW extracts stored for 12 weeks at 22°C in KAI decreased 33.8%, 48.5%, and 57.2%, respectively (p < 0.05). The order of anthocyanin stability was RAW> PAWE > PAW > PW, which was the same as the stability of color. Chroma of RAW, PAWE, PAW, and PW extracts were 217.5 and 190 mg C3G/g extract, respectively, almost four times as much as in RAW (56.2 mg C3G equivalent/g extract) (< 0.05). The first-order rate (week-1) for total anthocyanin decay of RAW, PAWE, PAW, and PW were 0.049 (R2=0.92), 0.069 (R2=0.92), 0.091 (R2=0.96), and 0.138 (R2=0.84), respectively. Acylated forms from PW degraded faster than from PAWE and PAW. Principle component analysis indicated that clusters were affected by temperature, extraction method, and also by their combination. In conclusion, the results indicated that extraction with a weak acid followed by pre-purification with ethyl acetate effectively increased color stability. Red corn pigments were more stable than purple corn pigments over three months of storage.

**E27-003**
**Novel Glycerol Ethers Phospholipids Produced by Solid to Solid Transphosphatidylation in the Presence of a Food Grade Phospholipase**
C. Torres, UAM, Email: carlos.torres@uam.es

**Introduction:**
Enzymatic transphosphatidylations usually reported utilize a very low concentration of phospholipases and a large excess of one of the reactants. On the contrary, the in situ product removal described in this study and utilization of a green biphasic medium consisting of a buffer and an organic phase comprised of GRAS flavoring additives, increases the applicability of the process. Incorporation of glycerol ethers into the polar head of phospholipids in the presence of a food grade phospholipase D offers the possibility of obtaining new bioactive ingredients. These novel phospholipids can be also utilized as lipid vehicles, such as liposomes, with improved gastro-resistance and stability properties for the delivery of other bioactive ingredients.
Method:
Different organic phases (limonene, pinene, ethyl isovalerate, ethyl butyrate, hexanal, and ciclopentane) and one aqueous phase (0.1 M acetate buffer at pH=5.5) were studied. The relative proportion of organic and aqueous phases was also investigated. Different molar ratios alkylglycerol:phosphatidylcholine (10:1, 5:1, 2:1, 1:1, and 1:2) were evaluated. Addition of calcium chloride and the reaction temperature have been also adjusted in the enzymatic transphosphatidyltransferase. Finally, the percentage of phospholipase D and the molar concentration of the reactants were also optimized.

Results and Discussion:
The ratio transphosphatidyltransferase to hydrolysis was evaluated for each different reaction mixtures tested. In some cases, formation of phosphatiatic acid was higher than the apparition of the glyceryl ether phospholipid. In some other mixtures, transphosphatidyltransferase reaction was almost negligible. These biphasic mixtures were discarded. The best results (70% w/w of glyceryl ether phospholipid) were achieved utilizing 5% (w/v) of phospholipase D and limonene acetate buffer at a ratio 1/3 at an equivalent ratio of chromatographic peaks. The productivity of the process was then optimized up to 126 Mm and scaled-up to 50 grams of reaction mixture with similar results in terms of composition and yield.

E27-004
Phytochemical, Antibacterial, and Antifungal Properties of an Aquous Extract of <I>Eucalyptus Microcorys</I> Leaves
D. Bhuyan, University of Newcastle, Email: desghoji.bhuyan@uon.edu.au

Introduction:
Australia is home to about 800 different species of eucalyptus and traditionally, many eucalyptus species have been utilized to heal wounds and treat fungal infections by the indigenous people of Australia. Research has mostly been carried out on eucalyptus essential oils with less emphasis on crude aqueous extracts. Moreover, <i>Eucalyptus microcorys</i> is one of the least exploited species in terms of its chemical content and antimicrobial properties.

Method:
Our study was designed to investigate the phytochemical, antibacterial and antifungal properties of aqueous extracts of <i>E. microcorys</i> leaves. Freeze-dried powdered extract was prepared and the phytochemical profile was studied by analyzing the total phenolic content (TPC), total flavonoid content (TFC), proanthocyanidins, antioxidants, and saponins. ATR, DPH and CUPRAC assays were employed to determine the antioxidant properties of the extract. Antimicrobial activity was evaluated for activity against 3 pathogenic bacterial (<i>Escherichia coli</i>, <i>Enterobacter aerogenes</i>, and <i>Staphylococcus lugdunensis</i>) and 3 fungal strains (<i>Geotrichum candidum</i>, <i>Aspergillus niger</i> and <i>Candida albicans</i>), using the 96 well microtiter plate-based method with resazurin dye.

Results:
These results demonstrate the significant potential of <i>E. microcorys</i> as a source of phenolics, antioxidants, and antimicrobial agents, and also highlight the necessity of further purification and characterization of specific phytochemicals previously investigated in the food, nutraceutical, and pharmaceutical industries.

E28-002
Sensory Evaluation of Soymilk Produced From Lipoxygenase-Free Soybeans After Pulsed Light Treatment
A. Alhendi, University of Florida, Email: aalhendi@ufl.edu

Introduction:
Lipoxygenase (LOX) catalyzes polysaturated fatty acid (PUFA) peroxidation in soymilk, producing off-flavors. Inactivation of LOX in whole soybeans prior to soy milk production is a potential way to prevent off-flavors. It was found that pulsed light (PL) could completely inactivate lipoxygenase in whole soybeans. However, the soymilk produced showed poor quality in terms of total solids because of high temperature. In this study, several procedural modifications were made to reduce soybean temperature and increase total solid of soymilk while still inactivating LOX.

Method:
Soybeans were shaken or spun during PL treatment at a strobe distance of 7 cm, or soaked in water to 20%, 30%, 40%, and fully soaked overnight before PL treatment at a strobe distance 5 cm of food. The LOX activity was determined using a spectrophotometric method. Sample temperature was measured using an infrared thermometer right after PL treatment. Total solid content was measured by drying method. Soymilk was produced by the Cornell method with modification. Two taste panels were conducted.

Significance:
This study demonstrated that treating soybeans with PL has no negative effect in general, although PL appeared to lower soymilk’s total solids and sometimes improved the sensory properties of soymilk.

Results:
The total solid content of soymilk produced from PL-treated soybeans (7 cm and 110 s) was 3.7%, and the soybean kernel temperature was 117ºC. Spinning soybeans during PL treatment required 250 s at a 7 cm distance to produce 3.7% total solids. Shaking soybeans during PL treatment increased the total solid (4.5%) and reduced the temperature to 112ºC. Fully-soaked soybeans treated with PL appeared to lower the kernel temperature (77ºC) and increase soymilk total solid (4.6%), compared with the other soaking treatments. Therefore, treatments with shaking and full soaking of soybean were chosen for soymilk sensory evaluation. No significant differences existed between control (no PL treatment) and soymilk produced from fully soaked soybeans that were PL treated for 110 s, 130 s, and 150 s in terms of overall liking, flavor, consistency, and color. Shaking of soybeans during PL treatment for 130 s improved the overall liking and flavor of soymilk significantly compared with the control.

E28-004
Effect of Ambient Light Color Cues on Aroma Perception
S. Samant, University of Arkansas, Email: sssamant@email.uark.edu

Introduction:
Prior research has shown that food and beverage color cues influence orthonasal as well as retronasal aroma perceptions. Ambient color cues such as ambient lighting also have potential to modulate aroma perception, but have up to now not been examined well as retronasal aroma perceptions. Prior research has shown that food and beverage color cues influence orthonasal as well as retronasal aroma perceptions. Ambient color cues such as ambient lighting also have potential to modulate aroma perception, but have up to now not been examined well as retronasal aroma perceptions. Objective of this study was to compare orthonasally and retronasally perceived aroma from alternative pizza crusts and are willing to taste further retronasal cues are needed to address concerns over bitterness, beany taste, and other undesired attributes. Analysis of the data from this preliminary terminology development will aid in further standardizing the definitive sensory description of quinoa pizza crust. Development of a quinoa pizza crust in the US Food Industry will have major implications for individuals with gluten sensitivity.

Results:
Water activity of prebaked crust remained unchanged over 2 weeks (0.93) while it increased in baked crust (0.90-0.91). Texture (hardness) increased for both prebaked (120N-374N) and baked (210N-747N) crusts. pH also increased for both prebaked (6.07-6.25) and baked (6.12-6.21) samples. Subjects preferred control (39) and combination (21) samples compared to others. Subjects chose dark brown for every category of their preferred sample. Favorable samples were described as savory (27) and beany (15) for flavor, and chewy (42) and bread-like (13) for texture. Over half of the subjects (50.5%) were interested in purchasing the samples. Judges defined over 40 attributes to characterize the sensory properties of crust ingredients. Judges analyzed the crust based on 25 predetermined terms and expanded terminology for future analysis.

E29-003
Sensory Evaluation and Descriptive Analysis of Quinoa Pizza Crust
H. Reid, Alabama A&M University, Email: hma.reid@gmail.com

Introduction:
Quinoa seeds may be milled as a gluten-free flour for breads and other baked products. The objective was to determine the sensory characteristics of a quinoa pizza crust and develop terminology for descriptive analysis.

Method:
A 2-way shelf-life study of the physiochemical attributes of quinoa prebaked and baked crust was performed. Sensory (preference and descriptive) testing was also conducted. For sensory testing, 12 pizza crust formulations were developed; 1 whole wheat crust, and 3 treatment quinoa crust formulations with modified salt, sage nectar, and a combination of modified salt and sage. Ninety-nine subjects rated coded samples (extremely dislike - extremely like) on a 5-point hedonic scale. Subjects were asked to describe flavor, texture, and most preferred sample. A descriptive profile was determined by 11 judges on quinoa crust ingredients. Descriptive analysis was conducted by 9 judges on whole wheat and quinoa crusts based on an intensity scale (0=least intense, 15=most intense).

Results:
Subjects report that consumers may be interested in alternative pizza crusts and are willing to taste further retronasal cues are needed to address concerns over bitterness, beany taste, and other undesired attributes. Analysis of the data from this preliminary terminology development will aid in further standardizing the definitive sensory description of quinoa pizza crust. Development of a quinoa pizza crust in the US Food Industry will have major implications for individuals with gluten sensitivity.

Results:
Water activity of prebaked crust remained unchanged over 2 weeks (0.93) while it increased in baked crust (0.90-0.91). Texture (hardness) increased for both prebaked (120N-374N) and baked (210N-747N) crusts. pH also increased for both prebaked (6.07-6.25) and baked (6.12-6.21) samples. Subjects preferred control (39) and combination (21) samples compared to others. Subjects chose dark brown for every category of their preferred sample. Favorable samples were described as savory (27) and beany (15) for flavor, and chewy (42) and bread-like (13) for texture. Over half of the subjects (50.5%) were interested in purchasing the samples. Judges defined over 40 attributes to characterize the sensory properties of crust ingredients. Judges analyzed the crust based on 25 predetermined terms and expanded terminology for future analysis.

E29-004
Significance:
This study demonstrates that treating soybeans with PL has no negative effect in general, although PL appeared to lower soymilk’s total solids and sometimes improved the sensory properties of soymilk.
E28-005
Using X-Ray Tomography to Determine the Effect of Particle Size and Shape on Salt Dissolution and Salty Taste Perception in Reduced Sodium Crackers
J. Johnson, Cargill Inc, Email: janice.johnson@cargill.com

Introduction: Consumers’ demand for clean label further complicates food manufacturers’ ability to identify simple sodium reduction solutions. Leveraging salt physical properties may help reduce sodium while not impacting ingredient declaration or taste in some food applications. Specific salt particle size/shape have been shown to increase salty taste perception in topical applications. The sensory benefit is believed to disappear in food matrices containing water. This theory may hold for high moisture systems, however, water competition by other ingredients may limit complete salt dissolution in lower moisture systems.

Method: Challenging the salt “complete dissolution” theory, crackers were formulated using various salt sizes/shapes and weight. Particle size (PS) ranges were 75-150, 150-300, 300-840 and 210–595µ. Shapes were cubed (table), cubed agglomerate (CA) and pyramid (P). Control crackers were made with table salt (210-595µ). Test cracker formulas used differently sized/shaped salt at 40% less weight than the control. To determine effect of particle size/shape/weight on sensory, crackers were evaluated for Liking (Flavor, Texture, Overall and Aftertaste) and Just About Right (JAR) for Saltiness perception. A sample panel (n=96, SPSS statistics) X-ray tomography method was developed to identify densities of particles similar to salt in crackers. Blank cracker (no salt) was used to remove background noise to create particle size distribution.

Significance: Results suggest that crackers with different salt sizes/shape can provide similar taste to control at 40% less salt. Similar sensory results may be due to presence of undisolved salt with different size/shape in lower moisture systems.

E29-002
Association Between Acute Stress and Sweet Taste Perception of Nutritive and Non-Nutritive Sweeteners
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Introduction: Acute stress is the most common form of stress, generally experienced over a short period of time, and anxiety is one of the primary symptoms of acute stress. Stress in this form has potential to affect human taste perceptions, particularly those of sweetness. Most prior research in this regard has focused on association between acute stress and sweet taste intensity of sucrose, while research focusing on the effect of acute stress on sweet taste perception of non-nutritive sweeteners and how they compare in this regard to sucrose is still limited. This study aimed to compare taste perceptions of tea beverages sweetened with nutritive sweeteners (such as sucrose) and non-nutritive sweeteners (such as sucralose and stevia) as a function of acute stress.

Method: Thirty-five participants (12 men and 23 women; mean age: 45 years) rated sweetness intensity and overall desirability of beverages in the presence and absence of a stressor (a public speaking test). Participants were also asked to subjectively rate how calm and pleasant they felt both before and after drinking each beverage (i.e., beverage-induced calmness and pleasantness, respectively). Since the data was not normally distributed, Friedman and Wilcoxon signed-rank tests were used to compare different sweeteners.

Significance: Different sweeteners, depending on whether they are nutritive or non-nutritive, affect the emotional state of a person differently. Based on these findings, researchers and industry can optimize development of stress-busting foods by appreciating the fact that sweet taste function of a person is affected in the state of stress.

Results: Results showed that overall liking, but not sweetness intensity, of the tea was decreased by acute stress, particularly for sucrose (P = 0.04). Moreover, drinking tea sweetened with sucrose under stressful conditions induced calmness among participants compared to drinking unsweetened tea that resulted in inducing more stress (P < 0.001); non-nutritive sweeteners did not exhibit this behavior (P = 0.72 for sucralose and P = 0.36 for stevia). In conclusion, association of acute stress and emotional state of participants with sweet taste perception was found to be more pronounced in nutritive sweeteners such as sucrose compared to non-nutritive sweeteners.

E29-003
Factors to Consider When Conducting Consumer Research With Kids: Using Chocolate Flavored Milk in Mexico as a Case Study
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Introduction: Understanding the needs of consumers has never been a simple task and it is more challenging when you want to include the youngest consumers, who play an important part in the buying decision process within a family. Takasago was interested in capturing a better understanding consumer behaviors, preferences, and needs in the growing chocolate milk market for new and innovative flavors for milk chocolate products. We present a case study that was conducted in Mexico in which we tried to understand what kids perceive about different chocolate flavored milks and identify new product opportunities.

Method: Three-stage research was conducted with 40 kids age 10-12 years old in a primary school around Mexico City. First, we observed how they behaved during recess time (i.e., what they ate and how they talked). Next, we conducted a small workshop with a group of 8-10 children. During each workshop, we engaged kids with activities to understand their consumption habits and their preference on chocolate flavored milks. Then, we conducted individual interview to gain further insights and offer these different chocolate flavored milks to try to get their feedback.

Significance: This study highlights important factors when conducting research with kids. Building rapport and gaining their trust during study, along with making them feel comfortable, allows us to truly understand what is in kids’ minds.

Results: Results showed that generally kids enjoyed chocolate flavor milks that are creamy, strong chocolate flavor, sweet but not too sweet, with a balance between flavor and sweetness, and also with a good chocolate aroma intensity. We were able to gain more insightful information from this research, as compared to bringing kids to the research.
facility from the other studies, because kids could express themselves more when they felt comfortable in their own environment. Another important insight was that we need to gain their trust, which is essential during a small workshop, and we have to be creative in research activities (i.e., make them fun and interactive) in order to keep them engaged for the entire study.

E29-004
The Relationship of Heart Rate, Facial Temperature, and Facial Expressions on the Sensory and Emotional Acceptability of Visual and Chocolate Stimuli
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Introduction:
Traditional sensory evaluation relies on the use of questionnaires for assessing products’ attributes and acceptability. This requires rational reasoning, whereas consumers’ behavior might be more oriented to unconscious motivations. Inclusion of biometrics (heart-rate, facial temperature, and expressions) can contribute insight regarding consumers’ sensory/emotional behaviors. Moreover, cultural differences are key factors affecting consumers’ choices since these can affect food perception. We studied biometric, facial expression, and sensory responses of different visual and chocolate stimuli of two consumer groups (Asians and Westerns).

Method:
Panelists (N=59; 36-Asians/23-Westerns) evaluated 19 different stimuli [15 images (5-positive/5-neutral/5-negative) and 4 chocolate samples (milk/60%-cocoa/70%-cocoa/ candy-inclusions)]. Consumers assessed their feelings using a 3-point scale (1=negative-feelings; 0=neutral-feelings; +1=positive-feelings) and, for chocolates, their liking using a 9-point hedonic-scale. A novel app was used for capturing videos from panelists. Facial temperature (FT) was recorded using FLIR-One® infrared camera. Heart-rate (beats-per-minute=BPM) was assessed using customized algorithms from videos. Face expressions (FE) were assessed using the FaceReader-TM. Data were analysed (α=0.05) using MATLAB® and SAS®.

Significance:
This study demonstrated that FT and FE changed depending of the stimuli presented. Moreover, cultural differences existed whereas chocolate liking was rated lower by Asians than Westerners. There was an increase in surprised-FE when panelists evaluated chocolate samples compared to that of the evaluation of images. These findings will be useful to better understand consumer acceptance based on unconscious and emotional responses.

Results:
The stimuli type (images vs. chocolates) had a significant effect on FT and neutral, surprised and scared FE whereas the consumers group (Asians vs. Westerns) only had a significant effect on sad-FE. FT was lower when Asian consumers evaluated chocolates vs. images (22.53-22.68 vs. 23.15-23.91°C). BPM (52.07-65.44) was not different among stimuli. Consumers’ feelings (images=0.78 to 0.96 and chocolate=0.20 to 0.80) and liking (chocolate=4.8 to 7.20) were evaluated for both groups. Chocolate liking was rated lower by Asians than Westerns. FT was positively correlated with scared-FE, and negatively correlated with disgust-FE. BPM was positively correlated with positive feelings, higher arousal and neutral-FE, and negatively correlated with angry-FE and disgusted-FE. For both groups, neutral-FE increased with positive images, surprised-FE increased with chocolate samples, and scared-FE increased with negative images.

E29-005
What Drives Teens to Consume Fruits and Vegetables?
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Introduction:
The strong link between diet and health puts a spotlight on lifestyles and foods that support health beyond providing basic nutrition. Obesity is a probable “killer disease” for America’s teens. It is important for teens to reduce intake of energy-dense, low-nutrient foods to achieve and maintain healthy body weight. One way to do this is to encourage intake of fruits and vegetables among teens. This study aims to (1) examine adolescents’ attitudes towards intake of fruits and vegetables, and (2) provide insight on demographic-related behaviors towards nutritional lifestyles. Weight management initiatives often focus on geographic areas where food insecurity is prevalent.

Method:
Convenience sampling was used to select 65 teens aged 11-18 years from low income households at Boys and Girls Clubs in Southwest Missouri. Smoothie and salsa mini-workshops were organized for the teens where they were taught some helpful tips for preparing healthful dishes. The teens completed questionnaire to identify what they consider healthy eating behaviors.

Significance:
Findings of this study will promote life-long consumption of fruits and vegetables among teens. It provides a road-map for healthful eating lifestyle among adolescents.

Results:
Data show that 75% adolescents will increase intake of raw fruits and vegetables if dip and sauce are provided. Peers/friends and parent influence on food selection was high at 77% and 67%, respectively. Preference for cooked and raw vegetables was 38% and 42%, respectively. Teens are willing to try new fruits and vegetables while most noted that friends influence their food selection decisions. A 58% awareness of MyPlate by teens underscores the importance of provision of nutrition education in this target group.

E30-001
Development of a Surface Plasmon Resonance (SPR) Based Biosensor for the Rapid Detection of Methicillin-Resistant S. Aureus (MRSA)
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Introduction:
Methicillin resistant S.aureus (MRSA) is an important antibiotic resistant human pathogen which may result in life-threatening bloodstream infections, surgical site infections, and pneumonia. Standard methods used for antimicrobial sensitivity testing (disk diffusion, minimum inhibitory concentration (MICs), etc.) of MRSA are based on the incubation of antibiotics with the microorganisms, which results in one day or longer incubation time. In this study, we developed a SPR-based biosensor device for the rapid detection and differentiation of MRSA and methicillin-susceptible S. aureus (MSSA) strains.

Method:
A 50 nm gold thin layer was coated on a glass using a sputtering machine. Before using the SPR system, gold coated chips were cleaned in piranha solution, which was freshly prepared and dried in a nitrogen flow. The ploy-L-lysine (200µg/ml) was pre-coated on gold thin film. After chips were fixed up on the SPR system, deionized water was syringed into the cell chamber for 30 min so as to avoid bubbles via a syringe pump. MRSA and MSSA strains were incubated in Brain Heart Infusion (BHI) broth for 18 hrs at 37°C. The strains were injected into SPRs microfluidic cell chamber for 45 minutes in order to immobilize microorganisms to the surface of gold chips and the response in the SPR angle shift was recorded in real-time. Unbound microorganisms on the surface modified gold chip were washed for 30 min with deionized water. Then, penicillin solution with a concentration of 5µg/ml was injected into the cell chamber: 5 different strains from each MRSA and MSSA were examined.

Significance:
Our study shows that the our SPR system is an effective tool to differentiate antibiotic susceptible and resistant strains in several hours and has the potential application to determine many antibiotic resistant foodborne pathogens.

Results:
Our experiment demonstrates that after 30 min application of penicillin, the angle shift of susceptible and resistant strains were determined as an average of -0.00396 and -0.00052, respectively. The results reveal that there is about 10 times difference between the susceptible and resistant strains of S. aureus.

E30-004
Platform Chemicals via Fermentation: Efficient 2,3-Butanediol Production From Renewable Xylose and Glucose Streams
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Introduction:
2,3-butanediol (BD) is a promising platform chemical with enormous industrial applications in food, fuel, chemicals, pharmaceuticals, and polymers. The production of 2,3-butanediol via microbial bioprocessing from resources such as plant-based biomass holds much promise for renewable BD. One of the challenges with utilizing biomass feedstocks is the efficient utilization of hemicellulose-derived monosaccharides, including xylose. Development of improved microbial bioprocessing technologies to produce BD from biomass holds opportunity to improve the feasibility of BD. In addition, high final titer and use of non-pathogenic microbial culture are critical for sustainable BD production via microbial route.

Method:
In our study, a non-pathogenic bacterium, Bacillus licheniformis DSM 8785, was employed for BD fermentation, and compared with Klebsiella oxytoca ATCC 8724; K. oxytoca are reported as the most robust BD producers, but not desirable for bulk chemical production due to its pathogenicity. We also carried out fed-batch process to produce high BD titer in the fermentation broth.

Significance:
This study determined that efficient BD production is possible using a non-pathogenic organism from single sugar medium; an appropriate biomass processing technology should be developed to obtain separate glucose and xylose streams from lignocellulosic biomass for better BD fermentation performance.

Results:
The results showed that B. licheniformis utilized both glucose and xylose; decreased fermentation performance resulted in a mixed sugar medium. BD productivity in glucose, xylose, and mixed sugar (glucose:xylose = 2:1) medium was 2.23, 1.58, and 0.91 gL-1h-1, respectively. BD fermentation using sorghum stalks hydrolyzate with 4% (w/v) total sugar was as efficient as synthetic sugars; poor xylose consumption was observed using hydrolyzates with 8% sugar concentration. A high BD titer (115 g/L) was obtained from fed-batch fermentation using glucose medium after four feedings, but the BD productivity gradually decreased as the fed-batch proceeded. As compared to K. oxytoca, the B. licheniformis culture had 2.2 and 2.5 times greater BD productivity using glucose and xylose medium, respectively, but was less efficient in biomass hydrolyzate with 8% sugars.
P01-001
Relationship Among Texture, Protein Solubility, and Moisture Content of Pacific Whiting (Merluccius Productus) Injected Fillets
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Introduction:
Pacific whiting (Merluccius productus) is one of the Pacific Northwest’s most valuable species. However, these fish produces a poor quality cooked fillet due to proteases that exhibit high activity during cooking. Brine injection technology is being investigated for its ability to deliver a protease inhibitor to counter protease activity. Previous studies with frozen Alaska pollock showed that white demerit bands (WD) were able to decrease protease activity in the raw fillet. The purpose of this study was to determine whether reductions in protease activity in the raw fillet would translate to improved cooked fillet texture.

Method:
Pacific whiting fillets were injected with brine containing different concentration (1, 2, or 3%) of dried egg white (EW) or dried potato extract (PE). Fillets were either heat treated at 90°C or they were incubated at 60°C and then heat treated at 90°C. Cooked fillets were evaluated for moisture content, total extractable protein (TEP), texture profile analysis (TPA), and SDS-PAGE analysis. Two way analysis of variance were used in this study to understand the effects of each factors (brine ingredients and heating conditions). Additional Pearson correlation analysis was utilized to determine the relationship between TPA attributes to TEP and moisture content.

Significance:
Potato extract, due to its low cost, might be a competitive substitute for egg white as protease inhibitor.

Results:
TEP was minimized with either 2% EW or 2% PE, suggesting better protein-protein gel networking during cook. For fillets cooked at 90°C, results suggest 2% EW or 3% PE resulted in better performing cooked fillets. Correlations analysis showed that cohesiveness and chewiness attributes have a significant negative correlation to moisture content while chewiness has a significant positive correlation to TEP. Overall, there was a significant difference in texture attributes value for fillets which were incubated at 60°C prior to cooking at 90°C (P<0.05). The electrophotometric pattern of samples revealed the highest molecular weight bands disappeared when fillets were incubated at the optimum temperature for cathepsin L (60°C) prior to cooking at the 90°C. Myosin bands, however, were present in all treatments heat treated at 90°C, except the fillets injected with water.

P01-002
Kinetics of Quality Changes of Shrimp (Liptopenaeus Setiferus) During Pasteurization
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Introduction:
As a popular seafood, shrimp is cultivated and consumed worldwide due to its unique flavorful high nutrition content and low calories. Many processing technologies have been conducted to guarantee the safety of shrimp products for consuming. Pasteurization as one of the most popular technologies can better maintain the quality of shrimp attributable to its relatively low processing temperature. However, there is no systematic research for evaluating the corresponding quality changes of different pasteurization conditions.

Method:
In this study, the whole shrimp (Liptopenaeus setiferus) were heated in sealed aluminum cells with water bath, the effects of pasteurization temperatures (65 to 90°C) and time (1 to 63 minutes) on its various quality attributes were investigated: Cook loss and water holding capacity, color changes (ΔE), area shrinkage and compression force were tested by analytical balance, computer version system, Image J, and Texture Analyser TA-XT2 respectively.

Significance:
The kinetic models obtained in this study can be applied into understanding and predicting the shrimp quality changes during pasteurization processes, and so further provided instruction on the pasteurization conditions to achieve safety of shrimp with less compromising on its quality.

Results:
The results indicated that with increasing pasteurization time and temperature, color changes and compression force increased and followed zero-order kinetic model; cook loss and area shrinkage increased and followed first-order kinetic model. The activation energy ( Ea) for cook loss, color, area shrinkage, and compression force were 61.9, 77.6, 31.1, and 57.0 kJ/mol, respectively. The correlations among cook loss, area shrinkage and compression force were analyzed by SAS and found high positive correlations with correlation coefficient range from 0.92-0.99. In terms of the other parameters, water holding capacity (WHC) increased from 65-80°C and decreased from 80-90°C, which indicated that an appropriate processing time with temperature at 80°C can keep high WHC.

P01-003
Performances of Cold-Set Binders, Food Hydrocolloids, and Commercial Meat Binder on the Physical and Chemical Characteristics of Tilapia Fish Balls
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Introduction:
Plasma powder FG and plasma powder FGH + Activa RM, a sodium alginate system, carrageenan, methylcellulose, commercial meat binder, and cornstarch were compared in preparation of Tilapia fish balls. The purpose of this study is to ascertain how meat binders affect the characteristics of fish balls.

Method:
The following parameters were measured: raw and cooked pH values, moisture, punctures values, Texture Profile Analysis (TPA), water activities (Aw), meat colors at different storage times, cooking yields, and cooked water holding capacity.

Significance:
These results provide a good reference for fish industries for new types of restructured fish products. These results provide a good reference for fish industries practical application for new types of restructured fish products. The results can help processors to manipulate various cuts of fish meat into affordable innovative protein options for consumers. More studies should be performed to determine the performance of combinations of meat binders for different fish products.

Results:
The results showed that the L* (Lightness), a* (Redness), b* (Yellowness) values of raw treatments decreased as storage time increased under refrigeration conditions, when compared values on day 0, day 1, day 3, and day 5. No significant color changes were found for L*, a* and b* values for cooked fish when compared with values on day 0 and day 5. Except for methylcellulose treatments, the cooking yield for other treatments was higher than control treatments (without binder). The pH of sodium alginate system showed the lowest values for both raw and cooked treatment. The control raw treatment showed higher Aw value compared with all other treatments, no significant differences were found for all cooked Aw. The TPA results showed that methylcellulose-cooked treatment showed the lowest hardness, adhesiveness, springiness, cohesiveness, gumminess, and chewiness. The raw methylcellulose treatment showed the lowest hardness and gumminess and the highest cohesiveness. The Activa RM raw treatment showed the highest hardness and lowest cohesiveness when compared with other treatments.

P01-004
Physicochemical Properties of At-Sea Frozen Alaska Pollock as Affected by Various Postharvest Conditions
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Introduction:
Alaska pollock fillets often demonstrate tough texture when stored frozen for extended time due to the function of formaldehyde (FA), which is a product of endogenous trimethylamine-N-oxide demethylase (TMAOase). Texture toughening is a result of protein denaturation followed by aggregation (cross-links). TMAOase, however, may behave differently under refrigerated or frozen storage.

Our objective was to investigate the physicochemical properties of Alaska pollock fillets subjected to freezing/thawing (F/T) as affected by pre-filletting storage conditions.

Method:
Alaska pollock, which were frozen at sea 2h after harvest in the Bering Sea, were airfreighted to the OSU Seafood Laboratory. Frozen samples were thawed in cold room (4-5°C) for 24 h and then, half of the thawed fish was headed/gutted (H&G) and treated as H&G while the other half was considered whole fish (WF). Both WF and H&G fish (HF) were stored in a refrigerator (<4°C) for 0, 4, 8, and 12 h, filleted, and subsequently frozen at -18°C. The fillets were subjected to F/T (0, 3, 6, and 12 cycles). All preparation and analysis activities were conducted in a cold room (4-5°C) or with samples kept in ice.

Significance:
H&G processing before chilled storage did not appear beneficial to maintain the highest quality of frozen fillets when freezing storage was abusive (temperature fluctuation). Additionally, HF treatment was more sensitive to refrigerated storage time for the quality of frozen fillet.

Results:
TMAOase activity and FA in HF at 12-F/T significantly decreased as refrigeration time before filleting increased. Significant increases at 6-F/T and decreases at 12-F/T in surface hydrophobicity were thought to result from protein denaturation and cross-linking, respectively. FA induced textural toughening was the highest after 12-F/T for HF samples. Shear force of HF4h, HF8h and HF12h increased by 22%, 30%, and 36% at 12-F/T compared to that at 0-F/T, respectively. A marked decrease in FA at 12-F/T in HF samples as refrigeration time increased was noted. FA was likely released in drip along with other solutes due to ice crystallization damage to cell membrane. Easy release of TMAOase caused by exposure of muscle tissue to ice crystals during severe F/T damaged HF muscle tissue more than WF.
Physicochemical Characterizations of Tilapia Fish Protein Isolate Under Various Comminution
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Introduction:
Understanding the factors affecting gelation is a way to improve the textural properties of fish protein products. Structural changes occurring during comminution and cooking of fish protein isolate (FPI) and surimi are different because refining methods are chemically opposed with regards to protein denaturation. FPI is refined through chemical denaturation while surimi protein is concentrated by avoiding protein denaturation. The two most important variables influencing protein quality are temperature and time. However, little information exists on cooking parameters of FPI, and there is no comparative study between FPI and surimi. Understanding the thermal stability of fish protein prepared differently would lead us to utilize the fish more effectively.

The objective of this study was to elucidate the gelling capability of FPI and surimi made from tropical fish tilapia as affected by cooking temperature and time.

Method:
Fresh tilapia (900 – 1400 g), which were raised in water at nearly 25°C, like tropical fish, were obtained from a farm in Eugene, OR. Fish were transported to the OSU Seafood Lab (Astoria, OR) and processed into FPI and surimi, respectively. Then, FPI and surimi paste samples were prepared at 79% moisture with sodium chloride (0 and 3%). The samples pastes were subjected to biochemical and rheological analyses. Surface hydrophobicity, surface reactive sulfhydryl content, and temperature sweep using a Bohlin CVO rheometer were measured. In addition, the sample pastes were cooked at 90°C for 30 min in a water bath. Fracture gel evaluation and color analysis were conducted on the cooked gels.

Significance:
Controlling cooking temperature and time may be a significant factor to enhance production of quality gel in FPI and surimi. Under optimized cooking conditions, cooked gel from FPI and surimi were comparable.

Results:
Results indicated both FPI and surimi prepared from tilapia chopped at 25°C for 18 min provided higher breaking force and penetration distance compared to cooking at 5°C for 6 min. However, FPI was more sensitive than surimi to differences in cooking time and temperature. Higher cooking temperature also improved color and surimi showed slightly higher whiteness than FPI. Addition of salt improved the gel-forming ability of FPI and surimi.

Micro-Emulsification/Encapsulation of Krill Oil by Coacervation With Krill Protein Isolated With Isoelectric Solubilization/Precipitation
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Introduction:
Krill oil has recently received much attention. However, it easily oxidizes. Krill oil contains long-chain-polyunsaturated-fatty-acids (LC-PUFAs) esterified in phospholipids (PLs). PLs are amphiphilic and can spontaneously form emulsions in aqueous solutions, particularly containing proteins. Isoelectric solubilization/precipitation (ISP) has been applied at a lab-scale to obtain krill protein isolates. Krill protein isolates may protect krill oil from oxidation in protein-oil micro-emulsion systems.

The overall objective was to determine feasibility to form krill protein-oil micro-emulsion and to characterize its properties. Specific objectives were to determine (1) composition, (2) surface morphology, (3) emulsification payload/yield, (4) lipid classes and fatty acid profile, and (5) lipid oxidation.

Method:
Krill protein was isolated using ISP at pH 11.0 and 5.0 for protein solubilization and precipitation, respectively. ISP yielded krill protein isolate with 91.5% moisture. The isolate pH was adjusted to 7.0. NaCl and transglutaminase were added at 2% and 0.5%, respectively. Five 100-gm batches of krill protein isolate were uniformly mixed with 0, 20, 40, 60, and 80 grams of commercially available krill oil to form micro-emulsion, followed by freeze-drying. The composition, surface morphology, lipid classes, fatty acid profile, and lipid oxidation were determined with proximate analysis, SEM, TLC, GC, and TBars, respectively. The emulsification payload and yield were also determined. Experiments were statistically analyzed.

Significance:
This study demonstrates that krill protein-oil micro-emulsion forms readily.

Results:
Even without added krill oil, krill protein isolate contained almost 20% of lipids (dry basis), indicating that ISP did not separate krill oil from protein. This demonstrates emulsification properties of krill protein-oil. Although the payload increased when krill oil was incrementally added to krill protein isolate, the emulsification yield decreased indicating that krill protein and oil were not efficiently forming micro-emulsion. Surface morphology revealed that clusters and not individual droplets of krill oil were enveloped by a film of krill protein. The main lipid class in micro-emulsions was PLs.

Eicosapentaenoic FA was approximately twice as high as docosahexaenoic FA. Lipids oxidation was slightly reduced with higher addition of krill oil. However, the suitability of TBARS, specifically for krill oil, has recently been questioned.

Evaluation of Propidium Monazide and Porcine Gastric Mucin as a Means to Quantify Infectious Human Norovirus GI.1 and GI.4 Strains for High Hydrostatic Pressure and Heat Treatments
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Introduction:
Human norovirus (HuNoV) is the most common cause of foodborne illness outbreaks in the US. Due to the lack of in vitro cell culture system or small animal model, researches on HuNoV usually relies on surrogates and molecular bio techniques. RT-qPCR could be used for HuNoV quantification, but it could not distinguish infectious virus particles from non-infectious particles. Propidium monazide (PM) is able to penetrate dead or damaged cells and block RNA amplification with the photo-induced azide group. Porcine gastric mucin (PGM) can acts like a receptor for HuNoV and potentially separate infectious norovirus particles from non-infectious ones.

Method:
In this study, PMA and PGM were first evaluated as a means to quantify infectious virus particles using Tulane virus (TV), a HuNoV surrogate, since it is cultivable.

Significance:
These results demonstrated that the PMA/RT-qPCR assay was probably the method of choice in estimating the inactivation of HuNoV for heat and HHP treatments, but very likely it would result in underestimation of HuNoV inactivation.

Results:
A 2-min heat treatment of TV at 80°C resulted in 4.9, 2.6 and 2.2 log reduction estimated using plaque assay, qRT-PCR, PMA/RT-qPCR and PGM/RT-qPCR, respectively. A 2-min high hydrostatic pressure (HHP) treatment of TV at 300 MPa and 21°C resulted in 3.4, 1.1, 2.2 and 2.2 log reduction using plaque assay, qRT-PCR, PMA/RT-qPCR and PGM/RT-qPCR, respectively. The results demonstrated that the PMA/RT-qPCR and PGM/RT-qPCR assays are better in estimating the inactivation of TV than the qRT-PCR assay, but still underestimated TV inactivation. The molecular techniques were further tested on HuNoV. A 2-min heat treatment at 90°C resulted in 0.5 and 2.2 log reduction of HuNoV GI.1 using qRT-PCR, PMA/RT-qPCR and PGM/RT-qPCR, respectively and 2.9, 3.1 and > 4.9 log reduction of HuNoV GI.4 using qRT-PCR, PMA/RT-qPCR and PGM/RT-qPCR, respectively. A 2-min HHP treatment of HuNoV GI.1 at 550 MPa and 21°C resulted in 1.7, > 3 and 3 log reduction using qRT-PCR, PMA/RT-qPCR and PGM/RT-qPCR, respectively. A 2-min HHP treatment of HuNoV GI.4 at 400 MPa and 21°C resulted in 0.7, 3.2 and 3.7 log reduction using qRT-PCR, PMA/RT-qPCR and PGM/RT-qPCR, respectively.

Encapsulation of Crude Laccase From Coriolus Hirsutus In Alginate and Alginate-Silica Matrices
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Laccase are multicopper oxidases that catalyze the oxidation of a wide range of aromatic and non-aromatic compounds. The broad substrate specificity of laccase has gained increasing attention making it an attractive choice for various industrial applications, including the food industry. Laccase could be used for the improvement of food quality, functionality and productivity while being a low cost mild technology. However, large scale use of the enzyme stresses a need for the development of economical enzyme production processes and immobilization methods. This research work aimed to study the encapsulation of crude laccase obtained from Coriolus hirsutus in alginate and alginate-silica matrices.

Method:
The effect of both matrices was assessed in terms of the enzyme residual activity, immobilization yield, reusability and protein leakage. The encapsulation of laccase in alginate was carried out in calcium-alginate beads. However, the alginate-silica beads were prepared using two different approaches: formation of alginate-silica hybrids by alginic acid mediated hydrolysis of silica precursor (approach1); and use of pre-hydrolyzed silica to form alginate-silica hybrids (approach2). Data was expressed by mean of duplicate trials with ±relative standard deviations calculated.

Significance:
Alginate-silica hybrids may be used as potential encapsulation matrices that would significantly promote the applications of laccase in food systems.

Results:
The results showed that, the alginate-silica matrix (approach2) provided a more confined environment for encapsulation with an immobilization protein yield of 70.7% in comparison to 58% for alginate and 53.5% for alginate-silica (approach1). The results were in accordance with the protein leakage studies performed, where a minimum leakage of 26.8% was obtained in alginate-silica (approach2) followed by, 56.8% and 64% in alginate and alginate-silica (approach1), respectively. Furthermore, a residual laccase activity of 81% was observed in alginate and, 68.6% and 37.4% in alginate-silica matrices (approach 2.1), correspondingly. Although, the alginate matrix produced highest enzyme activity, the results demonstrate its high porosity and inability to retain the enzyme for longer periods. Moreover, the reduced residual activity in alginate-silica
Double Encapsulation of Lactobacillus Plantarum With Protective Agents in Pectin-Rice Bran Capsules With Whey Protein Isolate Coating to Improve Viability During Freeze Drying and Under Simulated Gastrointestinal Conditions

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Introduction: Pectin-rice bran delivery systems for Lactobacillus plantarum (LP) have been shown to improve cell viability under acid and bile conditions. However, they failed to protect LP during freeze drying. Supplementation of a prebiotic with whey protein isolate (WPI) coating may help enhance cell survival during freeze drying and at gastrointestinal conditions. The objectives of this study were to develop double encapsulated LP containing a protective agent (prebiotic), pectin-rice bran, in capsules coated with WPI, and to determine the effects on LP viability during freeze drying and under simulated gastrointestinal conditions.

Method: LP was grown in de Man Rogosa and Sharpe broth, centrifuged, and separately suspended in 20% protective agent solutions, which also contained maltodextrin (MD), wheat dextrin soluble fiber (WF), or hi-maize starch (HM). Distilled water with no protective agent was used to prepare control capsules. Cell mixtures were then added into a pectin-rice bran gel solution at a ratio of 1:4. Gel solutions with LP and protective agent were dropped into a 4% CaCl2 solution containing 8% WPI to prepare double encapsulated LP capsules. Uncoated capsules were formed by dropping gel solutions with LP in 4 g/100 mL CaCl2 without WPI. Capsules were then freeze dried. Cell viability in freeze dried capsules was evaluated after freeze drying and at a simulated fed state with a copious meal (at pH 3.0, followed by pH 7.0) and with a standard meal (at pH 2.5, followed by pH 6.5) conditions. Duplicate experiments were conducted and data was statistically analyzed (α=0.05).

Significance: FHMC effectively improved LP viability and could be used as a new sybiotic product.

High Hydrostatic Pressure: A Novel Method of Glucose Oxidase Enhancement

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Introduction: Due to the lack of operational stability, the practical applications of several enzymes are not economically viable. This research objective was to stabilize glucose oxidase (GOx) at high hydrostatic pressure (HHP) and determine the range of pressures that has maximal catalytic rate and stability of GOx. The long term objective is to produce stabilized GOx that can be used at temperatures higher than currently possible for increased activity and industrial application.

Method: Aliquots of 15 µL of 0.12 units/mL GOx were added to 10%(w/v) β-D-glucose solution at ~5°C packaged in polyethylene pouches, and placed in reactor initially at 5°C to investigate the effects of treatment at simulated conditions of a copious meal (0.89 log reduction) and a standard meal (2.12 log reduction).

Significance: This study is shown to have greater performance for native whey protein as compared to PNGase F. Vmax, and kcat values of EndoBI-1 increased from 0.036 mg/ml*min to 0.053 mg/ml*min and 1.44 s⁻¹ to 2.12 s⁻¹ respectively after denaturation of whey protein. In contrast, Vmax and kcat values of PNGase F increased from 0.012 mg/ml*min to 0.049 mg/ml*min and 0.48 s⁻¹ to 1.96 s⁻¹, respectively upon denaturation. Km values of EndoBI-1 decayed much less notably (5.55 mg/ml to 1.86 mg/ml) after denaturation as compared to PNGase F (22.65 mg/ml to 3.21 mg/ml), we showed that the number of N-glycan structures released by EndoBI-1 did not differ considerably with denaturation unlike PNGase F. Overall, EndoBI-1 was able to tolerate the absence of substrate denaturation much better compared to the commercially available option PNGase F. Therefore, it is a promising enzyme for elucidation of N-glycans in their native form.

Effects of Extraction Conditions on Molecular Characteristics and Protein Stabilizing Behaviors of Soybean Pectin

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Introduction: Pectin is a water-soluble cell wall polysaccharide that stabilizes acidified milk drinks (AMD) by preventing protein sedimentation. Pectin is typically composed of a relatively long backbone of rhamnogalacturonic acid and short branches of neutral sugars. In AMD, negatively charged carboxyl groups on the pectin backbone can bind to positively charged amino acid groups on milk proteins, while unbound neutral side chains of pectin form loops or tails that extend into the aqueous phase and provide steric repulsion. Pectin preparation from raw materials such as citrus peel, apple pomace, or soybean okara usually involves extraction at low pH and elevated temperatures, causing pectin molecules to degrade to various degrees. The objective of this study was to investigate the effects of extraction temperatures on molecular characteristics and protein stabilizing behaviors of soybean pectin.

Method: Soybean pectin was extracted at either room temperature or 120°C, and characterized using biocinichonic acid assay for protein contents, phenol sulfuric acid assay for neutral sugars content, carboxyl sulfuric acid assay for galacturonic acid contents, and size exclusion chromatography (SEC) in combination with multi angle laser light scattering (MALLS) for molar masses. To compare the protein stabilizing behaviors of the two types of soybean pectin, 0.2-0.8% w/w of soybean pectin was added to simulated AMD containing 8.5% w/w total solids at pH 4. The particle size distribution and zeta potential of each AMD sample were evaluated using a zetasizer after 24 h of storage at 4°C.

Significance: These results confirmed that we have successfully extracted soybean pectin in its less degraded form at room temperature, and provided better understanding of how extractions temperatures affect its molecular characteristics and functionalities.

Results: The molar mass of the soybean pectin extracted at room temperature (SP-RT) was 1830 kg/mol, almost twice that of the soybean pectin extracted at 120°C (SP-H) (966 kg/
significantly higher final and setback viscosity values than A- (<0.500mm) and C-sized retrogradation enthalpies lower than gelatinization enthalpies. Germinated quinoa of 67.1 to 67.8°C (maize flour) and 55.5 to 57.4°C (quinoa flour). The maize flour had B particle size had higher enthalpy values than A and C particles. T0 were in the range Results:
The germination of some grains affects the functional properties of the flours and thus SPSS statistical package (LEAD Technologies, US).

Method:
The developed confections contained 100% GOS (Oligomate SS, Yakult Pharmaceuticals), or sucrose and 25% of either of GOS or CS. Glass transition temperature (Tg) and texture were analyzed immediately after manufacturing. Confections were also stored on ground powder at 57% and 75% relative humidity (RH) for 24 hours and analyzed for moisture content (MC), Tg, and crystallization by microscopy. Significance:

GOS seems to be a suitable replacement for CS in a traditional hard candy with potentially less crystallization over time. Furthermore, glassy confections comprised of 100% GOS may potentially have higher stability (less water adsorption and crystallization) than traditional glassy confections with sucrose, affirming their utility as agents for the delivery of the prebiotic in future human clinical trials. Results:

Tg, hardness, and stickiness were not significantly different between formulations after manufacturing (p<0.05). At 57% RH, adsorption of water was not significantly different between samples. However, Tg of the CS and 25% GOS confection were depressed approximately 15°C lower than the 100% GOS confection. The 100% GOS confection absorbed about 3% less water than the CS and 25% GOS confection at 75% RH, and its Tg was approximately 20°C higher. At 57 and 75% RH, the CS confection showed the most crystallization, while an intermediate amount of crystals was present in the 25% GOS confection, and an absence of crystals was apparent in the 100% GOS confection.

Significance:

The germination of cereals and pseudocereals is a simple technique that can favor the Physicochemical Properties of Germinated Quinoa and Maize Flour L. Montoya Devia, Universidad del Valle, A. Souvenez, B. Hamaker, Email: leidymaresalmontoyagmail.com

Introduction:
The germination of cereals and pseudocereals is a simple technique that can favor the baking processes. The influence of germination on the thermal, pasting, and rheological properties of quinoa (Chenopodium quinoa) and maize QPM (Zea maiz) flours with varying particle sizes was analyzed. Method:
The grains were acquired from Colombia. Adequate temperature (28°C) and relative humidity (87%) conditions were set in an environmental chamber for 48 hours during germination. Flour samples were sifted through different sieves, which allowed three distinct particle sizes to be obtained: A (<0.500 mm), B (0.106-0.500 mm), and C (<0.106 mm). The samples analyzed were control quinoa flour (CQF), control maize flour (CMF), germinated quinoa flour (GQF), and germinated maize flour (GMF), with particle sizes of A, B, and C. Thermal analysis, viscosity profiles, and frequency sweeps were performed. The results were expressed as the mean of 3 replicates and the standard deviation. Significance differences were determined using an analysis of variance (ANOVA) using the SPSS statistical package (LEAD Technologies, US).

Significance:
The germination of some grains affects the functional properties of the flours and thus has a potential use in the development of gluten free products. Results:

B particle size had higher enthalpy values than A and C particles. T0 were in the range of 67.1 to 67.8°C (maize flour) and 55.3 to 57.4°C (quinoa flour). The maize flour had retrogradation enthalpies lower than gelatinization enthalpies. Germinated quinoa flour had a higher initial gelatinization temperature than ungerminated corn flour. The peak, final, and setback viscosities were significantly higher (p<0.05) in germinated than in ungerminated quinoa flours. B-sized particles (0.106-0.500 mm) had significantly higher final and setback viscosity values than A (<0.500mm) and C-sized (<0.106mm) particles. The final and setback viscosities were higher in ungerminated than in germinated maize flours. The lowest value of the coefficients n were found in germinated samples and dough made with B size particles. For maize, GMF (B size particles) showed significantly higher elastic modulli than other samples. Germinated quinoa flour with large particle sizes (0.106-0.500 mm) could provide beneficial characteristics in the manufacturing of gluten-free baked goods.

P01-015

Enzymatic and Microwave-Assisted Alkaline Extraction of Oligo/Poly saccharides From Cranberry Pomace Byproducts E. Spadoni Andreani, McGill University, E. Davis, S. Karboune, Email: eugenio.spadoniandreani@mail.mcgill.ca

Introduction:
Most of the harvested American cranberries (Vaccinium macrocarpon) are processed into juice. After the rise in popularity of the fruit as health-promoting food, consumption of cranberry juice blends spread worldwide. Cranberry pomace (CP), the byproduct of cranberry juice production, is rich in cell wall polysaccharides (PS) that may have two non-functional and health-promoting properties, and can be a good source of novel arabino-oligosaccharides (OS), potential prebiotics. However, until now CP has been extensively studied only as source of phenolic compounds. The objective of this study was to investigate the effectiveness of two approaches (microwave-assisted alkaline and enzymatic) in generating OS and PS from CP.

Method:
The yields, monosaccharide (MS) profile and molecular weight distribution of the generated extracts were investigated. For the microwave-assisted extraction, two power settings (84.9 and 242.4 W/g of CP) and two concentrations of KOH (0.25 and 0.5 M) were tested. For the enzymatic approach, three multi-enzymatic biocatalysts (Pectinex Ultra SPL, Viscozyme L, and Depol 740L) were tested.

Significance:

Overall, this study reveals the potential of CP as a source of PS and OS extracts, enriched with phenolic compounds, with potential applications as functional food ingredients. Results:

At 84.9 W/g, the recovery yield of carbohydrate extract (PS, OS, MS) was higher at high KOH molarity (22.4%), while the yield of alcohol insoluble carbohydrates (AIK) was higher at low molarity (18.8%). The low power setting gave higher AIK yields. Compared to CP, all extracts obtained with the microwave-assisted approach contain higher percentages of uronic acids and lower percentage of neutral sugars (Xyl, Man, Glc), while maintaining similar proportions of Ara and Gal. The biocatalysts produced extracts with increased Gic content and Ara:Gal ratio compared to CP, and a percentage of Ara close to those in pomace and microwave extracts. The use of Viscozyme L as biocatalyst resulted in the lowest yield of carbohydrate extract (30.8%) and produced almost exclusively OS. Depol™ 740L had both the highest yield of carbohydrate extract (62.7%) and the highest OS yield (36.2%), while Pectinex Ultra SPL led to the lowest OS yield. The carbohydrate extracts generated by enzymatic treatment were also rich in polyphenols.

P01-016

Aroma-Active Compounds in Fluid Milk Vitamin Concentrates E. Yeh, Eileen Yeh, J. Yo, A. Schiano, D. Barbaro, M. Drake, Email: eyeh@ncsu.edu

Introduction:
Vitamin concentrates with Vitamins A and D are used for fortification of fluid milk. Vitamins A and D have heat, oxygen, and light sensitivity, and their degradation compounds may be sources of off-flavors in vitamin-fortified milk. Little research on vitamin degradation compound contributions to off-flavors has been conducted. The objective of this study was to determine aroma active compounds in vitamin concentrates used for fluid milk.

Method:
Fourteen (14) commercial vitamin concentrates (Vitamins A and D) in both oil and water matrices, were obtained in duplicate lots from multiple companies. All concentrates were within 45 days of manufacture with > 9 mo remaining shelf life. A trained sensory panel (n=8) documented aroma profiles of the concentrates in duplicate. Aroma active compounds in concentrates were characterized and identified by solid phase micro extraction (SPME) with gas chromatography-mass spectrometry (GC-MS) and gas chromatography-olfactometry (GC-O).

Significance:
An understanding of the impact of degradation of Vitamin A and D concentrates may elucidate source(s) of off flavor(s) in fluid milk.

Results:
Vitamin concentrates were diverse in aroma and exhibited key differences in floral, fruity/citrus, carrot, tea, and chemical/oily aromas. Concentrates containing Vitamins A and D displayed more intense and diverse aromas than those containing Vitamin D alone, and water soluble mixes were more intense and diverse than oil soluble mixes (p<0.05). Instrumental results were consistent with sensory results. Forty-three (43) aroma active compounds were identified and quantified in the vitamin concentrates, with more compounds detected in concentrates with Vitamins A and D than in those with Vitamin D alone. The key aroma active compounds in Vitamin A and D concentrates were hexanal, Z-3-hexen-1-ol, isoamyl acetate, octanal, limonene, β-phellandrene, β-damascone, β-ionone, β-cyclocitrinal, and α-ionone. Oxidative products 2,4-hexadienal, E2,2,4-heptadienal, and E2,4,4-heptadienal were more prevalent in Vitamin D premixes.
Sensitivity Detection of Norbixin in Dried Dairy Ingredients at Concentrations Less Than One Part Per Billion

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Introduction: Norbixin is the primary carotenoid in anatto extracts used in the cheese industry to color Cheddar cheese. Even after destruction through bleaching, norbixin may be detected in dried dairy ingredients. Regulatory restrictions dictate appropriate levels for dairy ingredients destined for infant formula as well as ingredients entering international commerce. Thus, there is a need for the detection and quantification of norbixin at very low levels in dried dairy ingredients. A rapid method exists for norbixin evaluation but it does not have the sensitivity required for compliance with existing regulations. The current method has a limit of detection (LOD) of 2.7 μg/kg and a limit of quantification (LOQ) of 3.5 μg/kg. The purpose of this study was to develop a method to extract and concentrate norbixin for quantification of low levels in dried dairy ingredients.

Method: A reversed-phase solid phase extraction column step was applied to concentrate and quantify norbixin in dried WPC80, WPC34, and lactose. Powder samples (n=20 each) were extracted with 10 ml of 50:50 acetonitrile and water, then diluted with 10 ml of water, and loaded onto the column at a rate of 1 ml/min. Norbixin was then eluted with 98:2 methanol and formic acid. Samples were evaporated to 200 μl and analyzed by UPLC with a photodiode array detector at 459 nm. An isotropic mobile phase consisting of 70% acetonitrile and 30% water with 0.1% (v/v) formic acid was used and, to help increase sensitivity, a large volume (10 μL) was injected onto the column (reversed phase C18 column). The run time was 0.70 min. Samples were also subjected to the existing method with no SPE step for comparison. Each product was evaluated in triplicate by each procedure.

Significance: The developed method provides detection and quantification of norbixin for dairy ingredients that have a concentration of <1 ppb for regulatory compliance.

Results: The proposed method had comparable recovery (p>0.05) to the previous method (>90% recovery in both WPC and lactose) and an LOD of 28 ppt (ng/kg) and an LOQ of 57 ppt (ng/kg).

Optimization of Carotenoid Analysis by Extraction With Ethyl Ether and Mobile Phase Adjustment

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Introduction: Carotenoids are bioactive compounds and colorants in foods. Concentrations of carotenoids, including retinol and carotenes, in food matrices are often determined by liquid chromatography. These compounds have drastically different solubility parameters thus extracting them simultaneously can be difficult and inefficient. Methods often use hexane as an extraction solvent, which solubilizes β-carotene and retinol well, but is less efficient at solubilizing lutein. The solvents used for these analyses are also expensive to dispose of and harmful to the environment. The objective of this study was to determine an extraction solvent and mobile phase which both optimized carotenoid extraction and eliminated hexane and tetrahydrofuran (THF) waste.

Method: Milk, whey, and sweet potato samples (n=10 each category) were prepared and evaluated by HPLC for retinol, α-tocopherol, β-carotene, lutein, and α-carotene simultaneously. Ethyl ether was evaluated as a diluent against four common diluents in the literature (containing various concentrations of hexane, THF, and ethyl acetate). A unique mobile phase (ethyl alcohol/ acetonitrile/ water) was subsequently evaluated against four common mobile phases for carotenoid determination (containing previous solvents). The limit of detection (LOD) was determined by measuring the average instrumental noise of 8 blanks multiplied by 3.3 standard deviations (SD). The limit of quantification (LOQ) was defined as 10 SD above the measured instrumental noise. All experiments were performed in triplicate.

Significance: The proposed method allows for the simultaneous determination of carotenoids with increased lutein and α-carotene sensitivity. Additionally, this method can cut cost in waste disposal and reduce the ecological footprint of the procedure.

Results: Samples solubilized in hexane had lutein and α-carotene values below the LoQ (p<0.05). Samples solubilized in ethyl ether had greater sensitivity to lutein than all other diluents (p<0.05), with peak areas above LOQ values (p<0.05). Samples solubilized in ethyl ether had equal concentrations of retinol, α-tocopherol, and β-carotene when compared to other diluents (p<0.05). Samples eluted using the proposed mobile phase had similar sensitivity to samples eluted with all other mobile phases (p>0.05). Matrix (dairy product vs. sweet potato) had no effect on sensitivity (p>0.05).

The Effect of Emulsifying Salts on Casein Micelles as a Function of Concentration, pH, and Temperature

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Introduction: Currently, the Code of Federal Regulations (CFR) lists 13 salts that may be used as emulsifiers in the manufacture of processed cheese. Although these salts are commonly used, their specific effects and mechanism of action are poorly understood, especially in systems with changing temperature, pH, or concentration. The aim of this study was to examine the effect that these ubiquitous salts have on the turbidity of a diluted skim-milk system as a way of measuring the aggregation or dissociation of casein micelles.

Method: A device was built to test the effect of environmental factors (salt, temperature, and pH) on the turbidity of a diluted skim-milk system. An aqueous solution with continuously variable salt concentration was achieved by making two solutions for each experiment, both buffered using 20mM Imidazole buffer and one containing 100mM of an emulsifying salt. These solutions were pumped in different proportions and comprised 98% of the total flow through an in-line UV-VIS spectrometer flow cell located in a thermostatic bath. The remaining 2% of the fluid was skim milk. Using this set-up, it was possible to create surface-response graphs showing milk’s turbidity as a function of various environmental conditions.

Significance: This empirical approach to understand emulsifying salts’ effect on casein micelles gives insight into the underlying mechanisms that can be used to more accurately tailor their usage for specific applications such as cheese manufacturing.

Results: Generally, increasing the concentration of the emulsifying salt decreased the solution’s turbidity. The specific salt, temperature, and pH conditions greatly affected the absorbance curve. Sodium hexametaphosphate (5mM) at pH 6.8 and 20°C decreased the diluted milk’s turbidity from 0.40 absorbance units (AU) to 0.02. Mono-, di-, and trisodium phosphate required 98mM to decrease to below 0.04 AU. At 20°C, these three salts also showed non-linear, multi-regional absorbance curves. The curve for monosodium phosphate initially increased to 0.57 AU at 1mM, decreased to a local minimum of 0.31 AU at 5mM, had a local maximum of 0.43 AU at 10mM and decreased to 0.03 AU at 98mM. At 50°C, however, the same salts showed linear reductions in turbidity, suggesting that hydrophobic interactions synergistically determine the ionic effect.

The Luminescent Lunchbox: Translating Research on Edible GRAS Probes Into an Educational Kit on Photophysics

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Introduction: Current research on generally recognized as safe (GRAS) luminescent food components can be used as an effective tool to explain photophysics to elementary and middle school students.

Method: This project translates our research on luminescent GRAS probes into an educational kit, the “Luminescent Lunchbox”; with instructions and supplies necessary to conduct four photophysical-related activities: (1) “Light Show”: students explore the electromagnetic spectrum by measuring the temperature of colored LEDs and corresponding results to energy, frequency, and wavelength; (2) “Fluorescent Food Scavenger Hunt”: students are introduced to fluorescence and its extensive occurrence in biological samples by photo-exiting food items and observing their fluorescence emission. They are also encouraged to conduct a scavenger hunt of luminescent foods in their homes or local grocery stores; (3) “Rainbow Ghosts”: students build a spectrophotometer using a diffraction grating, LEDs, and a camera phone. The predominant colors in the spectrum on the cell phone screen correspond to the fluorescence emission wavelengths of the food sample; and (4) “Shine Refine” the spectra of food samples observed in the previous activity are enhanced by using gelatin-cast absorptive filters.

Significance: Engaging young students in the pursuit of STEM careers, such as food science, requires developing innovative approaches to communicating scientific ideas. The “Luminescent Lunchbox” helps students understand conditions, applications, and limitations of luminescence in scientific research through captivating experiments with “glow-in-the-dark food.” Additionally, students are introduced to food chemistry through explorations of food components such as natural and artificial food pigments.

Results: The effectiveness, comprehensiveness, and liking of the kit was measured during a Science Saturday event run conjointly by the Rutgers Food Science Department and the 4H Program. A focus group of 35 students evaluated the activities. Its effectiveness was corroborated, as 77% of participants correctly answered content questions about fluorescence. 89% of participants were able to understand the information and vocabulary of the kit all of the time or most of the time. The difficulty of the modules was deemed simple to neutral by 77%, which is considered an ideal rating for an educational kit. Finally, over 60% of participants rated each of the modules as either very good or excellent.
Factors Related to Achievement in a Capstone Food Chemistry Course
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Introduction:
FDSC 4304 - Food Chemistry is a required course that allows students to understand the complex chemical reactions during harvesting, post-harvest preserving and preparing food. Students must integrate knowledge from prerequisite STEM classes. Much of the current emphasis on accountability is misplaced because it is “post mortem”. A prediction matrix would increase students’ likelihood of success and provide instructors key performance indicators for focused interventions. This study identified predictors of academic success in FDSC 4304.

Method:
After IRB approval, the university provided data on 116 undergraduates who completed food chemistry, FDSC 4304 between 2008 and 2015. Data included semester of enrollment and grade earned in FDSC 4304; transfer status; grades in selected STEM courses and introductory Food Science, FDSC 1103, completed prior to enrollment in Food Chemistry; and university GPA at the time of enrollment in FDSC 4304.

Significance:
Knowledge of students’ cumulative GPAs and grades in FDSC 1103 will allow instructors to focus on students who may need extra help. However, lower cumulative GPAs and lower grades in FDSC 1103 are only suggestive and must be used in combination with actual early course performance to efficiently identify students in need of additional help.

Results:
The mean GPA in FDSC 4304 was 3.05 (SD = 0.80) over the 7 years. It was negatively skewed (µ=-0.75) with 22.4% of students earning a C or lower. Cumulative GPA had the strongest significant (p < 0.001) positive correlation with FDSC 4304 grade (r = 0.64), followed by grades in statistics (r = 0.52), FDSC 1103 (r = 0.45), undergraduate chemistry (r = 0.44), and biology (r = 0.42); students’ transfer status and math grades were not significantly related to FDSC 4304 grades. Using partial correlations to control for the effects of cumulative GPA indicated only grades in FDSC 1103 were significant (r=0.70, p = 0.04). Multiple regression indicated a linear combination of cumulative GPA and FDSC grade explained 35.5% of the variance in FDSC 4304 grades, F(2, 69) = 18.99, p < 0.0001. The equation predicting FDSC 4304 grades was: Predicted Grade = UA GPA (0.75003) + FDSC 1103 Grade (0.26551) + 0.29410.

Exploring the Impact of Teacher Professional Development on Students’ Food Safety Knowledge and Behaviors
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Introduction:
“Hands On: Real World Lessons for Middle School Classrooms” is a comprehensive curricular unit designed to reduce the occurrence of foodborne illness by informing adolescents’ food safety habits through an effective educational intervention. Teacher professional development (PD) is a cornerstone of Hands On as it raises the teachers’ background knowledge of food safety issues and arms them with innovative classroom strategies ensuring success. There are two measures by which to judge the effectiveness of a training which measures the teachers’ change in food safety knowledge, behaviors, and indirect impacts, which measure students’ subsequent changes. Without measurable improvements in students’ knowledge or behaviors, the effectiveness of the PD is questionable. The purpose of this study was to examine the impact of PD on direct and indirect outcomes and identify elements of the training which improved outcomes.

Method:
Students’ (n=888) pre- and post- tests were matched with their teachers’ (n=70) training pre- and post- tests from the past 8 years. These tests were analyzed using paired and independent t-tests.

Significance:
The results from this study provide ongoing support for the effectiveness of the Hands On PD model and suggest that smaller group trainings may be more effective at impacting both direct and indirect outcomes.

Results:
Results indicate that both student and teacher knowledge (p<0.000, p<0.000) and behavior (p<0.000, p<0.000) scores significantly increased from pre to post test. The results also showed that teachers who attended training with six participants or less (small group) had a significantly higher change in behavior (p=0.002) as compared to teachers who had more than six (large group). This gain also translated well into the classroom. Students whose teachers attended a small group training had significant gains in student food safety behavior (p<0.000) compared to their peers whose teachers attended a large group training.

Effect of Drying Techniques on Antioxidant Capacity of Guava Fruit
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Introduction:
Frequent consumption of fruits and vegetables has been associated with low risk of chronic diseases. Guava (Psidium guajava Linn.) is a tropical fruit, which is widely consumed as fresh and processed. Guava is a seasonal fruit rich in natural antioxidant compounds, such as vitamin C and polyphenol compounds. Drying is one of the most common methods to preserve and extend the shelf life of guava. The objective of this study was to determine the effect of drying techniques on the antioxidant activity of guava fruit.

Method:
Guava was dried in oven (45°C), freeze dryer and by osmotic drying techniques. Fresh, freeze dried (FD), oven dried (OD) and osmotic-dehydrated (OS) guava extracts were prepared and analyzed for total polyphenols, flavonoids, antioxidant potential by 2,2-diphenyl-1-picrylhydrazyl (DPPH); ferric reducing oxygen radical absorbance capacity (ORAC); total antioxidant capacity (TAC) and to investigate inhibitory potential of guava extracts on enzymes α-glycosidase, α-amylase and lipase.

Significance:
In conclusion, drying methods enhanced the phytochemical extractability and antioxidant potential of guava fruit. Considering this in-vitro study, drying could be effectively utilized to extend the shelf life of guava fruit with minimum effect on health benefits.

Results:
Total polyphenols in Fresh, FD, OD, and OS were 415.69±56.95a, 295.30±4.11ab, 303.57±1.41ab, and 182.93±6.48b mg gallic acid equivalent (GAE)/100g, respectively. Flavonoids in Fresh, FD, OD, and OS were 202.01±0.16a, 96.93±1.73c, 105.07±0.58b, and 76.13±2.74d mg catechin equivalent (CE)/100g respectively. FD extracts were more effective in scavenging DPPH radical follow by fresh, FD, OD and OS. DPPH was observed in fresh, FD, OD and OS at 3.18, 0.42, 0.56 and 3.33mg/ml, respectively. Whereas FRAP, TEAC and TAC activities were found to be higher in fresh guava extracts followed by OD and FD. However, 45.06%, 36.03% and 30% inhibition of α-glycosidase, α-amylase and lipase enzymes were observed at 0.4, 0.8, and 0.8 mg/ml, respectively.

Effects of a Glucose-Cysteine Maillard Reaction Product on Lipid Oxidation in a Complex Food Emulsion
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Introduction:
The demand for natural antioxidants has increased over the years. A glucose-cysteine Maillard reaction product (MRP) was formed using heat, and its antioxidant effects on lipid oxidation were determined for a structured lipid enriched with docosahexaenoic (DHA) and arachidonic (ARA) acids in a complex infant formula food emulsion.

Method:
Trolox equivalency antioxidant capacity (TEAC) values were determined for MRP heating time intervals of 2, 4, and 6 h, and were compared to TEAC values of equivalent concentrations of α-tocopherol (TOC), equal combinations of MRP with TOC (TDC-MRP), and TOC with ascorbyl palmitate (TOC-AP). Infant formula emulsions were produced for oxidative challenge and the MRP-6h and the TOC-MRP-6h oils were compared to MRP and were compared to a control containing no added antioxidant. Lipid oxidation was monitored by peroxide value (PV) for primary oxidation and p-anisidine value (p-AnV) for secondary oxidation of the extracted oil over a 56 day period.

Significance:
These results indicate that the MRP could be useful in inhibiting secondary oxidation in complex emulsion matrices.

Results:
Total TEAC values for the MRPs were 1.04, 1.67, and 2.51 mg trolox eq/g for the 2, 4, and 6 h heating time, respectively. The MRP-6h was used in the infant formula emulsion oxidation study. Total TEAC values of TOC, TOC-MRP-6h, and TOC-AP were 3.95, 2.68, and 2.86 mg trolox eq/g, respectively. Positive polynomial and linear correlations were also observed for heating time with extent of browning (r=0.99) and extent of browning with PV and p-AnV (r=0.98), respectively. Oxidation results indicated an antioxidant effect for some MRPs and oxidation for the MRP-6h for days 14-28, and the TOC-MRP-6h and TOC-MRP for days 21-42. The induction time for MRP was longer compared to TOC with 23.6 and 19.8 days, respectively. The induction times for TOC-MRP-6h and TOC-AP were comparable with 41.8 and 41.6 days for PV and 41.7 and 39.8 days for p-AnV, respectively.

Emulsification Properties of Lactose Fatty Acid Esters
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Introduction:
Carbohydrate fatty acid esters have been studied for their use as antimicrobial agents in food systems. Lactose esters may also have emulsification properties. This research investigated the emulsification properties of lactose esters. Our previous studies showed that enzymatically synthesized lactose monodecanoate (LMD) and lactose monolaurate (LML) exhibited greater microbial inhibitory properties than lactose monomyristate.
(LMM) and lactose monocanoate (LMO) against Gram-positive bacteria. The objective of this research was to evaluate the influence of the fatty acid chain length on the emulsification properties of lactose esters in 20% oil-in-water (o/w) emulsions.

Method: Lactose and vinyl fatty acids were used to synthesize three different lactose esters (LMO, LMD and LMM) using the immobilized lipase from Thermomyces lanuginosus. Each emulsifier was added to o/w samples followed by passing through a microfluidizer for final concentration of 0.1%, 0.25%, and 0.5%. Emulsion stability using Turbiscan Classic MA2000, a vertical scan macroscopic analyzer, was conducted. Oil droplet diameter (D3,2) in the emulsion was also tested using a Beckman Coulter droplet size analyzer. Both were measured from day zero (the day emulsion was prepared) to the fourth day.

Significance: This research showed lactose esters containing decanoate and myristate may be useful emulsifiers in food systems. Specifically, lactose based esters, a class of sugar esters, are important, as they are environmentally friendly and can be synthesized using renewable resources. Therefore, these may be obvious choices as emulsifiers in o/w emulsions.

Results: Results suggested that the chain length of the lactose fatty acid ester significantly influenced the o/w emulsification properties. At the higher concentration of emulsifier (0.5%), LMD and LMM produced emulsions with rates of destabilization of 0.72 mm/day and 1.1 mm/day, respectively. However, LMO produced an unstable emulsion at the highest concentration of emulsifier (0.5%). On day zero and day four, LMD showed 7% of the volume of the droplets in the range of 0.5-1 μm at 0.5% and thus, lactose esters esterified with decanoic was considered a stable emulsifier. LMM at 0.5% showed 7% of the volume of the droplets in the range of 0.5-5 μm on day zero and day four, resulting in a stable emulsion.

P01-026
Effects of Processing on Phytochemicals and Antioxidant Potential of Fenugreek Leaves and Seeds
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Introduction: Fenugreek (Trigonella foenum-graecum) is an annual herb belonging to the leguminosae family. The reported health benefits of various parts of fenugreek, including the seeds and leaves, might be linked to their antioxidant compounds. The objective of this study was to determine the effect of processing on phytochemicals and antioxidant potential of fenugreek leaves and seeds.

Method: Leaves were dried by lyophilization (FDL) (3 days), force draft oven (ODL) (50°C for 15 hours), and pan frying (CL) (2 mins). Seeds were treated by germination (GS) (soaked in distilled water for 12 hrs, dried at 37°C for 20 hrs), and toasting (TS) (4 mins). Raw leaves (FL) and seeds (ES) were homogenized and ground to pass through a 1 mm sieve. Total phenolic content (TPC), total flavonoid content (TFC), ferric reducing antioxidant power (FRAP), and radical (2, 2-diphenyl-2-picrylhydrazyl (DPPH)) scavenging activity of fresh and processed fenugreek leaves and seeds were assessed in methanolic (ME) and aqueous extracts (AE).

Significance: Fenugreek could be used in the development of value added and functional food products. Development in the US food industry to cater to the needs of health conscious consumers.

Results: The fresh leaves had lowest antioxidant potential compared to the other treatments. Aqueous extracts of FDL yielded the highest total phenolic content (26.4 mgGAE/g dwb) and TS (AE) yielded the lowest (0.034 mgGAE/g dwb). CL (AE) yielded the highest flavonoid content (2.86 mgCAE/g dwb) and TS (AE) yielded the lowest (0.002 mgCAE/g dwb). CL (AE) exhibited highest FRAP (6.317 mMFe2+/g dwb) and FDL (AE) showed the lowest (1.298 mMFe2+/g dwb). CL (AE) also showed highest DPPH radical scavenging activity (40.29% inhibition dwb) FDL showed the lowest (20.88% inhibition). The results of this study suggest processing may affect the phytochemicals and antioxidant potential of both fenugreek leaves and seeds.

P01-027
The Evaluation of Thymus Daenensis Celak and Echinopora Platyloba DC. Essential Oil Composition and Their Antioxidant Activity in Soybean Oil
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Introduction: The objectives of this study were to, first, evaluate Thymus daenensis Celak (thyme) and Echinopora platyloba DC (Khoshaireh) essential oil composition and antioxidant activity and, second, predict oil oxidation through neuro-fuzzy modeling.

Method: The essential oils have been extracted by microwave assisted Cleverex extraction. The antioxidant activity of soybean oil containing two concentrations of 500 and 1000 mg/kg of essential oils during 20 days of storage at 55°C was evaluated by peroxide value, TBA value, and p-anisidine value compared with BHT. The composition of both extracts was analyzed by GC-Mass. The neuro-fuzzy modeling and preparing its graphs was carried out by Matlab software and other statistical analyses (ANOVA) was carried out by Minitab 16 using full factorial design.

Significance: Microwave assisted Cleverex extraction (MACE) considerably decreased the extraction time while it had an insignificant effect on essential oil composition which could bring new insights for faster extraction of essential oils in the industry. Thyme and Khoshaireh’s essential oils bearing antioxidants compounds such as Thymol, p-cymene and o-phellandrene had a suitable antioxidant activity which could be a suitable substitute for synthetic antioxidants in food industry. It has been shown the mentioned extracts could be applied in vegetable oil formulation, which suggests further research on their application in other food products.

Results: Thyme at 500 mg/kg and khoshaireh at 1000 mg/kg showed the best antioxidant activity. GC-Mass analysis results showed thymol (39.8%) and p-cymene (19.2%), which are the major compounds of thyme and o-phellandrene (16.6%), o-pinene (16.3), p-cymene (15.8%), and Thymol (13.3%), which are the major compounds of Khoshaireh’s essential oil. It has been shown that thyme and khoshaireh extract could be used as a suitable substitute for synthetic antioxidants and neuro-fuzzy modeling could be used as a suitable procedure to predict their antioxidant activity.

P01-028
Varietal Effects on Phytochemicals and Polyphenols Distributions in Pomegranate Fruit
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Introduction: Global production of pomegranate (Punica granatum) is expected to reach 1.7 million tons, with California as the largest producer state in the United States. The pomegranate orchard acreage has grown drastically in the past decade with soaring consumer demands for the “superfruit.” Fruits of the Wonderful variety constitute approximately 90% of the commercially available pomegranates. Monopolization poses a great risk due to the susceptibility of crops with similar genotypes succumbing to a particular plant disease. The research objective was to study the phytochemical properties of 5 different pomegranate cultivars: Molla Nepes (MN), Parfanka (P), Purple Heart (PH), Viksunyi (V), and Wonderful (W).

Method: Samples were provided by the USDA National Clonal Germplasm Repository in Davis, California. The fruits were manually separated into peel, seed, and juice. Pomegranate seed oil (PSO) was extracted and evaluated according to the AOCS methods. Methanol soluble and insoluble phenolic compounds in peel and seed were isolated for phenolic and antioxidant analysis. Total phenolic contents in the extracts were determined using the Folin–Ciocalteau method while their antioxidant activities were measured against standard Trolox solutions. Major polyphenol compounds in pomegranate peels were also identified. Statistical analysis was performed using the SPSS software.

Significance: The physicochemical evaluations of the pomegranate fruits demonstrated that some cultivars, especially Purple Heart, have positive attributes similar to Wonderful. They could potentially be cultivated to diversify the pomegranate market and to reduce risks associated with commercial planting of only one pomegranate genotype.

Results: The averaged fruit weights for different varieties were from 259.47g to 493.42g. MN and W produced the heaviest fruits, but their juice to peel ratios were lower than others. PSO contents ranged from 15.23-21.32% (dry basis). The pectic and acid values were not significantly different. Total phenolic contents (TPC) ranged from 146.29-279.32, 6.61-13.20, 5.86-9.04, and 4.28-6.19 mg gallic acid equivalent/g dry sample for the peel soluble, peel insoluble, seed soluble, and seed insoluble fractions, respectively. Trolox equivalent antioxidant capacities (TEAC) of the 4 fractions varied from 241.23-562.43, 17.40-26.51, 2.45-4.52, and 6.53-9.77 mg/g dry matter. The Wonderful variety possessed the highest TPC and TEAC, followed by the PH, V, MN, and P cultivars.

P01-029
Stabilizing Zein Nanoparticle Dispersions With Carrageenan
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Introduction: Zein is a protein abundant in corn gluten meal and corn gluten feed, byproducts of corn milling. This generally recognized as safe (GRAS) protein is hydrophobic and has already been shown to successfully encapsulate and improve the stability and bioaccessibility of hydrophobic bioactive compounds. However, zein nanoparticles (ZNP) suspended in water are inherently unstable and aggregate within one week. They are especially important, as they are environmentally friendly and can be synthesized using renewable resources. Therefore, these may be obvious choices as emulsifiers in o/w emulsions.

Results: The average weight of nanoparticles was from 20 fractions varied from 259.47g to 493.42g. MN and W produced the heaviest fruits, but their juice to peel ratios were lower than others. PSO contents ranged from 15.23-21.32% (dry basis). The pectic and acid values were not significantly different. Total phenolic contents (TPC) ranged from 146.29-279.32, 6.61-13.20, 5.86-9.04, and 4.28-6.19 mg gallic acid equivalent/g dry sample for the peel soluble, peel insoluble, seed soluble, and seed insoluble fractions, respectively. Trolox equivalent antioxidant capacities (TEAC) of the 4 fractions varied from 241.23-562.43, 17.40-26.51, 2.45-4.52, and 6.53-9.77 mg/g dry matter. The Wonderful variety possessed the highest TPC and TEAC, followed by the PH, V, MN, and P cultivars.

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Method: 
ZNPs suspended in water were produced by the antisolvent precipitation method and combined with iota carrageenan (ICGN) suspended in sodium phosphate buffer at ratios of 1:0, 2:1, and 1:1 ZNP:ICGN. Samples were stored at 4°C to evaluate stability over time. Particles were characterized with Dynamic Light Scattering (DLS), Turbidity, and Zeta Potential on days 1, 3, and 7 at pH 5.7.

Significance: 
In conclusion, ICGN has been shown to stabilize ZNP and prevent aggregation over 7 days. With improved stability, ZNP can be used to improve bioaccessibility or stability of functional compounds in food like nucleotides or antimicrobials through encapsulation. Successful commercialization of this protein would add value to a byproduct of corn production.

Results: 
It was found that at pH 5, average ZNP radius was about 100 nm. However, at all higher pH levels the particle size immediately aggregated to 1000 nm. The addition of ICGN at both 1:1 and 2:1 ZNP:ICGN kept the particle radius at about 100 nm from pH 5.25-6.75, and at pH 7.0 the particle size radius was 200-400 nm. These particles remained stable past 7 days. The ZNP combined with ICGN also had significantly lower turbidity than ZNP alone.

P01-030
Chemical Characterization, Functionality, and Baking Quality of Intermediate Wheatgrass (Thinopyrum Intermedium), a Novel Perennial Crop
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Introduction: 
Intermediate Wheatgrass (IGW) or Thinopyrum intermedium, is a perennial crop of interest to agronomists due to its extensive root system that result in reduced soil and water erosion, and increased nitrogen fixation. However, farmers will be reluctant to plant this crop without an established market, which relies on the characterization of IGW grains for parameters relevant to food use.

Therefore, the objective of this study was to analyze lines of IGW for the grains’ chemical composition, functionality, and baking properties.

Method: 
Sixteen IGW lines, along with one bulk IGW sample and wheat controls, were analyzed for proximate composition, dietary fiber, starch composition, and gluten forming proteins, following standard analytical procedures. Starch pasting properties were monitored using a rapid visco analyzer. Dough rheology was assessed using farinograph and Kieffer. Bread baking tests were also performed following AACC method 10-05.01.

Significance: 
This data will assist breeders in their screening and future breeding efforts for the development of IGW lines suitable for food applications. Enhancement of IGW’s protein functionality, determining the effect of fiber on dough development, and the impact of dough conditioners need to be studied.

Results: 
Compared to wheat controls, IGW samples had higher protein and dietary fiber contents, yet were deficient in high molecular weight glutelins (HMWG), an important protein component responsible for dough strength and elasticity. Slight variation in protein profile was observed among the different lines. The fat and ash content of IGW samples were similar to those of the wheat controls. Both farinograph and Kieffer showed weaker IGW dough strength compared to that of controls. These findings suggest that IGW has a superior nutritional profile, but poses challenges for baked products that require dough rising properties. These results can be explained by the lack of gluten network formation, and the higher fiber content that competes with protein and starch for water.

P01-031
Comparison of the Caramelization Kinetics of Beet and Cane Sucrose
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Introduction: 
While sucrose is traditionally thought to thermodynamically melt then undergo caramelization, recent research demonstrated that caramelization, a kinetic process dependent on time and temperature, can occur well below sucrose’s literature reported melting temperature, albeit over longer times. Additionally, a distinct difference between the DSC thermal profiles of white refined beet and cane sucrose sources has been reported. Beet sucrose exhibits one large endothermic peak, while cane sucrose exhibits two endothermic peaks, with one small peak preceding one large peak. Also, the melting onset temperature is substantial lower for cane compared to beet sucrose. Based on these findings, the objective of this study is to examine the kinetics of caramelization for crystalline beet and cane sucrose using Ozawa’s method. This differs from previous kinetic studies of sugar caramelization system, which examined competition of sucrose solutions or of crystalline sucrose at higher temperatures. Additionally, earlier studies only examined cane sucrose caramelization kinetics, not beet.

Method: 
Ozawa’s method is a non-isothermal kinetic model that uses heating rate and onset temperature, measured using DSC, to determine the activation energy (Ea) and pre-exponential factor (A) of the Arrhenius equation for the reaction. To measure the kinetic constants beet and cane sucrose were heated between 0.1 and 10°C/min from 25°C to the temperature at which complete loss of crystalline structure was achieved.

Significance: 
The difference in activation energies for the caramelization reaction between beet and cane sucrose sources suggests that the reaction is inhibited in beet sucrose, otherwise the kinetic constants would be identical. Chemical differences likely cause the disparity in reaction rate between beet and cane sucrose. This kinetic information is useful for developing alternative processing conditions using lower temperatures and longer times for caramel flavor and color production, rather than the traditional high temperature short time process.

Results: 
The average Ea for cane sucrose was 180.3±10.9 kJ/mol with an average A of 2.88E23 min^-1. For beet sucrose the Ea was 781.9±54.2 kJ/mol and A was 3.2E59 min^-1. These values indicate that cane sucrose requires less energy to initiate caramelization (lower Ea) and that molecules involved in the reaction collide less often (lower A) than in the case of beet.

P01-032
Kinetics of Rebaudioside A Degradation in Buffer Solutions as Affected by UV Light Exposure
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Introduction: 
Rebaudioside A (Reb A) is a natural non-caloric high-potency sweetener extracted from the leaves of Stevia rebaudiana. With Reb A use increasing in foods, understanding factors affecting its stability is necessary. The literature contains contradictory data about the photostability of Reb A. In addition, kinetic data are lacking regarding the effect of light on Reb A stability. The objective of this project was to determine the degradation rates of Reb A in buffer solutions as a function of ultraviolet (UV) light intensity.

Method: 
Six solutions containing Reb A were prepared: 0.1 M sodium phosphate (pH 3 and 7), 0.1 M sodium citrate (pH 3 and 7), and water adjusted to pH 3 and 7. Eleven 2-ml glass vials containing each solution were stored at 90°F in darkness, under low intensity UV radiation (365 nm, 27 μW/cm²), and under high intensity UV radiation (365 nm, 190 μW/cm²). Samples were removed at regular time intervals for up to 205 days. Reb A concentrations were determined using HPLC, and pseudo-first-order rate constants with 95% confidence intervals were calculated.

Significance: 
Manufacturers and distributors of beverages containing rebaudioside A must recognize the detrimental effects of light exposure on the stability of Reb A. Appropriate product formulations, packaging, and storage are needed to optimize the shelf life and quality of the Reb A products.

Results: 
Stability was adversely affected by light exposure. The degradation rate constants significantly (p<0.05) with increasing light intensity in all solutions. For example, in pH 7 citrate buffer, rate constants were 0.00016±0.000054, 0.00607±0.00088, and 0.0633±0.0229 1/d in darkness, under low intensity light, and high intensity light, respectively. Under dark conditions, the fastest degradation occurred in pH 3 citrate buffer, followed by pH 7 citrate buffer and then phosphate buffer at both pH levels. The sensitivity of Reb A to UV light was greater in citrate buffers than in water or phosphate buffers.

P01-033
The Effects of Monosaccharides, Disaccharides, Oligosaccharides, and Alditols on the Enthalpy and Temperature of Starch Gelatinization
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Introduction: 
Gelatinization occurs when the crystalline regions of starch granules are disrupted in the presence of heat and water. Understanding and controlling formulation effects on starch gelatinization are important for food structures and textures. The presence of sugars increases the gelatinization temperature (Tgel) and in efforts to reduce sugar in foods, it is important to document the effects of the alternate sweeteners on starch properties.

Method: 
Sweetener solutions (50% solutions of ribose, fructose, mannose, glucose, sucrose, maltose, xylitol, sorbitol, maltitol, isomalt, and maltodextrins) were used to make 2:1 and 1:1 ZNP:iCGN. Samples were stored at 4°C to evaluate stability over time. Combined with iota carrageenan (iCGN) suspended in sodium phosphate buffer at ratios of 1:0, 2:1, and 1:1 ZNP:iCGN. Samples were stored at 4°C to evaluate stability over time.

Results: 
Stability was adversely affected by light exposure. The degradation rate constants significantly (p<0.05) with increasing light intensity in all solutions. For example, in pH 7 citrate buffer, rate constants were 0.00016±0.000054, 0.00607±0.00088, and 0.0633±0.0229 1/d in darkness, under low intensity light, and high intensity light, respectively. Under dark conditions, the fastest degradation occurred in pH 3 citrate buffer, followed by pH 7 citrate buffer and then phosphate buffer at both pH levels. The sensitivity of Reb A to UV light was greater in citrate buffers than in water or phosphate buffers.

Significance: 
With a better understanding of how sweeteners influence starch gelatinization, a selective sugar replacement strategy can be developed to maintain the desirable Tgel and ultimately produce high quality reduced sugar products.
Results:
As the MW of the sweetener increased, the Tgel increased. For isomers and alditols with similar MWs, the Tgel varied based on the number and strengths of H-bonds between the sweetener and starch, and alditols tended to result in a greater Tgel, possibly due to the open structure having a greater flexibility to stabilize the starch granule. No trends were found between the Tgel and the aw, or between Tgel and the enthalpy of gelatinization. Vacuum treatments applied to study the effects of sweetener diffusion into the granule, with and without emulsifiers present, resulted in higher Tgels.

P01-034
Moisture-Induced Crystallization Behavior of Amorphous Sucrose Prepared by Various Amorphization Methods and the Thermal Behavior of the Resultant Crystals
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Introduction:
Amorphous sugars are key ingredients in food and pharmaceutical products due to their encapsulation abilities, high dissolution rates, and high solubility. However, amorphous sugars often undergo undesirable heat and/or moisture-induced physical changes, including stickiness, caking, and recrystallization. Though the physical stability of amorphous sugars has stimulated substantial research, one aspect of physical stability requiring further study is the effect of amorphization method on moisture-induced crystallization behavior. Thus, the objectives of this research were to compare the moisture-induced crystallization behavior of amorphous sucrose prepared by various amorphization methods, including freeze-drying, spray-drying, ball-milling, melt-re-crystallization, and spin-melt-quenching, and to assess the thermal behavior of the resultant crystals.

Method:
Moisture sorption profiles of amorphous sucrose, prepared using the aforementioned amorphization methods, were obtained from 10 to 90%RH at 10%RH increments at 25°C using a Dynamic Vapor Sorption instrument. For %RH values from 10% to 40%, samples were held at the desired %RH for 2000 minutes; for %RH values from 50% to 90%, samples were held at the desired %RH until a dm/dt criterion of 0.0005% was achieved for 10 consecutive minutes. All %RH samples, as well as “as-is” amorphous samples prepared by each amorphization method, were analyzed for glass transition, cold crystallization, and melting parameters using a TA Instruments Q2000 DSC.

Significance:
Overall, this research provides the food and pharmaceutical industries with new connections between commercially relevant processing methods and their impacts on stability, quality, and storage conditions of amorphous sugar-based products.

Results:
Under the experimental conditions employed, the minimum %RH for moisture-induced crystallization at 25°C was found to differ by amorphization method. Ball-milled sucrose recrystallized at and above 30%RH; freeze-dried, spray-dried, and spin-melt-quenched sucrose recrystallized at and above 40%RH; melt-quenched sucrose recrystallized at and above 50%RH. Although freeze-dried, spray-dried, and spin-melt-quenched sucrose shared the same minimum %RH for recrystallization, notable differences in the shape of the moisture sorption profiles for each sample demonstrate that amorphization method influenced moisture sorption behavior. When recrystallized at their minimum %RH, all sample types exhibited two endothermic DSC peaks. However, the onset temperature for both peaks varied as a function of amorphization method, with ball-milled samples showing the lowest values.

P01-035
A Novel Method for Qualitative Detection of Warmed-Over Flavor
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Introduction:
We applied colorimetric sensor array (CSA) technique to detect warmed-over flavor (WOF) in cooked chicken during refrigerated storage.

Method:
In order to fabricate a sensor array to detect volatile compounds associated with WOF, mainly aldehydes, sensing materials were prepared with 2,4-dinitrophenylhydrazine (DNPH) and pH indicators, and the sensor was fabricated by printing the sensing materials on a support material. Color changes of the array exposed to each sample were captured by digital camera, and color values were extracted for each sensing spot. The responses of the sensor array to the samples were studied by principal component analysis (PCA), hierarchical cluster analysis (HCA), and partial least squares regression (PLSR) to classify the samples with different storage time as well as to assess relationships between the CSA responses and indicators responsible for WOF development.

Significance:
To the best of our knowledge, this is a first attempt to monitor WOF development by CSA, and we found that the CSA can be used for qualitative detection of WOF.

Results:
The first 6 dimensions of 23 total dimensions explained 87.00% of the total variance, and most samples clustered according to refrigerated storage time and separated from each other by the first two principal components obtained from PCA. In addition, the samples were correctly clustered according to storage time without misclassifications by HCA. The PCA and HCA results showed that the CSA could distinguish between each storage time. For the TBARS prediction model, the correlation coefficient (r²p) was 0.9997 in the prediction range of 0.28-6.9 mg/kg. In each of the prediction models for perntanal, hexanal, and heptanal, all r²p were higher than 0.960 in the range of 0.58-2.10 mg/kg, 5.50-11.9 mg/kg, and 0.09-0.16 mg/kg, respectively. The correlations between CSA and TBAR or GC methods by PLSR demonstrated that the CSA could well predict WOF development in the samples.

P01-036
An Effective Mass Production Process for the Natural Sweet Compound Phyllodulcin From Sweet Hydrangea Leaves (Hydrangea Macrophylla Thunbergii Makino)
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Introduction:
Sweet hydrangea leaves have been traditionally used as medicine for therapeutic purposes and also consumed as tea due to a distinct sweet taste. Phyllodulcin is the key compound that exhibits antiallergenic and antifungal activities as well as a minty sweet taste. Despite of the great potential of this natural compound, the process for effective purification of phyllodulcin from hydrangea leaves has not been fully established. The objective of this study is to establish an efficient mass production process for phyllodulcin including pretreatment, extraction, decolorization, demineralization, and isolation.

Method:
The water soaking process for phyllodulcin biosynthesis by intrinsic β-glucosidase was optimized by applying different amounts of water at different reaction times. Scale-up extraction efficiency for 1 kg hydrangea leaves was also examined at 35°C with 70% (v/v) ethanol at various time points. Decolorization and demineralization were performed using a mixed bed column of anionic and cationic exchange resins. Various types of cartridges were also tested to further pretreat the extract, and phyllodulcin was purely isolated with acetonitrile as eluent using a preparative recycling HPLC system equipped with an ODx AP column.

Significance:
This promising mass production procedure would be beneficial for industrial utilization of phyllodulcin as a potential high-intensity sweetener.

Results:
When lyophilized leaf powder was mixed with 5 mL water and stood for 15 h at 30°C, phyllodulcin was fully biosynthesized via an endogenous β-glucosidase reaction. The amount of extracted phyllodulcin differed according to the extraction time (p<0.05) and the greatest yield of phyllodulcin (26.94 mg/g) was obtained with 30 min extraction at 35°C. Depending on the type of mixed bed ion exchangers for demineralization and decolorization of the crude extract, significantly different recovery of phyllodulcin ranged from 32.26 to 91.30% (p<0.05). The greatest amount of phyllodulcin was recovered from the combination of cationic Amberlite 200C Na+ and anionic Amberlite IRA-67 resins. The HLB cartridge removed impurities and colorants effectively, and the resulting pale yellow solution was over 90%. Finally, highly pure phyllodulcin was produced by recycling preparative HPLC, with over 99% purity and 2.12% yield. With the established scale-up process, a considerable amount of phyllodulcin can be obtained from hydrangea leaves.

P01-037
Spectral and Colorimetric Characteristics of Metal Chelates of Acylated Cyanidin Derivatives
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Introduction:
In food products, colorants derived from nature are becoming increasingly popular due to consumer demand. Anthocyanins (ACN) are a versatile class of naturally occurring pigments that produce red-purple-blue hues in nature. In the pH conditions of many food products ACN typically appear red-purple, but through metal ion chelation and molecular copigmentation, ACN can express blue-purple colors. The objective of this study was to evaluate the role of the degree and structure of acylation, as intramolecular copigments, on the spectral responses and stability of ACN-M+ complexes.

Method:
Non-, mono-, and di-acylated cyanidin (Cy) derivatives were isolated from food sources by semi-preparative HPLC. The ACN isolates were diluted to 50 µM concentrations in pH 6 with equimolar Al3+ ratios, λmax (nm) of malonic acid monoacylated Cy: 563 < triglycosylated Cy: 576 < monoacylated with hydroxycinnamic acids (sinapic: 579 < coumaric: 580 < ferulic: 583) < diacylated Cy (sinapinic-sinapinic: 596< ferulic-sinulic: 609. 

Significance:
Not only did metal chelation induce color evolution of ACN towards more purple and blue hues, fulfilling current demands for alternatives to synthetic colorants, but also increased the stability of these naturally occurring pigments.

Results:

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P01-038 Production of Polyhydroxybutyrate (PHB) From Switchgrass Pretreated With a Radio Frequency-Assisted Heating Process

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Introduction: Radio frequency (RF) was evaluated as a biomass pretreatment approach to generate hydrolysates. Then, the practicality of using this hydrolysate as medium to grow recombinant E. coli utilizing pBBR68 plasmid for production of polyhydroxybutyrate (PHB), a biodegradable plastic, was explored in this study.

Method: Switchgrass was pretreated under alkaline conditions with RF-assisted heating (traditional water bath heating as a control) and further enzymatically hydrolyzed to produce hydrolysates. Fermentation was conducted using the hydrolysates as carbon sources with or without yeast extract (as supplemented complex nitrogen sources).

Significance: The generated hydrolysates can be used for PHB production directly without concentration and detoxification. This study provided valuable references for developing a sustainable system to convert lignocellulosic biomass into value-added biochemicals in an economically efficient manner. It is expected that results of this study can subsequently be applied to enhance the conversion of lignocellulosic biomass for PHB as well as copolymer (such as PHBV and P(3HB-4HB)) production, thus increasing market potential and cost effectiveness.

Results: Results indicated that the hydrolysates generated through RF pretreatment performed consistently better for ABE fermentation than the control. In PHB fermentation using RF pretreated hydrolysates by Clostridium beijerinckii 8052, PHB concentration of 2.25 g/L was obtained, while it was only 1.23 g/L for the supplement medium added with other carbon sources. Yeast extract supplementation (up to 5 g/L) enhanced fermentation under all conditions and diminished the difference of performances among fermentations with different carbon sources. Taken together, this work demonstrates that radio-frequency (RF)-based dielectric heating pretreatment is a promising and efficient procedure in the biofuel production from lignocellulosic biomass.

P01-039 Characterization, Optimization, and Design of Helical and Double Tube Heat Exchangers

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Introduction: Heat exchangers can be characterized by their ability to thermally process many types of fluids. The first goal of this study was to compare the efficiency (in terms of overall heat transfer coefficient and pressure drop) of double tube and helical heat exchangers. The second goal was to determine the effect of product parameters (such as viscosity) and process parameters (such as flow rate) on overall heat transfer coefficient in a double tube heat exchanger. The third goal was to evaluate the effect of a static mixer on improving the homogeneity in the radial temperature distribution within the product. The fourth goal was to develop an Excel spreadsheet to determine optimal system parameters during processing.

Method: Water was pumped through the helical heat exchanger and an additional three fluids of different viscosities (1% CMC, 1.8% CMC, and 2% CMC) were pumped through a double tube heat exchanger at flow rates of 2, 4, and 6 gpm and at hot water temperatures of 95°C and 110°C. The temperature, pressure, and flow rate of product and the flow rate of the heating/cooling media were measured. The energy transferred, pumping power, pressure drop, and overall heat transfer coefficient were then calculated. Temperature was measured at three radial locations before and after the static mixer to determine its effectiveness in improving uniformity.

Significance: This research helps reduce trial and error by assessing how to design a system most suitable to a particular process. It provides insight on how to optimize an existing system by altering parameters (flow rate, hot water temperature, product, etc.) to achieve a desirable outcome (heat transfer, pumping power, etc.). Additionally, it provides the information necessary to help industries choose whether helical or double tube heat exchangers would be effective for their product.

Results: Overall heat transfer coefficient and pressure drop were significantly higher in the helical heat exchanger. Higher flow rates and lower viscosities proved advantageous in increasing the overall heat transfer coefficient. The mixer was most efficient at higher flow rates. Further, this spreadsheet was found to be effective in determining optimal system parameters for a particular process.

P01-040 Oil Surface and Interfacial Tension as Affected by Composition, Temperature, and Time

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Introduction: Surface and interfacial tensions influence the characteristics of processed foods, which can affect food processing kinetics, drop/bubble properties, and oil absorption. Food applications like frying take place at elevated temperatures required to obtain optimal food properties. The goal for this study is to develop an understanding of the relationship between temperature, time, and surface and interfacial energy in systems containing various oil-soluble surfactants. Both equilibrium and dynamic tensions were studied.

Method: Drop profile and maximum bubble pressure methods were used to measure dynamic oil/aer interface tension and oil/water interfacial tension, and the Wilhelmy plate method was used to measure equilibrium tension. Surface tensions of commercial vegetable oils (corn, soybean, peanut, olive, and canola oils) and pure triglycerides (triolein and tricaprylin) were investigated at different temperatures, with and without amphiphiles (fatty acids, monacrylin, and sorbitan monooleate) added deliberately. Purification of the commercial oils was also performed and the surface tension was compared to untreated oils.

Significance: In many food processes, such as spray drying, emulsification, and bubble formation in frying, the surface or interface is created very rapidly, and its energy or tension will affect the physical and chemical properties of food. Based on our study, lower oil surface tension at higher temperatures reduces the pressure needed to form steam bubbles during frying, hence increase rates of heat transfer. The difference of surface and interfacial tension among oils and the different surface-activity of surfactants provide guidance for the formulation of optimal emulsifiers, frying oils, and wetting agents in foods.

Results: Results showed that surface tension decreased significantly as temperature increased from 20°C to 200°C. Oil/surface tension ranges among commercial vegetable oils and purified oils were nearly indistinguishable, and only a small subset of added amphiphiles had some effect in lowering the tension. The addition of amphiphiles to the oils decreased interfacial tension dramatically and led to a stronger time-dependence in tension compared to the oil/surface. Monacrylin and sorbitan monooleate are among the best candidates for lowering interfacial tension.

P01-041 Extrudate Products With Corn Grits, Garbanzo Flour, and Distiller’s Dried Grains Developed for Food Applications: Physical Properties, Sensory Acceptability, and Glycemic Index

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Introduction: Pulse flours, when combined with distiller’s grains, represent a novel blend as they are gluten-free and high in protein and fiber content. The present study investigated the effects of distiller’s dried grains developed for food applications (FDDG) on the physical and sensory quality characteristics and glycemic index (GI) of garbanzo flour (GF)-corn grits (CG) based extruded products.

Method: Based on preliminary evaluation with different proportions of GF and CG, 50% CG was kept constant for all the extrusion runs and a blend of 50:50 GF and CG was chosen as the control. Garbanzo flour was replaced with FDDG at 15% and 30% and was extruded in a Brabender laboratory single screw extruder at barrel temperatures of 100, 125, and 150°C and screw speed 100, 150, and 200 rpm at a moisture content of 15 and 20%. A 4:1 compression ratio screw and a 3 mm die were used for all runs. The extruded products were evaluated for their physical (moisture-retention, expansion, hardness, water solubility index (WSI), and water absorption index (WAI)), sensory (flavor, texture, color, and overall acceptability) characteristics and in vitro glycemic index (GI) to evaluate their suitability as extruded snack products.

Significance: FDDG could be incorporated up to a level of 30% in a GF-CG blend to develop snack products similar to Cheetos® type snacks with acceptable physical and sensory properties, and low glycemic index.

Results: Incorporation of FDDG decreased torque and product expansion, but increased bulk density and hardness. The barrel temperature had a significant effect (P<0.05) on these...
parameters. Optimum extrusion conditions resulting in minimum bulk density and maximum expansion ratio were estimated. The expanded products have good cell structure with varying cell sizes when viewed under a microscope. WSI increased while WSI decreased compared to the control (P < 0.05). Samples flavored with cheese and onion flavors were used for sensory evaluation along with unflavored selected samples. The means scores of sensory evaluation indicated that all products containing FDDG up to 30% were within the acceptable range. There were no significant differences (P > 0.05) between products containing 15–30% FDDG in their color, flavor, texture and overall quality.

P01-042 Purple Pole Beans: Color and Anthocyanin Change During Heating E. Bornhorst, Washington State University, J. Tang, Email: ellen.bornhorst@wsu.edu

Introduction: Heirloom vegetables, such as purple beans, have become increasingly popular with American consumers. Anthocyanins responsible for the purple bean’s color are present in the outer layer of the pod skin. Cooking is a common way to prepare beans; however, when purple pole beans are heated, the purple color of the pod fades. Previous research on purple pod pole beans (Porr) focused on the anthocyanin content, but there is limited knowledge on the heat sensitivity of purple bean anthocyanin pigments during cooking. The objective of this research was to perform a kinetic study on the color and anthocyanin change during heating of purple pole beans.

Method: Fresh purple pod pole beans were obtained from the Moscow, ID farmer’s market. Beans were washed and cut into 4.5 cm long segments that were placed into custom-made aluminium test cells and heated at 60, 70, or 80°C for 0 to 30 minutes. Three replicates were performed for all time points. Color was quantified in CIELAB (L*‘a*‘b*‘) color space using a computer vision system that included a digital camera, light pod, and image analysis. Total monomeric anthocyanin pigment content was measured using the pH differential method.

Significance: During cooking of purple beans, the purple color disappears, but it still contains anthocyanins that may have diffused into the inside of the bean. These findings can help educate consumers about purple beans and improve processing of heirloom vegetable varieties to maintain quality.

Results: Raw purple beans had a dark purple color (L*‘22.8±1.7, a*‘4.1±0.9, b*‘-0.4±0.4) and total monomeric anthocyanin content of 130±5 mg cyanidin-3-O-glucoside/g sample. During heating the purple color faded yielding beans with a green color. The time it took to reach a completely green color was 10 minutes at 60°C (L*‘147.8±2.2, a*‘-2.1±1.2, b*‘15.8±2.4), 5 minutes at 70°C (L*‘167.1±1.8, a*‘-3.9±0.8, b*‘20.9±1.8) and 3 minutes at 80°C (L*‘149.3±2.1, a*‘-4.2±1.2, b*‘25.1±2.0). After the dramatic pod color change, ~75% of the anthocyanins remained. This implied that when the bean began to soften during cooking, the anthocyanins dissolved and diffused into the bean interior where they would not have been visible because of the pH (~5.5).

P01-043 Effects of Acidification of Sweet-Potato-Based Products in Regards to Dielectric Properties for Microwave Processing M. Caudill, North Carolina State University, V. Truong, J. Simunovic, Email: mocaudill@gmail.com

Introduction: Continuous flow microwave sterilization and aseptic packaging of low acid foods such as sweet potato puree has been successfully commercialized and consumed. With high cartridge content, SP can be mixed with fruit juices/purées to enhance the phytonutrient profiles in various healthy food applications. Decreasing the pH of the products to an acidic range of < 4.6 would lower the required heat treatment resulting in reduced degradation of thermosensitive nutrients. For microwave processing, dielectric properties determine the interaction between the products being processed and electromagnetic energy. This study aimed to (1) measure the dielectric properties of acidified SP formulations and (2) compare the measured values of dielectric constant (ϵ‘) and loss factor (ϵ‘‘) with those calculated using mixture equations.

Method: Covington sweet potatoes were cut into slices, steamed, ground into puree, and formulated with lemon juice, citric acid, strawberry puree, raspberry puree, and apple puree into various formulations with an acidic pH of 3.8. Dielectric properties of these SP formulations had moisture contents of 82-88% which did not affect the measured dielectric properties. All formulations followed the expected trend in which the ϵ‘ decreased linearly and the loss tangent (ϵ‘‘/ϵ‘) increased linearly as temperature increased. The measured ϵ‘ and ϵ‘‘ results were in good agreement with the calculated values using the complex refractive index mixture equation.

P01-044 Electrochemical Impedance Spectroscopy for Detecting Controlled Growth of Biofilm in a Flow System D. Yang, University of Georgia, J. Reyes De Corcuera, Email: ydylyqym@uga.edu

Introduction: Biofilm is an important concern in drinking water and food contact surfaces such as processing pipelines. Biofilms not only harbor pathogens but also other bacteria that induce corrosion, clog filters, and foul equipment reducing performance. Mature biofilm is inherently highly resistant to disinfectants while young biofilm is relatively easier to be eliminated. Therefore, it is critical to detect biofilm growth in real-time. Although electrochemical methods such as electrochemical impedance spectroscopy (EIS) have been reported correlated to biofilm growth, there are no reports on the dynamic electrochemical characterization in continuous flow systems with well-controlled levels of inoculum in suspension. The objective of this study was to characterize the dynamics of biofilm formation at selected, well controlled levels of inoculum in suspension.

Method: A flow system for continuous, precise dilution and control of bacterial loads in suspension was built to monitor biofilm growth on the inner surface of stainless steel 316 tubes in a wide range of time intervals (minutes to days). Pseudomonas putida bacterial suspensions were pumped through the system continuously and maintained at 5.1 +/- 0.3 log CFU/ml, 5.5 +/- 0.2 log CFU/ml, 6.8 +/- 0.3 log CFU/ml for 63 h, 49 h, or 12 h, respectively. Biofilm formation was quantified by total plate counting (TPC) using specific designed 8-direction swabbing technique and by potential controlled EIS measurements at 100 mV vs. Ag/AgCl in 3.0 M KCl in the frequency range of 0.1 Hz to 1 MHz.

Significance: This research can help better understand biofilm formation and has potential application in industries, especially in juice processing and water distribution systems.

Results: TPC results showed that biofilm reached 7.0 log CFU/swab, 6.7 log CFU/swab, and 6.3 log CFU/swab while impedance decreased 31.4%, 25.7% and 15.8% respectively after the three entire experiment durations. The regression equations for the corrected Zreal (Z) versus log biofilm colony counts (C) were Zreal = -23.3 C1 + 100.9 with R2 = 0.772 (5.2 < C1 < 70), Zreal = -18.1 C2 + 77.4 with R2 = 0.576 (4.5 < C2 < 6.7), and Zreal = -11.4 C3 +23.4 with R2 = 0.914 (4.9 < C3 < 6.3).

P01-045 The Effect of Components of Chocolate on Electrostatic Spray Quality S. Ren, The Ohio State University, S. Barringer, Email: rs471798221@163.com

Introduction: A continuous coating layer around food prevents food contacting the environment and extends shelf life. Changing the ingredients in chocolate can achieve smaller droplet size during spraying which makes a thinner continuous barrier with less cost. The objective of this research was to determine the effect of each ingredient in chocolate (cocoa butter, sucrose, milk powder, and cocoa liquor) and the effect of tempering in order to produce the best electrostatic spraying quality.

Method: The concentration of cocoa butter (25-45%), sucrose (0-45%), milk powder (0-45%), and cocoa liquor (9.5-29.5%) were varied in chocolate samples. The viscosity was measured using a Brookfield RVDV- II viscometer at 30°C with shear speed from 0-100 rpm. The electrical resistivity was measured using a resistivity cell, electrometer and a voltmeter at 30°C and 125V. Samples were sprayed using a TDC Liquid Electrostatic Coater at 30°C and -25kV. The droplet size was determined by Photoshop 6.0.

Significance: Increasing cocoa butter, decreasing sucrose and keeping an intermediate cocoa butter level improves spray quality and may reduce cost.

Results: The viscosity and resistivity both affected the droplet size. As cocoa butter increased from 25 to 45%, the droplet size generally decreased from 33.60 to 9.87mm2, because cocoa butter decreased the viscosity from 17.34 to 1.97 Pa·s. Liquid with low viscosity needs less energy to break up the filaments, so it generates smaller droplets. The resistivity and the droplet size showed a local peak at 35% cocoa butter; because the increased resistivity slows the movement of electrons to the surface thus reducing the repulsion which is needed to break the liquid into droplets. Similarly, as sucrose decreased from 45 to 30% and milk powder correspondingly increased from 0 to 15%, the droplet size decreased from 51.5 to 22.5mm2, because the resistivity decreased. The viscosity did not change as sucrose increased. As cocoa liquor increased from 0 to 29.5%, the droplet size and resistivity decreased and then increased, while the viscosity only decreased as cocoa liquor increased. Tempering chocolate increased the droplet size and the viscosity of the chocolate. Tempering did not change the resistivity.

P01-046 Acid and Moisture Uptake in Red Beets During Simulated Gastric Digestion With Varying pH in the Gastric Environment Y. Mennah-Gowela, University of California, F. Jannuzzi Guerreiro, C. Lemos, G. Bornhorst, Email: mennah@ucdavis.edu
Introduction: Red beets (Beta vulgaris L.) are consumed worldwide and their production is increasing. They are rich in nutrients such as betalains, and have antioxidant properties that might be affected by processing and pH of the gastric environment. Depending on the food consumed, stage of digestion, gastric mixing, or individual variability, the pH of the gastric environment may vary. The objective of this study was to determine moisture and acid uptake in canned, raw, and boiled red beets during simulated gastric digestion with varying gastric juice pH.

Method: Red beets were cut into cubes (12mm side length) and underwent simulated gastric digestion for each digestion, ten cubes were mixed with simulated saliva (0.2 mL/g) for 30s, then 100 mL of gastric juice (pH 1.8, 3.0, or 4.8) was added, followed by incubation in a shaking water bath (100 rpm) at 37°C for up to 240 min. Samples were taken at 9 time points. Acidity was measured via potentiometric titration and moisture content was measured gravimetrically. Triplicate digestions were completed.

Significance: The rate of acid and moisture uptake in red beets depends on the processing method and gastric pH. Understanding how acid interacts with foods is crucial to predict the its behavior during digestion to determine optimal food processing for specific food functional properties.

Results: Processing treatment, pH, digestion time, and their interaction significantly influenced acid uptake (p < 0.0001). For all gastric pH, acid and moisture uptake was higher in canned red beets, compared to raw and boiled. As expected, in all processing treatments, acid uptake was greater in digestions of pH 1.8 (ranging from 2.9±0.1 to 12.1±2.2 mg HCl/g dry matter after 240 min), canned. Moisture uptake was significantly influenced by processing method, pH, digestion time (p < 0.0001), but not by the interaction of the three (p > 0.05). For all gastric pH, canned and boiled had greater moisture uptake than raw red beets. For example, in pH 3.0, moisture in canned red beets increased from 99.9% to 94.8%, in boiled from 88.1 to 92.7%, and in raw from 86.8% to 88.4%.

P01-047
The Effect of Pigment Purity, Temperature, and Amount of Carrier on the Yield and Final Color Properties of Spray Dried Purple Corn Anthocyanin Powders
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Introduction: Spray-drying is an economic technique to increase shelf-life of heat sensitive materials. It has been successfully used to produce anthocyanin-rich powder but the impact of the spray-drying process on color quality and pigment stability has not been well characterized.

Method: This study evaluated yields of monomeric and polymeric anthocyanins, color properties (L*, c*, h*), haze and anthocyanins HPLC profiles before and after spray-drying of varying anthocyanins extracts (hot water extracts, 40% aqueous ethanol extracts, C18 purified pigments), inlet temperature (130, 150, 170°C) and amount of maltodextrin (2%, 5%, 10%).

Significance: Quality of feeding materials, and drying conditions affected the yield and quality of the final product. Hot water extracts sprayed-dried with 5% maltodextrin under 150°C gave the highest anthocyanins yield and good solubility with the least color or pigment changes.

Results: The yield and final color quality of spray-dried purple corn anthocyanins were associated (p<0.05) with anthocyanins purity, inlet temperature, and amount of maltodextrin. The amount of carrier had the biggest impact on anthocyanins yield, associated (p<0.05) with anthocyanins purity, inlet temperature, and amount of maltodextrin. The yield and final color quality spray-dried purple corn anthocyanins were associated (p<0.05) with anthocyanins purity, inlet temperature, and amount of maltodextrin. The amount of carrier had the biggest impact on anthocyanins yield, associated (p<0.05) with anthocyanins purity, inlet temperature, and amount of maltodextrin.

P01-048
Solvent-Free Fabrication of Curcumin Nano-Particles With Enhanced Solubility and Antioxidative Action
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Introduction: Curcumin is a naturally occurring hydrophobic polyphenol found in tumeric (Curcuma longa). Various activities of curcumin, including anti-inflammatory, anti-cancer, anti-oxidant, as well as anti-microbial effects have been widely studied in recent years. Despite its pharmacological and anti-microbial benefits, its application in food is limited due to its poor solubility and bioavailability.

Method: In this work, the ultrasound-assisted size reduction of curcumin to nano-scale was carried out in order to enhance its delivery and anti-oxidative efficacy. Subsequently, physical properties of curcumin nanoparticles (CNPs) such as morphology, melting point, crystal structure, and solubility were investigated. Finally, anti-oxidative efficacy of CNPs was evaluated using oxygen radical absorbance capacity (ORAC) assay.

Significance: This solubility and antioxidant efficacy enhancement achieved by a simple size reduction process to nano-scale will endow curcumin application with a high potential in the nutraceutical and pharmaceutical industry.

Results: As a result, fabricated CNPs with an average size of 164 nm demonstrated 1.8-fold increased solubility comparing to micron-sized curcumin. X-ray diffraction pattern revealed the increase of amorphous portion in curcumin from less than 5% to 20% after size reduction. Also, a morphology change from crystalline structure to amorphous shape and a melting point depression of CNPs was observed via SEM and DSC. Lastly, the antioxidant efficacy of CNPs was enhanced 6.1-fold compared to the unprocessed curcumin.

P01-049
Influence of Food Residues on Electrical Conductivity and Active Alkaline Magnitudes in CIP Cleaning Solutions
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Introduction: In the food and beverage industry, cleaning and sanitizing is completed through Clean-in-Place (CIP) systems. Residues deposited on the food-contact surfaces during processing are removed through CIP system cleaning solutions; typically sodium and/or potassium hydroxide blends with other chemicals as adjuncts (including chlorine). Monitoring of active alkaline concentration and electrical conductivity (EC) in the cleaning solutions may be an indicator of cleanliness of the surface. Active alkaline concentration is a measurement of hydroxyl group in the cleaning solution. In a manufacturing plant, titrations to determine active alkaline concentration cannot be measured during continuous cleaning operations. Therefore, the in-line measurement of EC was introduced as an indicator to determine active alkaline concentration. The objective of this study was to establish a relationship between the levels of food residue, and the levels of electrical conductivity and active alkaline in solutions to accomplish cleaning requirements.

Method: Reconstituted non-fat dry milk (NFDM) 20% w/w solution was used in this experiment to create a model food residue. Three different percentages (w/w) of sodium hydroxide (0.5%, 1.0%, 1.5%) and potassium hydroxide (0.5%, 1.0%) were prepared. The increasing volumes of NFDM (0ml, 0.2ml, 0.4ml, 0.6ml, 0.8ml, 1.0ml) were added to a fixed volume of sodium hydroxide solution. Changes in active alkaline concentration, EC, and protein concentration were measured through acid-based neutralization titration, EC meter, and BCA protein assay, respectively.

Significance: From the standpoint of a sensor, the effectiveness of cleaning may be indirectly measured by electrical conductivity and active alkaline concentration of the cleaning solution during CIP operations.

Results: The results from this investigation demonstrated a strong linear relationship (R²=0.96) between the electrical conductivity and the active alkaline concentration in the cleaning solutions containing food residues. As the amounts of NFDM added to cleaning solution increased, both electrical conductivity and active alkaline concentration decreased. The magnitudes of decrease in both EC and active alkaline were proportional to the increase of protein concentration in solution. It was found that 1.5% w/w sodium hydroxide solution had the largest decreasing rate in electrical conductivity and active alkaline concentration.

P01-050
Development of a Novel Functional Drink Using Nanotechnology
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Introduction: Currently, there are a lot of functional drinks to help quickly replenish water and electrolytes after physical training. These drinks contain only water soluble vitamins (mainly B complexes) and very few salts as electrolyte, while a combination of water and fat soluble vitamins, as well as BCAAs is very difficult to be realized due to their different solubility and stability. In this study, a novel formulation of functional drink with a complete supplementation of electrolyte, water and fat soluble vitamins, branched chain amino acids (BCAA), as well as peppermint oil (antimicrobial agent) was developed. Nanotechnology, combining nano-emulsification and nano-complexation, was adopted to overcome the complexity and achieve multifunction.

Method: The nano-sized particles were prepared through multiple steps including
homogenization, pH adjustment, pasteurization, and centrifugation. Peppermint oil and fat soluble vitamins were first emulsified in aqueous phase containing sodium caseinate, and nanocomplex particles were formed by inducing adsorption of pectin on casein nanoparticles during pH adjustment and heating treatment. The physicochemical properties, including particle size, polydispersity index, zeta potential, stability, and antioxidant activity, were comprehensively investigated. Both freeze-drying and nano spray drying technologies were applied to obtain powders of functional drinks, and the morphology of powders was observed under scanning electron microscope.

Significance:
A novel formulation of functional drink containing a complete profile of nutrients were successfully developed, and promising physicochemical properties were achieved. Nanotechnology was simply integrated into the manufacturing of this functional drink while no specialized instrument was needed, suggesting the great potential of future scale-up production and commercialization.

Results:
The final particle size, PDI and zeta potential of the functional drink were 200 – 300 nm, 0.2 – 0.4, and −25 to −35 mV, respectively, depending on the concentrations of NaCas and pectin, and fabrication pH. The functional drink was stable under both 4 and 25 °C up to 30 days of storage. The functional drink also exhibited significantly stronger antioxidant activity compared to egg yolk LDL, inducing pro-oxidant activity of LDL. Spray-dried powders were microparticles, while freeze-dried powders had flake-like morphology. Both powders were successfully redispersed in water with nano-scale size.

P01-051
Egg Yolk LDL/Pectin Nanogels as Potential Oral Delivery Vehicles for Nutrients
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Introduction:
Egg proteins have many desirable and unique functional properties, including emulsifying, gelling, and foaming characteristics. Although egg white as a food protein-based biomaterial has been widely studied for its potential to encapsulate and deliver bioactives, yolk protein has received very limited attention in this field. The first objective was to systematically characterize the nanostucture of egg yolk LDL. The second objective was to develop LDL/pectin nanogels and explore their encapsulation and delivery potentials. Thirdly, the Nano Spray Drying technique was studied as a novel strategy to obtain nano-size solid powders of nanogels.

Method:
The physicochemical properties of freshly extracted LDL were analyzed at different pH conditions to understand its ultrastructure. Nanogels were prepared by a heating-induced crosslinking of LDL, close to the isoelectric point of LDL, to induce permanent denaturation and facilitate adsorption of pectin. The pure LDL and nanogels were characterized by particle size, polydisperse index, and zeta potential. The morphology was observed under both scanning and transmission electron microscope. The molecular interactions were investigated by Fourier transform infrared (FT-IR) spectroscopy. Curcumin was encapsulated as a model compound and controlled release profile was studied in simulated gastric and intestinal fluid.

Significance:
Our results indicated that egg yolk LDL is a great natural biomaterial to fabricate nanoscale delivery systems. The novel LDL/pectin nanogels have promising features for oral delivery of nutrients, providing a low-cost approach for the functional food industry.

Results:
The prepared nanogels had a diameter of 8-16 nm and zeta potential of -41 mV, with spherical shape, smooth surface, and homogeneous size distribution, as evidenced by dynamic light scattering (DLS) and TEM. The FT-IR spectrum revealed that hydrophobic and electrostatic interactions were the driving forces to form nanogels. The spray-dried nano-size powder of nanogels exhibited excellent re-dispersibility in water, overcoming the drying challenge (irreversible gelation) of egg yolk LDL and greatly expanding the practical applications. The mass ratio of curcumin/ LDL played an essential role in determining the particle size (120-300 nm) and encapsulation efficiency (66-100%). The nanogels had excellent stability under simulated gastrointestinal conditions with the presence of digestive enzymes and enabled controlled release of curcumin.

P01-052
Selective Separation of Two Model Proteins Using Stimuli-Responsive Polymer Chitosan in an Aqueous System
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Introduction:
Although several methods for protein purification have been developed in bioseparation processing, there is still a need for a process that offers efficiency, simplicity, reliability, and low cost. Biopolymers provide an option for protein purification and are being used for several reasons such as biodegradability, cost efficiency, non-toxicity, and abundance in nature. In this study, the effectiveness of chitosan, a pH-responsive polymer (pI=6.5), was evaluated as a flocculating agent in the separation of two model proteins, bovine serum albumin (BSA, pI=4.5) and lysozyme (pI=11). A process was developed based on inverse transition cycling where changing the pH creates alternating environments where electrostatic interactions will allow the binding and unbinding of the protein from the polymer.

Method:
Protein and polymer were mixed at pH values where charges were complementary, followed by inducing a phase transition change of chitosan by increasing pH (above 6.5) and entrapping the protein in the polymer matrix, and finally centrifuging for polymer matrix separation. The resulting pellet was then suspended and adjusted to desired pH (below 6.5) to obtain a soluble polymer, entrapped protein was then quantitated using Bradford assay. Factors used to optimize the process were chitosan molecular weight at 120 kDa and 342 kDa, pH during mixing step at 4.5 and 6, and protein/polymer ratio at 1:1 and 1:10 molar ratio.

Significance:
Results from BSA recovery indicate that the proximity between chitosan pKa and BSA pl values reduced electrostatic interactions during separation process and other polymers with higher pKa values should be selected. Results using lysozyme conclusively showed that chitosan's primary method of entrapment is due to polymer bridging rather than electrostatic interaction at chosen pH values. Polymers chosen for protein separation should not have a pKa value close to the pH where electrostatic interactions should prevail to inhibit charge neutralization.

Results:
Results showed that none of the three factors were significant (P<0.05) for BSA separation; however, pH and protein/polymer ratio were significant (P<0.01) for lysozyme separation. Based on these results, the most efficient conditions for BSA capture was using the 120 kDa chitosan in 1:1 molar ratio and at pH 6.0 resulting in 27% protein separation.
the films decreased as TiO2 concentration increased. To test the bactericidal activity of the films, a film cover method was used. A piece of TiO2 CA film (4x4 cm2) was applied onto a drop of 1 ml bacteria inoculum in a petri dish. UV-A light with intensity of 2.00 mW/cm2 was applied from the top for 3 h or 6 h. This arrangement was selected to simulate the practical application, in which case the light has to penetrate through food packaging film before reaching to food/bacteria.

**Significance:**
The results indicate that UV-activated TiO2 polymer films can potentially be used to minimize microorganisms in packaged food during storage and distribution.

**Results:**
After 3 h treatment, no significant bacteria reduction was found for all TiO2 CA films regardless of TiO2 concentrations when compared to blank CA film. Increasing treating time from 3 h to 6 h significantly improved bactericidal activity. After 6 h treatment, CA films containing 1%, 3%, and 5% TiO2 could reduce E. coli O157:H7 by 3.14 log, 2.10 log, and 1.57 log, respectively. The lower microbial inactivation with increase of TiO2 concentration in the films may be due to the reduced UV-A light penetration for films with higher TiO2 concentration as indicated by the UV-A light intensity on the other side of the film (1.13, 0.42, and 0.17 mW/cm2 for 1%, 3%, and 5% TiO2 CA films, respectively).

**P01-055**
**Thermal Inactivation of Salmonella Agona in a High-Fat Matrix as Influenced by Water Activity**

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**Introduction:**
Salmonella can survive in low-moisture-high-fat foods for several years. Despite nationwide outbreaks and recalls for Salmonella associated with high-fat products, information on inactivation of Salmonella during baking of high-fat food products is limited. The objective of this project was to evaluate the impact of water activity and temperature on Salmonella Agona thermal inactivation kinetics in a defined high-fat food matrix.

**Method:**
A high-fat matrix, composed of a 48:26:19 weight ratio of carbohydrate: fat: protein, was inoculated with plate-harvested cells of Salmonella enterica serovar Agona 44796. Buffered peptone water was added at varying levels to achieve water activities of 0.5, 0.6, 0.7, 0.8, and 0.9. The dough was hand massaged and then held in a controlled environment at ambient temperatures (23±2°C) for one hour to equilibrate. Triplicate samples were packed in aluminum test cells and treated under isothermal conditions (60-90°C) for 6 dwell times. Serially diluted samples were enumerated on trypticase soy agar with 0.6% yeast extract after 48 h incubation at 37±2°C. Positive samples were confirmed on xylose lysine deoxycholate agar.

**Significance:**
Critical factors associated with pathogen destruction were identified during treatments. Results indicated that a correlation existed between temperature and water activity. These variables must be accounted for when predicating inactivation of Salmonella enterica in high-fat foods under dynamic process conditions.

**Results:**
The D75ºC-values for water activities of 0.5, 0.6, 0.7, 0.8, and 0.9 were 13.08, 15.32, 4.04, 0.6, 0.7, and 0.8, respectively. The lower microbial inactivation with increase of TiO2 concentration in the films may be due to the reduced UV-A light penetration for films with higher TiO2 concentration as indicated by the UV-A light intensity on the other side of the film (1.13, 0.42, and 0.17 mW/cm2 for 1%, 3%, and 5% TiO2 CA films, respectively).

**P01-056**
**Enhancing the Safety of Fresh Produce Using Sequential Application of Bacteriophage and Gaseous Ozone**

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**Introduction:**
In this study, we aimed to replace the existing postharvest spray application of chlorine with a lytic phage spray on produce after harvest, followed by gaseous ozone treatment during the vacuum cooling process to enhance the safety of produce. Therefore, we assessed the efficacy of a lytic phage, gaseous ozone and their sequential application in inactivating Escherichia coli O157:H7 on fresh produce postharvest intervention method.

**Method:**
Spinach leaves were spot-inoculated either with 5 or 7 log CFU/g of E. coli O157:H7 and sprayed with E. coli phage (~7 log PFU/g) or sterile phage-free peptone water (control). Phage-treated leaves and control samples were held for 60 minutes then subjected to gaseous ozone treatment. The cooling was done at two cooling conditions: initial TiO2 application (28.5 in Hg) was followed by ozone treatment (1.5 g ozone/kg gas-mix, at 10 psi) and holding for 30 minutes.

**Results:**
Phage, gaseous ozone, and their sequential treatments significantly (p < 0.05) reduced the E. coli populations by 1.7, 1.9, and 3.4 log CFU/g, respectively, at higher inoculum level, when compared to control treatments with phage-free peptone water. Log reductions of E. colI O157:H7 were more pronounced at the low inoculum level tested. Log reductions achieved were 2.0 and 3.4 log CFU/g of E. coli O157:H7 from phage and ozone alone treatments, respectively, and no survivors were detected after the sequential treatments. In addition to comparisons with phage-free peptone water control, sequential treatments significantly reduced the E. coli populations by 4 log CFU/g, at least, when compared to inoculated untreated leaves. Color and texture of treated spinach leaves were comparable to the inoculated untreated leaves.

**Significance:**
Ozone and bacteriophage treatments do not have the drawbacks of chlorine application; therefore, their sequential use would fill the current research gap in produce decontamination technologies and meet the need for an intervention method that maintain product quality throughout the processing steps.

**P01-057**
**Effect of Nisin and Lysozyme on Fermented Ciders Contaminated by Lactic Acid Bacteria**

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**Introduction:**
Hard ciders, like other fermented beverages, may be contaminated by a variety of lactic acid bacteria (LAB). Bacteria can impart unwanted flavor qualities and foul production equipment. A successful antimicrobial for cider must control a variety of contaminants and be allowable under the applicable regulations. Hen egg white lysozyme and nisin have been used to target LAB in different applications. Lysozyme is approved for use in wine. Nisin has GRAS status for some food products. To our knowledge, applications of lysozyme and nisin in fermented ciders have yet to be examined in the literature.

**Method:**
Initial efficacy was determined by applying different concentrations of the antimicrobials to agar plates of more than 12 different LAB frequently found as fermentation contaminants. A smaller subset of LAB was used in fermented and bottled cider for this project to evaluate the impact of nisin and lysozyme in bottled cider. This smaller group was selected based on the enzyme sensitivity data, growth in cider, and the literature. During mock contaminations, apple cider was racked from the primary fermentation and priming sugar was added. Samples contaminated with LAB were dosed with lysozyme and/or nisin at the bottling stage. Two weeks after bottling, cider samples were taken and LAB were enumerated using MPN with cycloheximide MRS media.

**Significance:**
These results suggest that nisin and lysozyme can effectively control cider contamination, giving the cider industry alternatives to traditionally used sulfites. With continued success in alcoholic beverages, consideration should be given to applying for GRAS status for nisin.

**Results:**
Drop plate assay data revealed 8 of the 12 strains tested were insensitive to lysozyme to all concentrations tested (0 to 10000 µg/ml) while the most sensitive strain was inhibited at 40 µg/ml. Nisin consistently reduced colony formation of all LAB at concentrations ranging from 4 to 16 µg/ml, well below the maximum allowed in cheese (250 µg/ml). Mock contamination results revealed lysozyme and/or nisin treated ciders obtained up to a 3 log reduction in MPN/ml regardless of the source of the contamination. Untreated samples ranged from 106 to 108 MPN/ml while the treated samples were 102 to 103 MPN/ml.

**P01-058**
**Resveratrol and Naringenin Inactivate Escherichia Coli O157:H7 in Apple Cider by Impairing Bacterial Cells and Down-Regulating Acid Resistance Genes**

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**Introduction:**
Unpasteurized apple cider contaminated with Escherichia coli O157:H7 (EHEC) has been implicated in several outbreaks and recalls during the last two decades. The acid resistance (AR) mechanisms in EHEC enable in its acid adaptation to survive longer under lethal acidic conditions as encountered in cider. The USDA-National Advisory Committee on Microbiological Criteria for Foods recommended the usage of treatments that result in significant EHEC reduction during fruit juice manufacture. In this study, the efficacy of two GRAS-status phytochemicals, resveratrol (RV, ingredient in grapes), and naringenin (NG, ingredient in grape fruit) to inactivate EHEC in apple cider was investigated.

**Method:**
A five-strain mixture of EHEC (~6.5 log CFU/ml) was inoculated into cider, followed by the addition of RV or NG (0%, 0.1%, 0.2%, 0.3% v/v). The cider samples were stored at 4°C for 14 days and EHEC were enumerated on days 0, 1, 3, 5, and 14. Additionally, the pH in uninoculated cider added with or without the antimicrobials was monitored throughout storage. Moreover, the deleterious effects of RV and NG on EHEC cells was visualized by scanning electron microscopy (SEM). The effect of RV and NG on genes encoding EHEC AR systems, namely arginine decarboxylase (adhE), glutamate decarboxylase (gad) and general stress protection (rpoS) was studied using real-time quantitative PCR (RT-qPCR). Triplicate samples were included, and the entire study was replicated three times.
Significance: Results suggest the potential use of RV and NG as natural antimicrobial additives to enhance the microbiological safety of apple cider; however, detailed sensory studies to determine consumer acceptability of treated cider are warranted.

Results: Naringenin (0.2 and 0.3%) was found to be most effective in reducing EHEC in cider, and decreased bacterial counts by −4.5 log CFU/ml by day 14 (P<0.05). Resveratrol (0.3%) reduced EHEC counts by −2.5 log CFU/ml compared to controls. SEM showed that NG and RV (0.3%) caused a complete destruction of bacterial cells, and surviving EHEC appeared “lemon shaped” in the cider. RT-qPCR results from EHEC treated with 0.1% RV or NG revealed that both compounds down-regulated the transcription of all three AR genes (P<0.05). Further, RV or NG addition did not change cider pH (P>0.05).

P01-059
Identifying and Modeling Meteorological Risk Factors Associated With Pre-Harvest Contamination of Listeria Species in an Integrated Dairy and Vegetable Crop Farm
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Introduction: Foodborne disease outbreaks associated with produce have been traced back to pre-harvest production stages. The Listeria species, which is naturally found in a variety of environments, has the potential to cause pre-harvest contamination of produce. The objectives of this study were to investigate the prevalence of Listeria spp. in an integrated dairy and vegetable crop farm and composting facility, and to identify specific meteorological factors affecting Listeria spp. presence.

Method: Environmental samples were collected monthly from locations within an integrated dairy and vegetable crop farm over a period of 14 months and were analyzed for Listeria spp. Meteorological factors (temperature, precipitation, and wind speed) were evaluated for their association with the presence of Listeria spp. by using logistic regression (LR) and classification tree (CT).

Results: According to the LR model, wind speed was identified as a significant risk factor, indicating that increasing average wind speed 2 days prior to sampling increased the probability of isolation of Listeria spp. (odds ratio = 4.7, 95% CI = 1.9-12.0, P-value = 0.0007). In addition, the LR model identified precipitation as a moderate risk factor, as probability of Listeria spp. isolation increased with increasing average rainfall amount in the previous 5 days (odds ratio = 1.24, 95% CI = 1.0-1.6, P-value = 0.04). Results from CT revealed that wind speed and precipitation were the most important factors influencing the presence of Listeria spp., which confirmed the findings from LR. The CT predicted that a farm sampling location was more likely to be Listeria spp.-positive with high average wind speed in the previous 5 days (>1.7 m/s) and high average amounts of rain in the previous 2 days (>7.8 mm).

Significance: These findings suggest that the presence of Listeria spp. in integrated dairy and vegetable crop farms was influenced by wind speed and precipitation. Meteorological factors should be considered when evaluating farm management practices to reduce potential pathogen contaminations at the pre-harvest level.

P01-060
Development of an Optimal Dry Inoculation Method for Low-Moisture Foods
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Introduction: Wet inoculation of foods is the most common artificial inoculation method in microbial food safety studies, requiring a drying period of at least two to three hours post-inoculation, depending on the sample size. However, using a wet inoculation method for low-moisture foods is undesirable as it introduces excess water to a naturally dry product. Chalk has been used as an alternative inoculation method and does not introduce unnecessary moisture. In this study, we developed an optimal dry inoculation method for low moisture foods using chalk.

Method: Escherichia coli 0157:H7 700594 were grown in tryptic soy broth at 37°C and harvested after 24 h. Chalk was inoculated with E. coli culture at concentration approximately 8 CFU/ml. The inoculated chalk was then dried at 37°C for 4 days in the incubator versus refrigerator. Then, the chalk was crushed into fine powder and used for inoculation of the almonds. Excess powder was strained out after almonds were coated with the chalk powder. Recovery of the cells were observed by enumeration on selective media, of the almonds. Excess powder was strained out after almonds were coated with the chalk. Then, the chalk was crushed into fine powder and used for inoculation after 24 h. Chalk was inoculated with Escherichia coli for use in microbial safety and quality of dry inoculation methods.

Results: An inoculum level of 7 log CFU/g was obtained from the chalk after drying. Compared to drying in refrigerator, drying in the incubator has a significantly higher inoculum level (P<0.05). Inoculated almonds had inoculum level of 6.7, 6.7 and 6.0 CFU/g, respectively, recovered on MacConkey’s Sorbitol agar. Bacterial recovery and enumeration were done after 6, 24, and 48 h post-drying.

Significance: The usage of dry inoculation method is practical for artificial inoculation of dried and low moisture foods, especially when larger sample sizes are utilized. This method could be adopted in a food safety challenge study.

P01-061
Evaluation of Hot Water, Gaseous Chlorine Dioxide, and Chlorine Treatments for Enhancing Safety and Quality of Fresh-Cut Cantaloupes
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Introduction: Fresh-cut cantaloupes have been implicated in numerous foodborne outbreaks of salmonellosis. Commercial treatments are limited in their ability to inactivate Salmonella enterica. Our objective was to evaluate the efficacy of hot water, gaseous chlorine dioxide (ClO2), and chlorine (Cl2) on enhancing microbial safety and sensory qualities of fresh-cut cantaloupes.

Method: Cantaloupes inoculated with cocktail of Salmonella enterica (Michigan, Mbandaka, and Poona) were treated as follows: 200 ppm CI2 for 40 min, 5 mg/L ClO2 for 4.5 hours and hot water at 76°C for 3 min. Fresh-cut cantaloupes were prepared from treated whole cantaloupes and divided into two sets, one set was treated with NatureSeal to evaluate its effect on the shelf-life and sensory qualities of the fresh-cut, the second set (control) was packed without further treatment. Fresh-cut samples were stored at 4°C for up to 21 days.

Significance: These results provide a framework to producers of fresh-cut cantaloupes for the potential use of hot water as an intervention treatment for enhancing the microbiological safety and qualities of this commodity.

Results: All sensory qualities (color, water loss, and texture) of fresh-cut samples treated with NatureSeal were significantly (p<0.05) better than the control samples. All treatments significantly (p<0.05) reduced the pathogen cell populations on the rind of the cantaloupes and the fresh-cut samples prepared from the treated melons. All fresh-cut samples prepared form hot water treated cantaloupes were negative for the pathogen throughout the storage sampling. The fresh-cut samples prepared from ClO2 and Cl2 treated cantaloupes were negative for the pathogens following 14 and 21 days of storage only.

P01-062
Microbial Risk Analysis of Produce Grown on a Sustainable Chicken Production Farming System
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Introduction: Sustainable agriculture encourages the use of organic fertilizers instead of synthesized ones, and poultry manure can be recycled as an economical organic fertilizer and added to soil to supply necessary plant nutrients. However, fruits and vegetables in direct contact with manure-contaminated soil can easily be contaminated by coliforms and food-borne pathogens such as Salmonella spp., E. coli, and Listeria spp. These human pathogens may lead to serious foodborne outbreaks and infections in individuals with weakened immune systems (e.g. children and pregnant women), thus remaining a concern for sustainable farming using poultry manure.

Method: In this study, chicken manure was added to soil in 2014, and then we identified the presence or absence of coliforms and the above three pathogens in the soil samples collected from a sustainable farming system over five months during 2015 in Minnesota and analyzed the risk of microbial contamination through the use of Pettrills and FDA’s Bacteriological Analytical Manual methods. In addition, spinach and cantaloupes grown in the study field were examined for the presence of these microorganisms and the risk of foodborne disease.

Significance: Overall this study identified that additional control parameters such as heat or chemical treatment of chicken manure should be implemented into this practice of sustainable farming to improve the safety of produce items.

Results: This study detected acceptable coliform and Salmonella spp. levels in soil, spinach, and cantaloupes, but that E. coli and Listeria spp. were present in several soil and cantaloupe samples throughout the study.

P01-063
Growth and Biofilm Formation by Listeria Monocytogenes in High and Low Concentrations of Catfish Mucus Extract
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Introduction: Several reports indicate that fish mucus promotes growth, colonization, and adherence
of fish pathogens on the skin surface but the role of mucus in the persistence, growth and survival of L. monocytogenes (Lm) in catfish processing environments is not well established. The objectives of this study were to determine the growth rates, survival and biofilm formation by Lm strains containing high and low concentrations of catfish mucus at 22°C and 10°C.

Method:
Growth rate of Lm BUG600 was determined at 22°C or 10°C for 72 h and its survival was determined at 22°C for 70 days in high (0.375 mg/ml) and low (0.026 mg/ml) concentrations of catfish mucus. Six Lm catfish isolates were evaluated for their biofilm formation on stainless steel surface and one Lm catfish isolate was used to evaluate biofilm formation on various surfaces in low and high concentration of catfish mucus at 22°C or 10°C up to 7 days

Results:
In 0.375 mg/ml of mucus, Lm BUG600 reached 9 log CFU/ml at 22°C in 32 h whereas it grew to 7 log CFU/ml at 10°C in 72 h. In 0.026 mg/ml of mucus, Lm BUG600 remained ~3.5 CFU/ml at both 22°C and 10°C in 72 h. Lm BUG600 survived by yielding a recovery of 6.2 log CFU/ml in 0.375 mg/ml of mucus at 22°C for 70 days while it was non-detectable in 0.026 mg/ml mucus. No significant differences were found in biofilm formation by six Lm strains on stainless steel coupons containing catfish mucus. At 22°C, all Lm strains were able to form a higher biofilm (~7 logs CFU/coupon) than at 10°C (~5 log CFU/coupon) in catfish mucus in 7 days. Buna rubber had significantly lower biofilm formation by Lm HCC23 cells compared to stainless steel, polyethylene and polyurethane surfaces at 22°C or 10°C for 7 days

Significance:
Lm can survive for a longer period if catfish mucus is present on the food contact processing surfaces. The growth rate and biofilm formation by Lm strains increased with increasing concentrations of catfish mucus on different catfish processing surfaces tested at 22°C or 10°C.

P01-064
Development and Evaluation of Novel ‘Green’ Multifunctional Nanocomposite Films With Carnosic Acid Stabilized in Cocoa Butter-Based Nanocarriers
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Introduction:
Lipid-based nanosystems are extensively used in the pharmaceutical industry for drug delivery strategies, and their potentiality in food applications is the central idea of the current research. The purpose of our present project is develop novel multifunctional nanocomposite films using lipid nanosystems as filler to extend the shelf life of a food product, by improving barrier properties and delivering bioactives on consumption. Cocoa butter (CB) was used as the lipid base of nanocarriers, due to its polymorphic nature and carnosic acid (CA), a strong antioxidant and a bioactive from rosemary, was loaded in the carrier using hot-melt homogenization technique to create nanoparticles (NP). Hydroxypropylated starch (HPS) was chosen as the bulk material of the films due to its excellent film forming properties, but hydrophobicity of hydroxypropyl groups limit its utilization. in this project, nanocomposite of HPS with CA-loaded CB NP were prepared.

Method:
Different NP amounts were added to HPS solutions to make nanocomposite films by pour casting. Both NP and films were evaluated and studied for moisture barrier properties (moisture isoethers, water absorption rate, and surface properties) by using standard ASTM methods and SEM imaging. Mechanical properties (Tensile strength and elongation %) were calculated using texture analyzer. pH controlled in-vitro digestion of NP was studied to assess bioaccessibility of CA for absorption. The antioxidant activity of digested NP and film after in-vitro were calculated using DPPH assay. A comparative t-test and a One-Way Analysis of Variance (ANOVA) were performed using Prism 5 software.

Significance:
Lipid NP can be utilized to serve both as nano-filler and nutraceutical delivery system using this approach.

Results:
Results confirmed that reduced water vapor permeance by 30-40% and stability at a wide range of relative humidity compared to HPS films, due to homogeneous embedding of CA in the nanocomposite films. The mechanical properties of the films did not significantly differ from the control. Antioxidative activity of CA (IC50 7.44 ± 2.54) was observed in the aqueous phase of digested nanocomposite, which shows that CA was bioaccessible for absorption.

P01-065
Development of Advanced Multilayer Films for Microwave Assisted Pasteurization System (MAPS)
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Introduction:
Microwave assisted pasteurization (MAPS) has the potential to produce safe and superior quality ready-to-eat (RTE) foods since dielectric heating provides a more efficient means of heating than conduction. In-container pasteurization requires microwave-transparent packaging to withstand temperature ranging from 70-90°C. Pasteurization does not inactivate anaerobic microbes, thus food requires refrigeration and aerobic environment. Aerobic environment can be created and maintained using lower oxygen barrier polymeric films. Since, MAPS may affect film barrier properties, a better understanding of the morphological changes of films subjected to MAPS is essential. In this research, we developed three multilayer films and investigated their performance during microwave-assisted and conventional thermal pasteurization processes.

Method:
Three films was tested with following composition: (Film A): polyethylene terephthalate (PET)/barrier PET/polyethylene (PE); (Film B): PET/nylon-polypropylene (PP) and (Film C): PET/low density polyethylene (LDPE)/Nylon/LDPE. The processing parameters of MAPS (preheating up to 61°C for 30 mins, heating in microwave section for 2 mins, holding at 93°C for 20 mins, and cooling for 5 min) used in this study were found to provide the best quality of mashed potato with desired lethality (F90 = 10 min). The changes in gas barrier were further correlated to crystallinity, melting enthalpy (ΔHm), dielectric loss (κ*) and water content (WC) of the films.

Significance:
Beneficial for selecting suitable packaging structure for newly developed MAPS.

Results:
Unlike film A, significant increase (P<0.05) in OTR and WVTR occurred for films B and C due to longer processing time of MAPS (52 min) compared to thermal process (36 min). Reduction in gas barrier for films B and C can be attributed to plasticization, caused by thermal damage and absorbed water in the hydrophilic nylon layer. For film A, reduction in gas barrier was caused by thermal effect. However, melting enthalpy (ΔHm) of the films increased after pasteurization and was correlated to the increase in overall crystallinity (1-4% increase) of the polymeric packaging. Increases in OTR and WVTR can be attributed to the fragmented crystalline structures and smaller crystal size observed in X-ray diffraction. Because of the impact of MAPS on gas barrier properties, a multilayer film with PET as barrier layer is recommended for MAPS.

P01-066
Understanding the Barrier Properties Changes of Polymer Packages Subjected to Microwave-Assisted Thermal Sterilization
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Introduction:
Microwave assisted thermal sterilization (MATS) is an advanced thermal process developed to produce high quality shelf-stable foods. In the U.S. the 915-MHz MATS system has received no objection from Food and Drug Administration (FDA) and USDA Food Safety and Inspection Service for sterilization of low acid foods. Efforts are being made to develop commercial MATS foods with shelf life for 1-2 years, and military or space mission foods with shelf life up to 3-5 years. Polymer packages are most suitable for MATS, but the barrier properties deteriorated during the high temperature and high humidity processing. In addition, the barrier properties may be influenced by the temperature and humidity fluctuation during long-term storage. Knowledge of package barriers changes helps to prevent the possible oxidation and desiccation that may occur in the food systems thus shortening the shelf life. The objective of the study is to investigate barrier properties changes of two multi-layers pouch films with polyethylene terephthalate (PET) barrier layer (film A) and ethylene vinyl alcohol (EVOH) barrier layer (film B), respectively subjected to MATS.

Method:
The pouches with 8 oz mashed potato were processed by the MATS with the lethality of F0 = 9.0 min. The pouches were then stored at 4, 23, and 35, and 45°C.

Significance:
This work provides valuable information for design and selection of barrier packages for MATS or other thermal processed foods.

Results:
The oxygen transmission rates (OTRs) increased 5 and 2.2 times (P<0.05), and the water vapor transmission rates (WVTRs) increased 30% and 10% after process for films A and B, respectively. During the first two months of storage the OTRs and WVTRs greatly decreased, then remained constant till up to 12 months. X-ray diffraction patterns indicated that crystallinity of the PET barrier layer decreased (P<0.05) from 79% to 65% after process, it then recovered up to 74% in first 2 months but decreased again after 6 months of storage. For EVOH barrier layer the crystallinity% remained steady after process and during storage. Changes were also observed for crystal size and d-space. However there were no direct relationships between changes in barrier properties and crystal parameters.

P01-067
Functionality of Cellulose Nanofiber Based Films Modified by Different Concentrations and Molecular Weights of Chitosan
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Introduction:
Nanoporous structure of cellulose nanofiber (CNF) based film matrix may be damaged under high relative humidity (RH) conditions or with direct water contact due to the hydroxyl groups in cellulose backbone with high surface area. Chitosan (CH) has a high
affinity to adsorb onto cellulose. When incorporating chitosan into CNF film matrix, CH may improve functionality of CNF films. However, the exact effect depends on polymeric structure, molecular weight (Mw), and concentration of applied chitosan. This study investigated the effectiveness of different concentrations and Mw of chitosan on the physicochemical, mechanical, water-resistant, and antibacterial properties of CNF based films.

Method:
CH at different concentrations (10% and 20% w/w CNF in dry base) and MW (68, 181 and 287 kDa w/w CNF in dry base) was dissolved in 1% acetic acid (w/v) and incorporated to 0.5% CNF with 10% glycerol (w/w CNF in dry base). The mixed suspension was cast to form uniform films and then conditioned at 25°C and 50% RH for 2 days before all measurements. CH concentration and MW as main factors and their interaction were analyzed through a completely randomized two factorial design, and data were analyzed by two-way analysis of variance (ANOVA) with least significant difference (LSD) post hoc multiple comparison test (p<0.05).

Significance:
This study demonstrated that CH concentration and MW are important factors affecting hydrophilic, mechanical, and antibacterial properties of CH modified CNF films. These films may be applied as coatings for long-term cold storage of fresh produce under high RH conditions (85-95%).

Results:
CH concentration showed significant impact on tensile strength (TS) and water absorption (WA) of derived films, in which significantly lower TS (24.9 N) and WA (77.2%) were observed in 20% CH incorporated CNF film. CH MW exhibited significant effect on water solubility (WS), showing significantly lower WS (21.5%) in 287 kDa CH incorporated film. There was significant interaction effect between chitosan concentration and MW on water vapor transmission rate (WVTR), in which lower WVTR (1047 g/m2 d) was found in 20% and 68 kDa CH incorporated film, such film also showed strong antibacterial property against L. innocua and E. coli.

P01-068
Protective Effect of Gallic Acid Against Degradation of Anthocyanins and Color in Fortified Vitamin C Cranberry Juice
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Introduction:
Although Vitamin C is an effective antioxidant, Vitamin C fortification increased degradation of color in the juice during storage. Anthocyanins are natural pigments, and are also well-known as antimicrobial, and antioxidative compounds. Even though, it was found that Vitamin C could fade red color, ascorbic acid is still widely fortified in commercial juices in order to enhance nutritional level to improve sales. Most previous solutions for degraded color were addressed by either adding artificial color (Red #40), or blending with other juices i.e. grape, apple. Therefore, the aim of this study was to determine a natural compound that can protect against red color and anthocyanin degradation in cranberry juice during storage.

Method:
Cranberry juice samples were fortified with ascorbic acid (40, 60, 80 mg/100mL) and added gallic acid at 0, 80, 160, and 320 mg/100mL. Juice pasteurization was at 83°±2°C for 1 minute. Samples were stored in the dark at 23°±2°C, and evaluated for color and anthocyanins every 2 days using a spectrophotometer. ANOVA was determined using SAS®. Tukey HSD in JMP® was used to evaluate significant difference at p<0.05. Kinetics of degradations were determined using a nonlinear regression inverse method in MATLAB®.

Significance:
The outcome of this research provided a potential solution of using gallic acid to preserve a health-beneficial component (Anthocyanins), and endogenous red color in commercial cranberry juice. The gallic acid is a non-toxic substance, and it could cost as low as $0.03 per serving size (240mL) with 320mg/100mL gallic acid addition. Moreover, results from this kinetic study could be used for modeling equations and process design to predict retentions of anthocyanins and red color at different concentrations of Vitamin C and gallic acid.

Results:
Addition of gallic acid (80, 160, 320 mg/100mL) significantly increased red color intensity (37%) (p<0.01) and anthocyanin concentration (41%) (p<0.03) , compared to no gallic acid addition. Moreover, the kinetic study revealed that orders of degradation reactions significantly decreased (p<0.03) with increasing ascorbic acid concentrations. Color degradation followed 4.4 – 2.9 – 2.2 order, while anthocyanin degradation followed 3.3 – 2.15 – 1.25 order at 40, 60, 80 mg/100mL ascorbic acid concentration, respectively.

P01-069
Storage Quality Evaluation of Lightly Roasted Blanched Peanuts When Compared to Raw Shelled Peanuts
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Introduction:
It has been found that lightly roasting and blanching process can help in identifying aflatoxin-contaminated nuts and thus sorting them out. However, quality changes during storage of such processed nuts are not well documented. During storage, lipid oxidation occurs which produces off-flavors and causes reduced consumer acceptability. This process may be accelerated by factors like moisture, oxygen, processing conditions, and high storage temperature. The objective of this study was to compare oxidative stability of lightly roasted peanuts (LRP) and raw peanuts (RWP) under different storage conditions.

Method:
Two packaging materials (nylon mesh and high barrier plastic bag) and two storage temperatures (21°C and 40°C) were used for both LRP and RWP. Samples were taken at 0, 6, 12, 18, 24, and 32 weeks for peroxide values (PV) and gas chromatography–mass spectrometry (GC-MS) analyses. Two replicates were carried out for this study. ANOVA followed by post-hoc mean separation (Fisher’s LSD) was used to analyze the data at 5% level of significance.

Results:
Results showed that both primary and secondary oxidation products increased with time. RWP had very low PV (<10 meq peroxide/kg) under all storage conditions. Around 5-20 fold increase in PV were found in LRP. LRP stored in mesh bag at 40°C (LRPM4) reached the highest PV (85.32 meq peroxide/kg) at week 32. GC-MS detected 14 aldehydes, 11 alcohols, 3 ketones, 3 organic acids, and 4 esters. Results indicated that LRPM4 was the most oxidized sample. Also, peanuts packed in mesh bags oxidized at a quicker rate as storage temperature increased. RWP had more alcohols than LRP mainly resulting from hexanal, which was the major alcohol in RWP. Hexanol might also be associated with the high levels of hexanal in RWP. LRP had higher concentrations of other secondary oxidation products such as octanal and nonanal.

P01-070
Identification and Quantification of Individual Phenolic Acids and Aldehydes in Three Phenolic-Rich Food Legume Varieties as Affected by Thermal Processing
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Introduction:
Phenolic acids and phenolic aldehydes are a major class of phenolic compounds, which contribute substantially to the antioxidant activity and ACE inhibitory activity. However, reports on the type and content of phenolic acids and aldehydes in legumes were incomplete and inconsistent. In addition, there has been little research to quantify free-form and total contents of individual phenolic acids and aldehydes separately, especially when legumes were subjected to various heat treatments. The objective of this study was to comprehensively identify and quantify free-form and total contents of individual phenolic acids and aldehydes as affected by various boiling and steaming processing conditions in three phenolic-rich legume varieties.

Method:
Lentil, black soybean and black turtle bean were soaked, boiled and steamed under three pressures: regular (100°C), 5 psi (108°C), and 15 psi (121°C) for different periods of time based on texture palatability tests. Free phenolic acids and aldehydes were extracted with acidified aqueous methanol and total phenolic acids and aldehydes were extracted with ethanol acetate after alkaline hydrolysis in the presence of EDTA and ascorbic acid. Individual phenolic acids and aldehydes were identified and quantitated by HPLC using 17 authentic standards.

Significance:
This study provides a comprehensive understanding of the type, form and quantity of phenolic acids present in three legumes subjected to various boiling and steaming treatments. These data can be used by the food industry to select optimal processing methods to achieve highest health benefits.

Results:
Results showed protocatechuic acid, protocatechuic aldehyde, and p-coumaric acid in lentil; protocatechuic acid in black soybean; and protocatechuic acid, ferulic acid, and sinapic acid in black turtle bean were identified after extraction with acidified aqueous methanol. After alkaline hydrolysis, except those listed above, one, seven, and four more types were identified, respectively, for the three legumes. All identified phenolic acids and aldehydes were present predominantly in non-free conjugated/complexed form. For both free-form and total contents of phenolic acids, significant differences (p < 0.05) existed among thermal treatments. Some thermal treatments caused significant increases in the content of some free phenolic acids, which suggested liberation from complex with other legume components.

P01-071
Physicochemical Properties and Bioactive Compounds of Different Fruit Pomaces
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Introduction:
Fruit pomaces from juice manufacture are rich sources of bioactive compounds, including polyphenolics and dietary fibers. However, most pomace ends up in a landfill for disposal or is partially used as animal feed. For expanding their utilizations
in food and other fields, it is important to investigate the characteristics of different fruit pomaces. This study aimed to evaluate physicochemical properties and bioactive compounds in wet and dried apple (AP), blueberry (BB), raspberry (RB), and cranberry (CB) pomaces.

Method: Wet AP, BB, and CB pomaces were dried using an impingement oven at 110°C for 3 h to obtain dried pomaces with ±0.8% moisture content. The dried pomaces were ground into powders with size <0.5 mm. Moisture content, water activity, pH, titratable acidity, total soluble solids, total lipid, color measurement, total phenolic content (TPC), total anthocyanin (TAC), sugar (sucrose, glucose, fructose), and total dietary fiber (TDF) were quantified for both wet and dried pomace samples. All tests were performed in triplicate and calculated on dry-weight (DW) basis. Data were analyzed via multivariate analysis of variance (ANOVA) with a least significant difference (LSD) post hoc multiple comparison test (P < 0.05).

Results: The wet and dried AP pomaces had great amount of acid extractable pectin (18.87% and 10.07%, respectively), while wet and dried BB pomace had low soluble solids (0.54% and 0.24%, respectively), and high total dietary fiber (21.0% and 16.6%, respectively). The CB pomaces were rich in wet and dried pomace solid (25.1% and 20.1%, respectively), total phenolic content (22.34 mg gallic acid equivalent/g DW), total anthocyanin (256.18 mg cyanidin-3-glucoside/100 g DW and 174.97 mg cyanidin-3-glucoside/100 g DW, respectively), and total dietary fiber (16.6% and 15.2%, respectively). Wet BB pomace was rich in sugar (13.5% and 12.9% respectively), total dietary fiber (35.2% and 30.3%, respectively), and total phenolic content (15.5% and 11.4%, respectively). Wet and dried CB pomaces were also high in TDF (68.8% and 58.6%, respectively) and pectin (10.58% and 11.48%, respectively).

Significance: This study suggested that fruit pomaces are high in pectin, dietary fiber, and phenolic contents, but the exact amount varied depending on the types of fruit source. AP and CB pomaces are high in pectin and fiber contents, while BB and RB pomaces are rich in TDF.

P01-074
Quality and Stability of Apple Juice Treated With Cold Plasma and Ozone
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Introduction: The global fruit juice market is estimated around 592 billion. Apple juice is an excellent source of phenolic compounds that prevents degenerative diseases, cardiovascular diseases, and cancer. Apart from health benefits, polyphenols contribute towards the formation of hazes and sediments, the development of characteristic flavors and prevent color changes during processing. Unfortunately, consumers prefer unpasteurized apple juice due to superior taste. Yet the downside is the danger of contamination in untreated products and this has turned attention towards emerging non-thermal techniques like cold plasma that prevent microbes while reducing organoleptic and nutritional degradation. The aim is to treat apple juice with cold plasma and compare product quality and stability in terms of microbial load, color, phenolic content, and rheological properties with ozonation.

Method: Cold plasma was generated with a dielectric barrier set-up. The power source was a 15 kHz transformer and the electrode spacing was 2 cm. The independent parameters were voltage (kV) and treatment time (s). Ozone gas was generated from pure oxygen using a corona discharge generator at controlled flow rate. Ozone concentration was recorded using an ozone analyzer. Gas flow rate, ozone concentration and treatment time were varied. The efficacy was determined using plate count method (microbial load), rheometer (viscosity), and HunterLab colorimeter (color).

Significance: With low power requirements, cold plasma generates bactericidal molecules efficiently inside a sealed package. With maximal bacterial reductions and minimal quality loss, cold plasma proves to be more beneficial and safe for the fruit juice industry.

Results: A 5 log reduction of E. coli was achieved by ozonation and cold plasma treatments. However, a significant color reduction was observed with increased L and b values in ozonated samples whereas only 5-10% reduction was recorded with cold plasma. A shear thinning behavior was observed in both treatments. Total phenol content experiments showed a 50% reduction during ozonation and a 30% reduction with plasma treatment.

P01-075
Yield Stress and Microstructure of Tomato Puree Subjected to Continuous High-Pressure Homogenization (CHP) Processing
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Introduction: Yield stress of high moisture content fruit and vegetable products are important to the manufacturers because it influences the consumer acceptability, processing properties, and storage stability of the products. In the study, how continuous high-pressure homogenization (CHP) processing influences the yield stress and microstructure of tomato puree was investigated.

Method: Tomato puree was processed by continuous high-pressure homogenization (CHP) at 69-276 MPa, for 1-3 passes. Then the yield stress, particle size distribution, color, color, moisture and content of the samples were measured. Microstructure of the samples was studied by light microscope. Two-way ANOVA tests carried out by SAS were used to analyze the data.

Significance: This research provides manufacturer information about how pressure and number of passes influence yield stress of tomato puree changes during a high pressure processing.
So that manufacturer can adjust the pressure and number of passes to make desirable products or to reduce the energy cost of processing. For researchers, this research provides information for vegetable or fruit nano or microstructure study.

Results: No differences in moisture or color were found due to different treatments. Laser scattering and light microscopy showed CHP reduced the pulp particles to ~10–100 μm, producing smaller and more uniform particles, with processing at 276 MPa and 2 passes reducing the greatest particle reduction. In general, yield stress decreased with homogenization pressure, but increased with number of passes. Viscosity as a function of shear rate was best fitted by the Sisko model. Increased CHP pressure and passes resulted in lower viscosity at low shear rate, but higher viscosity at high shear rates. The results suggest CHP produced more uniform particles that contribute to viscosity, but with less shear-thinning behavior.

Significance: These results suggest that using an oregano extract in French fries processing can be an effective way to reduce acrylamide level in fried potato products. Addition of oregano extract may affect the sensory properties of the ready-to-eat product and this will be considered in future work. The length of time of soaking the potato strips in oregano extract is an important factor and should be controlled.

P01-078
Low Moisture Extrusion for the Manufacture of Healthy Snacks: Processing Effects on Protein and Biopolymers as Determined by Fourier Transform Infrared Spectroscopy (FTIR)
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Introduction: With rising consumer interest in healthier food options, there is an increasing demand for novel food sourcing and production methods. Plant based proteins offer an attractive possibility to satisfy the request for protein rich foods. This is also an opportunity for the food industry to contribute to a more sustainable future, since less resources such as freshwater or energy are required for the production compared to animal based protein products. Fiber is known for its benefits to the gut and cardiovascular health, but is often underrepresented in today's diet. Popular consumer products like snacks or breakfast cereals are analyzed using Fourier Transform Infrared Spectroscopy (FTIR) and then correlated to the physical properties of the product.

Results: For all blends and the pure protein isolate, the protein's water solubility was reduced during extrusion, and the extrusion parameters influenced the change in protein structure in amide I and II region and in beta sheets and alpha helix composition. Protein isolate extrusion reduced the amount of beta-sheets by up to 8% and increased the number of beta turn structures. The number of alpha helices was slightly reduced by processing (2-3%), and the most expanded product was found to have the most alpha helical structures left intact.

Significance: This research supports the food industry in understanding the interactions between the components and, thereby, enable the manufacture of healthy snacks and breakfast cereals for the consumer market. This can support the community in their desire to lead a healthy and balanced life.

P01-079
Intramuscular Difference in Color and Mitochondrial Functionality of Postmortem Beef Semimembranosus
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Introduction: Beef semimembranosus is a large muscle exhibiting intramuscular variation in color stability and can be separated into color-stable outside (OSM) and color-labile inside (ISM) regions. Previous research attributed intramuscular color variation to the differences in temperature and pH decline during carcass chilling and differential abundance of sarcoplasmic proteome. Biochemically active mitochondria in postmortem muscle can also influence meat color in a muscle-specific manner. However, intramuscular variation in mitochondrial functionality and its possible relationship with color are yet to be investigated. Therefore, our objective was to examine the functionality of mitochondria isolated from beef OSM and ISM.

Method: Semimembranosus muscles were obtained from five (n = 5) beef inside rounds, and each muscle was separated to OSM and ISM steaks. One steak each was assigned for assessing mitochondrial functionality, whereas another steak was utilized for evaluation of instrumental color and metmyoglobin reducing activity after blooming for 2 h. Mitochondria isolated from OSM and ISM was utilized for measuring mitochondrial oxygen consumption rate (OCR) in the presence of succinate (40 mM) at pH 5.6 and 25°C. The experimental design was a randomized complete block design, where each carcass (n = 5) served as a block. Data were analyzed using the Mixed Procedure, and means were separated by least significant differences at P < 0.05 significance.

Significance: OSM steaks demonstrated greater mitochondrial OCR and greater color stability than their ISM counterparts. The observed variation in mitochondrial functionality between OSM and ISM could be partially responsible for the intramuscular color variation of beef semimembranosus.
Results:
ISM steaks exhibited greater (P < 0.05) redness (a* value), lightness (L* value), yellowness (b* value), and chroma than OSM steaks. However, OSM demonstrated greater (P < 0.05) color-stability and metmyoglobin reducing activity than ISM. Mitochondrial OCR was lower (P < 0.05) in ISM than OSM, which indicated the existence of intramuscular variation in mitochondrial functionality of beef semimembranosus.

P01-080
Use of DNA Mini-Barcoding to Identify Poultry Species in Food Products
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Introduction:
Poultry prices are expected to decrease in the coming years, thereby increasing the profitability of substitution for higher-cost species in processed products. Animal species can generally be detected using methods based on DNA analysis, such as DNA barcoding. However, DNA can become degraded during processing, making it difficult to identify species based on sequencing of the full-length DNA barcode. Therefore, the objective of this study was to investigate the ability of short DNA sequences (mini-barcodes) to identify poultry species in processed foods and to compare the results to full-barcoding.

Method:
Twenty-eight products were collected for the study, including luncheon meat, ground meat, jerky, canned meat, and pet food. All products were labeled as containing chicken, turkey, or duck. Each sample underwent both full and mini-barcoding of the cytochrome c oxidase subunit I (COI) gene. Successfully sequenced samples were then analyzed and identified through the Barcode of Life Database (BOLD).

Significance:
Overall, this study showed that while mini-barcoding has the potential to be used for species identification in processed products, future studies need to be carried out to optimize this methodology.

Results:
The results showed that full-barcoding was more successful overall for identification of poultry species in the products, with a success rate of 71%, while mini-barcoding showed a success rate of 46%. Full-barcoding was most successful at identifying chicken in the products, with positive identifications in 9 of the 13 samples listing chicken on the label. On the other hand, mini-barcoding was not able to identify chicken in any of the samples, likely due to a lack of primer-binding in the mini-barcode region of this species. Mini-barcoding was most successful with samples labeled as turkey, with a success rate of 79%, compared to a success rate of 64% with full-barcoding. The difference in success rates was due to the failure of DNA barcoding to identify four canned turkey products, whereas mini-barcoding was successful with two of the four products. Samples labeled as duck were equally successful (67%) between both barcoding methods.

P01-081
The Effect of Replacing Fat With Protein-Stabilized Oil Pre-Emulsion on Physical Characteristics and Oxidative Stability of Fresh Sausage
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Introduction:
There is a growing interest in reformulation of traditional sausages by partial or total replacement of animal fat with vegetable oils to improve the nutritional value of meat products.

Method:
In this study, commercial soybean oil was pre-emulsified using pre-heated soy protein isolate (90°C, 10 min, SPI) and sodium caseinate (SC). Fresh (not nitrite-cured) sausages were prepared with 10% lipid and 18% protein by 60% substitution of pork back fat with pre-emulsified oil. Our objective was to compare processing parameters, physical characteristics, and oxidation stability of fat-replacement sausages (60% oil/40% fat) with the control sausage (100% fat).

Significance:
The results indicated that a significant reduction in lipid oxidation and cooking loss could be achieved by using protein-stabilized emulsions as partial substitutes for fat in fresh sausages without adversely affecting the product quality.

Results:
Sausages produced with SC-emulsified oil (SC sausage) exhibited a rising and higher storage modulus (G') upon temperature sweeping (20-80°C) in the dynamic rheological thermal analysis, when compared with the control and the SPI sausages that reached their G' peaks at 60°C and 67°C, respectively. Incorporation of pre-emulsified oil into sausages improved the water-binding properties, characterized by 1.5% to 3% less cooking losses than the control. During storage at 4°C, cooked SC sausages showed lower TBARS values in the first five days, and the SPI sausages displayed a slower lipid oxidation rate throughout 14 days comparing with the control. Moreover, SC and SPI sausages possessed higher CIE L* value and lower b* value (P < 0.05). The a* value of the control sausage dropped rapidly during storage while the fat replacement with pre-emulsified oil helped maintaining the redness. There was no significant difference in the texture profile attributes between the treatments (P > 0.05).

P01-082
Bacillus Subtilis Spore Resistance Properties to Cold Plasma
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Introduction:
Bacterial spores are extremely resistant towards multiple environmental stress conditions; the involved resistance factors include the outer layers of the spores, DNA saturation with small acid soluble proteins (SASP), DNA repair systems, and a high level of dipicolinic acid (DPA) in the core.

Method:
In this study the mechanisms responsible for spore resistance to cold plasma were investigated. Therefore, Bacillus subtilis spores and isogenic mutant strains were treated using a diffuse coplanar surface barrier discharge plasma system. The plasma treated strains were: PS578 (α), without the two major α/β-type SASP; FB122 (β), without DPA; PS3328 (cotE), which lacks the outer coat; and the wild type strain PS3832; all being treated up to 5 min in a static atmosphere using different process gases (air, N₂, O₂). Spores were inoculated with a similar density on glass beads and shaken continuously during the treatment. The generated plasma was characterized using optical emission spectroscopy, gas analysis indicator tubes and by quantification of ozone.

Significance:
The results show that different factors are involved in Bacillus subtilis spores’ resistance to cold plasma. The α/β-type SASP play a significant role in spores’ resistance to emitted UV-C photons. Furthermore, the outer coat and the DPA protect spores against damage by generated ROS.

Results:
Air plasma showed high emission intensities in the UV-A and UV-B range, and lower ones in the UV-C range. N₂ plasma emitted mainly UV-C photons. O₂ plasma generated a high amount of reactive oxygen species (ROS), like atomic oxygen and up to 22,000 ppm ozone. The strains PS3328 and FB122 were sensitive towards the O₂ plasma with an inactivation of 4.1 and 3.8 log₉, after 5 min treatment, whereas the others showed a reduction of 2.7 log₉. The strain PS578 was sensitive towards the N₂ plasma treatment with a reduction of 4.8 log₉, after 0.5 min. The others were inactivated by 3.1 (PS3832), 2.8 (PS3328) and 1.7 log₉ (FB122). For air as process gas the strain PS578 also showed, as shown for N₂, the highest inactivation with 4.8 log₉, after 5 min treatment, the strains PS3832 and PS3328 were inactivated by 3.1 and FB122 by 2.1 log₉.

P01-083
Tailoring the Health-Promoting Properties of Cherries Through Smart Selection of Pulsed Electric Fields Conditions That Promote the Release of Anthocyanins
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Introduction:
Pulsed electric fields (PEF) enhance the release of phytochemicals, resulting in foods with a unique phytochemical profile and diverse health-promoting properties. Further release of phytochemicals from solid plant tissues still occurs during storage after PEF. Cherries contain an abundance of phytochemicals, namely anthocyanins and phenolic acids that would protect human against oxidative stress. This research aimed to study the effect of storage after PEF on anthocyanins release and the bioprotection capacity of the resulted cherry juices against hydrogen peroxide (H₂O₂) induced oxidative stress in a human intestinal (Caco-2) cell culture model.

Method:
Regular short barcodes (Prunus avium cv. Staccato) were processed with PEF at 1.5kV/cm, 20µs pulse width, and 10Hz square-wave pulse with an energy input of 147kL/kg. The release of each anthocyanin compound was quantified using HPLC-DAD-MS and monitored for up to 72h storage (4°C) after PEF. The bioprotection capacity of cherry juices was evaluated by determining the enzymes involved in the antioxidant defense system of Caco-2 cells (i.e. superoxide dismutase, catalase and glutathione peroxidase).

Significance:
This study demonstrated the potential of PEF combined with smart selection of subsequent storage duration in producing functional foods that could reduce oxidative stress effect and manipulate the cellular antioxidant metabolism to maintain the redox status during oxidative stress.

Results:
The greatest release of cyanidin-3-O-rutinoside, cyanidin-3-O-glucoside, peonidin-3-O-glucoside, pelargonidin-3-O-glucoside and peonidin-3-O-glucoside occurred 24h after PEF (at least 5-fold higher compared to untreated samples). It was observed that the cherry juices obtained at 24h storage after PEF were able to completely remove the negative influence of H₂O₂ on Caco-2 cells. The cellular antioxidant enzyme activities were restored at the same level as the healthy cells without H₂O₂ exposure. This bioprotection effect was not observed in cells supplemented with untreated juices. However, extending the storage time from 24h to 72h after PEF led to a considerable loss of anthocyanins, up to 50%, but the anthocyanin contents were still significantly (p<0.05) higher than that of untreated samples. Interestingly, cells supplemented with these PEF-treated cherry juices had stimulated the cellular antioxidant defense system, in which all antioxidant enzymes were at least 50% significantly (p<0.05) higher compared to the healthy cells without H₂O₂ exposure.
Effect of Ultraviolet-C Irradiation and Photosensitizers on Mitigation of Aflatoxins
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Introduction:
TiO2-UV is an emerging technology that utilizes a titanium dioxide (TiO2) photocatalyst to accelerate reactive oxygen species (ROS) generation during ultraviolet (UV) illumination. These ROS play a major role in inactivating foodborne microorganisms. The objective of this study was to develop a TiO2-UV based photocatalytic pestirization technique for grape juice. Treatment parameters, including the wavelength and intensity of UV, TiO2 recipe, and treatment time, were evaluated based on their efficacy with respect to microbial inactivation.

Method:
Different surface treatments were developed by varying a combination of TiO2 sol-gel and SiO2 sol-gel coatings. All the photocatalyst recipes had four coatings of TiO2-SiO2 with P25 particles (50/50). The variation was in terms of the additional outermost coating. Surface treatments were A1 (TiO2 sol-gel and SiO2 sol-gel outermost coating), A2 (TiO2 sol-gel outermost coating), and A3 (no additional outer coating), in which glass slides were coated and subjected to calcination at 500°C for 30 min. Commercial grape juice (pH 2.9±0.2; Turbidity 2.27±0.13 NTU), inoculated with 6-7 log CFU/mL of E. coli ATCC 25922 was treated under UV-A (350 nm) and UV-C (254 nm) light in the presence of TiO2 coated and uncoated (control) glass slides for 5-20 min. Samples were analyzed for enumeration of survivors (spread plate method) after treatment. Data were analyzed using one-way ANOVA and LSD test at P<0.05.

Significance:
UV-A based photocatalytic pestirization is expected to overcome the loss of light-sensitive nutrients which is the major limitation posed by the conventional UV-C pasteurization of fruit juices. The major findings of this study are expected to expand the applications of photocatalytic oxidation in pestirization and surface sterilization of food and packaging materials.

Results:
Results indicate that 1.29, 1.90, 1.96, and 2.70 log CFU/mL reduction were obtained with control, A1, A2, and A3 recipes at 350 nm irradiation for 20 min. There was a significant difference (P<0.05) in microbial inactivation between A3 and the other treatments. The photocatalytic treatment and time had significant effect on the inactivation of E. coli (P<0.001) whereas their interaction did not have any significant effect (P>0.05).

Effect of Ozonation and Cold Plasma Treatment on the Quality and Stability of Orange Juice
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Introduction:
The global fruit juice market is worth $92 billion and is expected to reach $100 billion in the next 2-3 years. Orange juice leads the sales, accounting for more than 35% of total juice sales. Thermal processing is widely employed in orange juice processing, however, quality deterioration such as ascorbic acid loss and color degradation are observed. A growing interest in non-thermal preservation techniques that prevents microbes while minimizing changes in organoleptic and nutritional properties. The objective of this work is to evaluate the effectiveness of ozone and cold plasma in orange juice processing in terms of microbiological stabilization, color, and ascorbic acid content.

Method:
Ozone gas was generated from pure oxygen using a corona discharge generator at controlled flow rate. Ozone concentration was recorded using an ozone analyzer. Quality parameters were studied as a function of gas flow rate, ozone concentration and treatment time. Cold plasma was generated with a dielectric barrier set-up. The power source was a 15 kV transformer and the electrode spacing was 2 cm. The independent parameters were voltage (kV) and treatment time (s). The efficacy of treatments was determined in terms of reduction in viable counts over time. Color was measured using a HunterLab colorimeter while the ascorbic acid content was determined by volumetric method.

Significance:
Cold plasma generates bactericidal molecules efficiently, with low power requirements inside a sealed package. With maximal bacterial reductions and minimal quality loss, cold plasma can be effectively used to preserve fruit juices on an industrial scale.

Results:
A 5 log reduction of E. coli and Salmonella was achieved by ozonation and cold plasma treatments. However, a 25% color reduction was observed in samples treated with ozone whereas 10-15% reduction was recorded with cold plasma. The ascorbic acid content decreased by 60% during ozonation and 40% during plasma treatment.

High Pressure Assisted Infusion of Calcium in PME Treated Baby Carrots
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Introduction:
The aim of this study was to fortify the most commonly eaten vegetable snack in the U.S. – baby carrots – with calcium using the non-thermal technique of high pressure processing (HPP). According to the National Health and Nutrition Examination Survey in 2010, 42% of the American population did not meet the RDI for calcium (~1000 mg/day), and 43% of the population was dependent on calcium supplements for their daily calcium requirements. Through this project we aim to provide the population with calcium infused baby carrots as healthier and convenient option to meet the daily calcium requirement.

Method:
Baby carrots treated with pectinmethylesterase (PME) enzyme solution (29.2 nkat/g) at 37 °C for 45 min, were infused with calcium using calcium lactate gluconate (CLG) solution under high pressure at various pressure-time combinations. Box-Behken design was used to study the effects of high pressure (150 MPa – 550 MPa), hold time (5 min – 15 min), and CLG concentration (3%-9% w/v) on the amount of calcium infused (mg/cm length of baby carrot). After 48 h, the coated baby carrots were analyzed for calcium using ICP-OES, β-carotene extractability using reverse phase HPLC, texture (hardness) (N) using a compression test on the texture analyzer, and color (L*, hue, and chroma).

Significance:
HPP enhanced the infusion of calcium in baby carrots, significantly increased the β-carotene extractability, preserved hardness, and slightly darkened the color of the baby carrots. Using HPP to infuse missing micronutrients into fruits and vegetable matrices can be further explored for other fruits and vegetables to provide the population with nutrient infused healthy snacks.

Results:
Calcium infusion of up to 100 mg/serving of baby carrots (equivalent to 10 % RDI of calcium) was obtained at 350 MPa for 5 min using 9% CLG solution. Pressure, hold time, and CLG concentration had a significant effect on calcium infusion. HPP also increased the amount of β-carotene extracted by 4-5 times compared to the control. The texture of the calcium infused baby carrots showed higher hardness than the control, while the color was darker.

Use of High Voltage Atmospheric Cold Plasma (HVACP) for Reducing Salmonella Typhi in Tender Coconut Water (TCW)
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Introduction:
TCW has an increasing market demand owing to its nutritional value and delicate flavor.
Cold plasma treatment has been demonstrated as an effective non-thermal technique for microbial inactivation on food surfaces, packaging materials, and fruit juices. Development of a non-thermal method for microbial reduction in TCW is needed, due to its volatile flavor and potential for bacterial contamination.

**Method:**
A direct HVACP treatment at 90 kV was applied on TCW and also a tender coconut water simulant (TCWS) in two different gases: air and MA65 (65% CO2, 30% CO2, 5% N2). The TCW was consisted of malic acid, ascorbic acid, glucose, fructose, fat, egg protein, KCl, MgCl2, CaCl2, and Na2HPO4. A 2.5 ml sample was prepared and sealed in packages inoculated with Salmonella enterica serovar Typhimurium LT2. HVACP treatment time was varied from 0-120 s and samples were stored under refrigeration for 24 h prior to analysis. All experiments were performed in triplicate.

**Results:**
Optical emission spectroscopy was performed to characterize the plasma reactive gas species. Effects of gas, TCW, and TCWS were also evaluated for pH, conductivity, color, Brix, and titratable acidity before and after HVACP treatment. HVACP results show that 120 s treatment time was required to achieve a 1.3 log reduction in air plasma and 3 logs in MA65 plasma at 90 kV. Comparable reductions in CWSM of 1.41 log and 3.7 log in air and MA65 plasma respectively were also observed. A slight decrease in pH was observed for both gas treatments, it was not a primary bactericidal effect. The type of reactive gas species generated and their interaction with soluble solids appear significant. Comparing TCW and TCWS composition, we also observed the presence of malic acid and phosphates limited Salmonella inactivation. Interestingly, when the TCW and TCWS were fortified with 400 ppm citric acid a greater than 5 log reduction of S. Typhi was observed for both air and MA65 gas. No major impact on quality was observed.

**Significance:**
The results demonstrate that HVACP treatment can achieve significant bacterial reductions in liquids that contain citric acid or are fortified with citric acid. HVACP technology may be a viable process to pasteurize TCW.

**P01-091**

**Development of Guava Cheese**

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**Introduction:**
Guava is a highly perishable fruit and a rich source of Vitamin C. Guava cheese (GC) is a semi-solid concentrated fruit slice that is widely consumed as a snack in many parts of the world, produced by dehydration of fruit pulp at 60-80°C for 30 minutes. The objective was to develop a formulation consisting of fruit puree with added sucrose or agave, chia seeds, and almonds.

**Method:**
Pectin was added at select concentrations (0.5%, 1%, and 1.5%) along with citric acid to enhance the shelf life of product. Extended shelf life (3 months) studies were conducted on physicochemical and sensory parameters.

**Results:**
Moisture content, pH, and water activity of guava cheese samples at 0 and 90 days were between 28.32±0.36 to 34.34±0.17, 3.35±0.16 to 3.25±0.03, and 0.81±0.00 to 0.79±0.07 N. Ash, protein, and fat contents of control samples were only 2% lower than samples with pectin. Firmness, mouthfeel, flavor and overall acceptability of control and 1% GC were equally liked by the panelists; whereas, 1.5% GC and 0.5% GC were scored lower on sensory parameters (firmness, mouthfeel, flavor, and overall acceptability) by panelists based on a five-point hedonic scale. Total polyphenols in control, 0.5%, 1%, and 1.5% guava cheese samples on 0 and 90 days were between 9.6±0.1 to 3.50±0.05, 9.8±1.27 to 3.43±0.17, 8.0±0.8 to 3.68±0.07, and 6.8±0.8 to 3.79±0.07 N. Ash, protein, and fat contents of control samples were only 2% lower than samples with pectin.

**Significance:**
Guava cheese may be utilized as a fruit snack by adding alternative sweeteners and functional ingredients for health benefits without affecting the physical properties of product. Guava is an underutilized fruit in the US, and development of functional products may enhance consumption and provide beneficial effects.

**P01-092**

**Antioxidant Activity of Papaya Peel Extracts Against H. O. Induced Oxidative Stress in HepG2 Cells**

**S. Salla,** Alabama A & M University, **R. Sunkara,** L. Walker, **M. Verghese,** Email: swethasalla@gmail.com

**Introduction:**
Papaya peels (PP) are discarded after consuming the fruit, however, they contain phenolic compounds and are a great source of potential health benefits. In this study, we aimed to use this abundant by-product to develop a functional beverage extracts. A functional yogurt-based beverage was developed and sensory analysis was also conducted using a 5-point hedonic scale comparing consumer preference of herbal or chai beverages.

**Results:**
The highest phenolic content was observed in CT aqueous extracts (AE) (500 mg GAE/g), all other extracts had significantly (P≤0.05) lower phenolic content. CT AE had significantly (P≤0.05) higher flavonoid content compared to all other extracts (1.7 mg CAE/g). The highest DPPH radical scavenging activity was observed in HT methanolic extracts (ME) (44.48% inhibition). The lowest DPPH radical scavenging was observed in HT AE (21.88% inhibition). Approximately 61% of sensory panelists gave the yogurt-based developed product a rank of 4 or greater (on a 5-point hedonic scale) with 41% of panelists preferring the HT beverage over the CT beverage.

**Significance:**
The results of this study suggest that a combination of herbal teas and spices may benefit consumers by improving their antioxidant status and may have potential as a functional-beverage.
Two sensory tests (one for elderberry and one for aronia kefir) were carried out in the antioxidant activity that may contribute to decreasing the risk of chronic diseases, such as breast cancer. Elderberry products made with commercially available juice were high in total phenolic content, and DPPH scavenging capacity were conducted. Higher acceptability was observed among kefir made with sugar compared to products made with other natural sweeteners. The highest overall acceptability score was the aronia kefir (6.27), which was sweetened with sugar. Higher sugar content resulted in higher acceptability (6.65) among elderberry kefir products. Approximately 50% of the panelists were non-consumers of kefir and more than 50% panelists were naive for aronia and/or elderberry. Considering scores higher than 5 demonstrated that consumers have positive attitudes towards the products, the results were very promising. Aronia products made with juice from fresh berries contained high amounts of phenolic compounds including anthocyanins and exhibited antioxidant capacity. Elderberry products made with commercially available juice were high in total phenolic compounds and lower in anthocyanins.

Significance: Value added products such as kefir containing aronia or elderberry can provide potential food products to boost the local farm economy in Maine, and would help to increase the consumption of the underutilized berries and provide a healthy food choice for the public.

P01-093
Effect of Processing, Purification, and Fractionation of Phenolic Substances in Three Phenolic-Rich Legumes on Antioxidant and ACE Inhibitory Activity
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Introduction: Lentil, black soybean, and black turtle bean have been reported to possess high antioxidant activities which are related to the prevention of hypertension. However, effects of purification and fractionation of phenolics in the extracts on the yield, phenolic composition, antioxidant, and ACE inhibitory activity of resultant extracts and fractions have not been fully studied. This study’s objective was to study the effect of processing, purification, and fractionation on phenolic composition, antioxidant, and ACE inhibitory properties of extracts and fractions.

Method: Lentil, black soybean and black turtle bean were steamed at 100 ºC for 10, 50, and 30 min, respectively. The cooked and respective raw legumes were extracted with acetone/water/acidic acid (70/29.5/0.5). The crude extract (CE) was purified by removing sugar, organic acid, and protein by XAD-7 packed column. The extract was designated as semi-purified extract (SPE). The SPE was further separated in LH-20 packed column through sequential elution by water, 50% ethanol, and 50% acetone. Phenolic composition, ACE and antioxidant activity were analyzed for CE, SPE, and each column fraction.

Results: The results showed that steaming treatment had great impact on the yield, phenolic composition, antioxidant and ACE inhibitory activity. Total phenolic content (TPC), total flavonoid content (TFC), condensed tannin content (CTC), DPPH radical scavenging activity, and oxygen radical absorbing capacity (ORAC) of SPE were improved by more than 10 times compared with CE. Fractions eluted by 50% ethanol and 50% acetone exhibited higher values than their respective water-eluted fractions. In most cases, fractions eluted by 50% acetone had significantly (p < 0.05) higher TPC, TFC, CTC, and DPPH than the 50% ethanol eluted fractions. The ACE inhibition IC50 values of crude extracts from lentil, black soybean, black turtle bean were 261, 204, and 530 µg/ml, respectively; and the IC50 values for respective cooked crude extracts were 261, 189, and 1028 µg/ml, respectively. ACE inhibitory activity might be more related to specific structure rather than total sums of phenolic compounds and their antioxidant activities.

Significance: This study offers a chromatographic method to effectively concentrate and separate phenolic compounds. Our study shows ACE inhibitory activity might be more related to specific structure rather than total sums of phenolic compounds and their antioxidant activity.

P01-094
Evaluation of Sensory and Phytochemical Properties of New Kefir Products Incorporated With Aronia or Elderberry Juice
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Introduction: Aronia and elderberries are underutilized berries that grow in North America and can be grown commercially. They have a high content of phenolic compounds and exhibit high antioxidant activity that may contribute to decreasing the risk of chronic diseases, such as diabetes. In this study, new products were developed by incorporating either aronia or elderberry juice into kefir, which is a fermented dairy product that contains up to 18 varieties of bacteria. Table sugar or natural sweeteners (monk fruit or stevia) were added to the products to increase the sweetness.

Method: Two sensory tests (one for elderberry and one for aronia kefir) were carried out in the Sensory Testing Center of University of Maine. Each test had 100 untrained panelists that were recruited from the University community. Demographic information was collected, and consumer acceptability was assessed with a 9-point hedonic scale (1=dislike extremely and 9=like extremely). Proximate analysis (color, pH, Brix, and titratable acidity) and phytochemical measurement (total monomeric anthocyanin content, total phenolic content, and DPPH scavenging capacity) were conducted.

Results: The highest overall acceptability score was observed among kefirs made with sugar compared to products made with other natural sweeteners. The highest overall acceptability score was the aronia kefir (6.27), which was sweetened with sugar. Higher sugar content resulted in higher acceptability (6.65) among elderberry kefir products. Approximately 50% of the panelists were non-consumers of kefir and more than 50% panelists were naive for aronia and/or elderberry. Considering scores higher than 5 demonstrated that consumers have positive attitudes towards the products, the results were very promising. Aronia products made with juice from fresh berries contained high amounts of phenolic compounds including anthocyanins and exhibited antioxidant capacity. Elderberry products made with commercially available juice were high in total phenolic compounds and lower in anthocyanins.

Significance: Value added products such as kefir containing aronia or elderberry can provide potential food products to boost the local farm economy in Maine, and would help to increase the consumption of the underutilized berries and provide a healthy food choice for the public.

P01-095
2α-Hydroxysursolic Acid Inhibits Cell Migration and Invasion in MDA-MB-231 Human Breast Cancer Cells via EGFR-Dependent PI3K/Akt Signaling Pathways
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Introduction: Breast cancer is the most common cancer diagnosed among women in the United States. Epidemiological studies suggest that increased consumption of fruits and vegetables has been linked to reduced risk of developing breast cancer. Previous work from our lab demonstrated how 2α-hydroxysursolic acid, one of the major triterpenoids isolated from apple peels, had potent anti-proliferative activity against human breast cancer cells. However, the mechanisms of anti-migration and anti-invasive activities are not completely understood. The objective of this study was to investigate the mechanisms of action of 2α-hydroxysursolic acid in inhibiting cell migration and invasion in MDA-MB-231 human breast cancer cells.

Method: 2α-Hydroxysursolic acid was isolated and purified from apple peels as reported previously in our laboratory. Anti-migration of 2α-hydroxysursolic acid in MDA-MB-231 cells was evaluated by scratch assay. Anti-invasion of 2α-hydroxysursolic acid in MDA-MB-231 cells was evaluated by trans-well assay. Effects of 2α-hydroxysursolic acid on MMP-2 and MMP-9 enzyme activity was determined by zymography assay. All the key proteins involved in regulating cell signal transduction pathway were determined by Western Blot analysis.

Results: 2α-Hydroxysursolic acid significantly inhibited EGF-induced MDA-MB-231 cell migration and invasion in a dose-dependent manner at the concentrations without cytotoxicity. The activities of MMP-2 and MMP-9, critical enzymes for cancer cell migration and invasion, were dramatically inhibited in a dose-dependent manner. Western blot analysis indicated that 2α-hydroxysursolic acid significantly inhibited EGF-induced phosphorylation of EGF receptor (EGFR) and Akt. Furthermore, 2α-hydroxysursolic acid suppressed EGF-mediated nuclear protein levels of NF-κB, c-Jun and c-Fos, known as transcriptional factors, led to down-regulation of VEGF expression.

Significance: 2α-hydroxysursolic acid has been shown to have potent activity in inhibiting migration and invasion in MDA-MB-231 human breast cancer cells via EGFR-dependent PI3K/Akt signaling. These results are important in understanding anticancer activity of fruits and vegetables and potential application of 2α-hydroxysursolic acid in the prevention of breast cancer.
Results:
Rats fed 5% quinoa had the lowest weight gain (232.7 g), and rats fed control had the second lowest (233.3 g). Highest weight gain was observed in rats fed 10% quinoa (245 g). Lowest cecal weight was seen in rats fed 5% quinoa (0.94g) and highest seen in rats fed 10% quinoa (1.14g) compared to control (0.97 g). Rats fed control had the highest cecal pH (7.01) compared to treated groups, and rats fed 20% quinoa had the lowest (6.78). Rats fed control had the highest number of total AFC (231) compared to rats fed treatment diets. Within treatment groups, rats fed 20% quinoa had the highest number of total AFC (121.50) compared to 10% (69.67) and 5% (83.67). For crypt multiplicity, rats fed 5% quinoa had the highest number of AFC at 1 crypt/focus. Rats fed 10% quinoa had the second highest number of AFC at 2 crypt/focus. Total caryps for control were higher (777) compared to treatment groups, and lowest observed in rats fed 10% quinoa (528). Results show that, in most treatment groups, rats fed quinoa had highest weight gain, lowest AFC occurrence, lowest crypt multiplicity, and lowest total crypts.

Significance:
Diets containing quinoa reduced AFC development and may play a role in chemoprevention. Quinoa may have benefits in reducing the incidence of pre-neoplastic lesions, and regular consumption should be encouraged via food products.

P01-097
In Vitro and In Vivo Absorption of Mango Galloyl Derivatives
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Introduction:
Mangoes (Mangifera indica L.) are a fruit grown in tropical and subtropical regions worldwide with cultivars available for consumption throughout the year in the most developed countries. Mangoes have been found to contain galloyl derived polyphenols, which include gallic acid, monogalloylglucosides, and galloantinonins ranging in degrees of polymerization from 4 to 12 galloyl substitutions. Many bioavailability studies are available for gallic acid, yet little work has been performed investigating the absorption of monogalloylglucoside and galloantinonins other than pentagalloylglucose. Gallic acid has been found to undergo Phase II metabolism and assessment of the biological activities of its metabolites will provide the foundation for conducting clinical trials with a high relevance for public health. The objective of this work was to investigate if galloyl derivatives other than gallic acid produce are absorbed and produce Phase II metabolites.

Method:
For in vitro absorption the apical layer of confluent Caco-2 monolayers were incubated with gallic acid and monogalloylglucoside. Aliquots from the basal layer were taken every 0, 30, 60, and 120 min. For in vivo absorption young pigs were orally administered with gallic acid and monogalloylglucoside at 32 mg/kg body weight with plasma taken over a 10 h range. Samples were analyzed for galloyl derivatives via HPLC-MS.

Results:
Gallic acid and monogalloylglucoside were found to transport across Caco-2 monolayers at a rate of 0.011%/h and 0.009%/h respectively. Oral administration of gallic acid and monogalloylglucoside led to the characterization of the gallic acid phase-II metabolites, 4-O-methyl gallic acid and 4-O-methyl gallic acid 3-O-sulfate in plasma. Despite differences in stereochemistry, results indicate that both gallic acid and mono galloyl glucoside are absorbed in the enterocytes and produce galloyl derived metabolites that are found in circulation.

Significance:
Mangoes are currently global popularity and wide range of galloyl derivatives make it a practical and relevant medium for studying gallic acid metabolism. Gallic acid has been shown to possess both anti-cancer and anti-inflammatory activity in vitro, and if its activities of its metabolites will provide the foundation for conducting clinical trials of monogalloylglucoside and gallotannins other than pentagalloylglucose. Gallic acid and monogalloylglucoside were found to transport across Caco-2 monolayers with a high relevance for public health. The objective of this work was to investigate if galloyl derivatives other than gallic acid produce are absorbed and produce Phase II metabolites. Gallic acid and monogalloylglucoside were found to transport across Caco-2 monolayers with a high relevance for public health. The objective of this work was to investigate if galloyl derivatives other than gallic acid produce are absorbed and produce Phase II metabolites. Gallic acid and monogalloylglucoside were found to transport across Caco-2 monolayers with a high relevance for public health. The objective of this work was to investigate if galloyl derivatives other than gallic acid produce are absorbed and produce Phase II metabolites.

P01-098
An Investigation of Food Intake Patterns of Adolescents Ages 13 to 19 in Madison County, Alabama
C. Holden, Alabama A&M University, J. Patterson, M. Verghese, L. Walker, Email: carlissa.holden@gmail.com

Introduction:
The Centers for Disease Control reports that approximately 12.7 million U.S. children and adolescents (aged 2 to 19 years) are classified as obese. A diet rich in whole grains, fruits, vegetables, lean meats, and low-fat or fat-free dairy products is considered a healthy diet for adolescents; and may be used to combat obesity. This study examined dietary patterns and medical history of African-American, Asian, and Caucasian adolescents (ages 13-19 years) in Madison County, Alabama.

Method:
A Food Intake Survey was administered to participants (n=406) to determine food intake habits of milk, grains, vegetables, proteins and fruits. Select questions were derived from the National Institute of Health Dietary Health Questionnaire (DHQ), which has been validated for its effectiveness in assessing dietary patterns of different ethnic backgrounds.

Results:
Results showed highest frequency of consumption of milk to be 3 to 4 times a week; and showed significant differences (p < 0.05) in milk consumption rates between Caucasians (5.5 oz/d) and African-Americans (0.5 oz/d). Overall average rate of consumption for food: juice was 6 oz/d; breads 1.5 slices/d; protein 10 oz/d; and snacks 3 cups/d. Caucasians more frequently consumed fast foods (1 time per week) compared to African-Americans (1 time per month). The prevalence of diabetes, heart disease, high blood pressure, or high cholesterol in participants was each less than 1%. Participants reported a lower prevalence of high blood pressure (25%), high cholesterol (38%), and diabetes (14%) in their mothers compared to their fathers (49%, 52%, and 30%). The highest frequency of out-of-school physical activity was 2-3 times per week with no significant differences (p < 0.05) among ethnic groups.

Significance:
Interventions providing educational information regarding healthy food choices; physical activity; and nutrition related culinary ideas for healthy eating habits are suggested in order to combat the poor eating habits observed, and may also serve in the prevention or decrease of adolescent obesity.

P01-099
Hypocholesterolemic Effects of Pressed and Solvent-Extracted Fruit Seed Oil
H. Teh, University of California, W. Yokoyama, Z. Pan, T. McHugh, Email: hteh@ucdavis.edu

Introduction:
Heart disease causes 25% of all deaths in the United States. Cholesterol-carrying low-density lipoprotein (LDL) from high-fat diets is a major risk factor. Adequate intake of plant-derived oil rich in polyunsaturated fatty acids (PUFA) could substantially reduce plasma total cholesterol and LDL. The objective of this study was to compare the hypolipidemic effectiveness of mechanically pressed or solvent extracted grape, tomato, and pomegranate seed oil in decreasing plasma and hepatic cholesterol using hamster models.

Method:
Male Golden Syrian hamsters, randomly assigned into groups of 8, were treated with 7 different high-fat diets. The control (C) diets contained 18% (w/w) butter. In the fruit seed oil (FSO) diets, 10%, 10%, and 3%(w/w) oils of grape (GSO), tomato (TSO), or pomegranate (PSO) obtained from pressed and solvent-extracted methods were used to replace the corresponding portions of butter. After a 3-week ad libitum feeding period, organs, blood, and fecal samples were collected and analyzed. Body and organ weights were recorded. Plasma lipoproteins were determined by size-exclusion chromatography. Enzymatic assay kits were used to quantify plasma triglyceride, liver cholesterol, and triglycerides.

Results:
Body and organ weights of the hamsters on the FSO diets were not different from on the C diet, indicating FSO have no toxic effects. Blood plasma lipid of the FSO diets ranged from 100-200 mg/dl, significantly lower compared to 650 mg/dl of the C diet. Except for pressed PSO, the LDL/HDL ratios were also decreased in all FSO diets. No significant differences were observed between oil of distinct extraction methods. Liver fat contents of pressed TSO, solvent-extracted GSO, and both PSO diets were higher. Liver triglycerides, total cholesterols, and free cholesterols did not vary between FSO and C. However, liver cholesterol-esters were higher in FSO than in C. High PUFA contents in FSO might have increased LDL uptakes by LDL-receptors and lipid esterification in liver tissues.

Significance:
In conclusion, partial replacements of saturated fat in high-fat diets with PUFA-rich tomato, pomegranate, and grape seed oil from both pressing and solvent extraction could effectively reduce triglyceride levels and improve HDL/LDL ratio in blood. Incorporating these fruit seed oils as parts of a heart-healthy diet is highly recommended.

P01-100
Effect of Viscosity of Food on Glycemic Index: a Human In Vitro Digestive Study
K. JS, Rutgers University, D. Salvi, D. Salvi, Email: karthik.js@rutgers.edu

Introduction:
Digestion is the process of breaking down food into smaller components that can be easily absorbed in the intestinal tract. Based on the previous human in vivo studies, our hypothesis is that the rate of digestion and nutrient absorption is inversely proportional to the viscosity of the food. An in vitro experimental study was performed to predict the effect of the viscosity of food on nutrient release and absorption in the human small intestine, which for starchy foods can be related to the glycemic index of the food.

Method:
The TIM-1 system, an in vitro gastrointestinal model patented by TNO (The Netherlands) was used in this study. Using 5 g maltodextrin as the feed, the viscosity of the stomach content was controlled by varying the proportions of glycerol and water. The initial viscosity values of the stomach content ranged from 1.85 mPa.s to 134.10 mPa.s. After the oral ingestion of food in the TIM-1 system, the experiments were carried out for 5 h. Digested food that were absorbed in the jejunum and ileum sections of the small intestine were collected periodically. Glucose concentrations in the collected samples were evaluated by a chemical assay method. The glycemic index values of these foods were evaluated using 5 g glucose in pure water as the reference food.
The recovery of alkali, enzymatic, and solvent extractions were 91.25 ± 3.08, 97.85 ± 1.93, and 93.7 ± 2.09 respectively. S-FPC and A-FPC had the highest and lowest protein content in order. All emulsions showed mono-modal droplet distribution with the small value of d4,3 ≤ 0.45 μm particle size. The highest (94.8%) and lowest (75.2%) solubility was recorded for E-FPC and S-FPC respectively. A-FPC showed the highest viscosity, water content, and oil holding capacity. Each protein concentrate showed its own unique functional property that could be suitable in a food system. Overall, this study indicated that the correlation of a proper amount of mucilage improves the emulsifying properties of protein concentrate.

Significance:
Flaxseed protein/mucilage concentrate can meet the current consumers’ demand to the plant-based protein and fiber in the food emulsion systems.

P01-103
Greater Galangal (Alpinia Galanga (Linn.) Swartz) Flower Extract Against Listeria Monocytogenes and Staphylococcus Aureus in Culture Medium and Chicken Meat Systems
X. Tang, University of Florida; C. Xu, A. Simone, M. Marshall, S. Williams, Y. Yagiz, Email: tangx1991@ufl.edu

Introduction:
Galangal (Alpinia galanga) flower was found to be rich in phytochemicals and essential oils in our previous study. It is hypothesized that these active components in galangal flowers can be potentially used as natural food preservatives in food system. To test this hypothesis, the antimicrobial activities of various galangal flower extracts against S. aureus and L. monocytogenes were evaluated in culture medium and then in chicken meat systems.

Method:
Galangal flowers were extracted by liquid-liquid (methanol-hexane) extraction and solid-phase extraction. Antimicrobial activity of extracts were tested against S. aureus and L. monocytogenes, and expressed as MIC50 value by using Alamar blue assay. For chicken meat system, two selected fractions extracted from galangal flower at 0, 0.1%, and 0.5% levels were evaluated for their effects on the growth of S. aureus, L. monocytogenes, and naturally present spoilage microflora for 5 days at 4°C. The pH, objective color, and microbial population of all tested chicken meats were investigated after the storage of 0, 1, 3, and 5 days. Tukey’s pairwise tests were performed for comparison of means with SPSS. The significance level was defined at P<0.05.

Results: 100% methanol fraction of galangal flower extract exhibited the strongest antimicrobial activity in culture medium with a MIC50 value of 79 μg/ml against S. aureus and 158 μg/ml against L. monocytogenes. While the galangal flower solid extract showed higher antimicrobial activity in culture medium with a MIC50 value of 582 μg/ml against S. aureus and 703 μg/ml against L. monocytogenes. In the chicken meat system, at the level of 0.5%, both galangal flower extracts exhibited good antimicrobial properties against S. aureus and spoilage microflora but no obvious effect against L. monocytogenes. However, at the level of 0.1%, neither of these extracts exhibited an inhibitory effect on S. aureus, L. monocytogenes, or spoilage microflora. Promisingly, galangal flower extracts showed no adverse effects on the objective color or pH of the chicken meat during storage.

Significance:
These findings indicated that greater galangal flower extracts could be utilized as natural food preservatives to control the growth of S. aureus and spoilage microflora in raw chicken meat, and therefore enhance its safety, quality, and shelf life.

P01-104
Obtaining an Extruded Breakfast Cereal High in Fiber With Flaxseed and Amaranth
J. Tobías-Espinosa, A. Quintero-Ramos, C. Amaya-Guerra, E. Pérez-Carrillo, F. Martínez-Bustos, J. Biez-González, M. Núñez-González, J. Ortega-Gutiérrez, Email: jazletobias@gmail.com

Introduction:
Cereals and cereals-based products are unique functional property that could be suitable in a food system. Overall, this study was to elaborate an extruded breakfast cereal with flaxseed and amaranth as ingredients with acceptable physicochemical and functional properties.

Method: Six different mixtures were prepared using flaxseed (10% and 15%), and amaranth (30%, 40%, and 50%), which were added to a mixture consisting of corn starch and additives such as sucrose, cinnamon, and cocoa. They were processed in a twin-screw extruder (screw speed of 272 rpm, 22% of moisture content and temperature barrel of 150 °C). The extruded products were evaluated with different chemical analyses (proximal analysis, total dietary fiber, soluble, and insoluble fiber); physical properties (water absorption and solubility indices, bulk density, expansion rate, texture (crispness and hardness), pasting properties and for scanning electron microscopy.

Results: The cereals obtained had significant fat content, dietary fiber and high protein content (12%) compared to other commercial breakfast cereals. The different proportions of ingredients in the mixtures affected significantly the physicochemical properties (p<0.05). The extruded cereals from mixture with higher content of flaxseed resulted with the highest content of soluble fiber (1.9%). Also, the extruded cereals resulted in lower maximum viscosity (MaxV) values (<9.5 Cp), attributed to the damage that
occurred during the extrusion process. This relates to the results of microscopy analysis; which revealed a loss of starch structure. Texture analysis showed that hardness of the extruded cereals was significantly affected by the different mixtures (p < 0.05). However, no significant differences were observed in the crispness parameter (p > 0.05). The extruded cereal from the mixture with 15% figs and 40% amaranth resulted in higher hardness value (5.2 N), and presents the highest content of dietary fiber.

Significance: The addition of high fiber as figs and amaranth grains to breakfast cereals processed by extrusion-cooking presents acceptable physicochemical properties: it is a healthy alternative of consumption for people with chronic degenerative diseases.

P01-105
Impact of Extrusion on Fruit/Vegetable-Millet Blends on Recovery of Carotenoids and Product Physical Properties
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Introduction: In Senegal, interest in leveraging native plants as food ingredients for alleviating micronutrient deficiencies has grown simultaneously with the desire for new convenient forms of traditional products. Extrusion offers a cost effective path to generation of high quality instant thick and dry porridges from traditional grains. However, the extent to which extrusion can be adapted to generate new micronutrient dense blended fruit/vegetable-cereal products has not been fully explored.

Method: To understand the impact of extrusion on quality attributes of instantized fruit/vegetable-cereal blends, millet (Senegalese Soun var.) was prepared as whole grain (WG) or decorticated (DC) (ext rate=70%). Powdered carrot (CRT), papaya (PAP), and mango (MAN) were combined with WG or DC millet (25:75%) and adjusted to 30% moisture prior to extrusion on a Technochem Mini-Extruder© (900rpm; Final Temp = 87°-91°C). Instantized products were assessed for quality attributes (color, water absorption and water solubility index, pasting properties (RPV), as well as provitamin A and total carotenoids recovery (HPLC)).

Results: Extruded products contained 619-7442 and 440-6906 µg/100g DW of total and provitamin A carotenoids respectively. Carotenoid recovery ranged from 29.7-65.9% suggesting marginal to good quality to good stability. CRT blends provided highest carotenoid levels reaching 7442 µg/100g DW due to high starting material content. Extrusion of DC millet with CRT and PAP powders had greatest impact on final color increasing browning index and chroma values respectively from 30 and 15 (DC Control) to 90 and 40 (DC-CRT) and 72 and 35 (DC-PAP) (P<0.05). Similar effects were observed in WG products. Water solubility and absorption indexes were a significantity (P<0.05) increased by added fruit/vegetable powders in both DC and WG products. Extrusion with fruit/vegetable powders altered physical properties of final porridges. Highest peak and final viscosities were observed in WG-CRT porridges (1517 and 2426 RVU) while MAN and PAP addition decreased viscosity. Peak and breakdown viscosities were lower in DC blends (864-1243.3 and 80.7-145 RVU) compared to DC control (2453.3 and 1978.7 RVU).

Significance: These data suggest that production of extruded fruit/vegetable millet blends with reasonable recovery of provitamin A carotenoids is possible, however, the impact to physical and sensorial properties must be further explored.

P01-106
Consumer Acceptability of a ‘Simply Sweet’ Ice-Cream Product Sweetened With Whole Dried Figs (Ficus Carica L.)
E. Salcido, California State University, Long Beach, C. Rock, C. Costa, P. Kreyes, M. Chakalain, S. Marquez, Y. Liu, Email: Esaclido22@gmail.com

Introduction: In Senegal, interest in leveraging native plants as food ingredients for alleviating micronutrient deficiencies has grown simultaneously with the desire for new convenient forms of traditional products. Extrusion offers a cost effective path to generation of high quality instant thick and dry porridges from traditional grains. However, the extent to which extrusion can be adapted to generate new micronutrient dense blended fruit/vegetable-cereal products has not been fully explored.

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Significance: These data suggest that production of extruded fruit/vegetable millet blends with reasonable recovery of provitamin A carotenoids is possible, however, the impact to physical and sensorial properties must be further explored.

P01-107
Investigating Cereal Endosperm Phenolics as Potential Disulphide Interchange Mediators in Polymerization of Starch-Associated Proteins
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Introduction: Cooked sorghum porridges have poorer nutritional quality compared to other cereal porridges, with protein most implicated in the reduced digestibility. During cooking, starch-associated kafirins in sorghum form web-like matrices surrounding the starch granules, adjusting around the swelling granule rather than remaining static upon initial formation. This appears to slow the starch digestion. We hypothesized that phenolic compounds function as redox agents for sulfhydryl-disulphide interchanges during cooking. In sorghum, a stable polymerized protein matrix is formed, while other cereal grains show a collapsing of this matrix on cooking. The 3-deoxyanthocyanidins in sorghum are theorized to be mainly responsible for this difference in stability. Cereal endosperm extracts were analyzed for solubile phenolic content and ability to polymerize a model protein during cooking.

Method: Soluble phenolics from 3 flours (decorticated normal white sorghum, white corn masa, and white rice) were extracted with aqueous ethanol or methanol, alone or acidified. Solvent was removed under vacuum and phenolics were resolubilized in water. Total phenolics content (TPC) was measured by modified Folin-Ciocalteu method as Gallic Acid Equivalents (GAE) and antioxidant activity as Trolox Equivalents by DPPH radical. Phenolic-specific fractions were obtained by solid-phase extraction (SPE) and separated using UPLC-DAD-ESI-MS in negative ion mode. Several compounds were identified and 9 quantified by comparison to standards. Chicken ovalbumin was heated with SPE fractions and separated using SDS-PAGE to observe occurrence of protein polymerization.

Results: Sorghum and corn masa contained 1.66±0.19 and 1.41±0.20 mg GAE/g for acidic methanol extracts, respectively, approximately twice that of rice (0.75±0.10). Solvent affected TPC for sorghum and masa, but rice levels were comparable between solvents. Acidified extraction solvents increased antioxidant activity 30-80%. Higher amounts of sorghum 3-deoxyanthocyanidin were extracted using acidified solvents, and apigenin ranged from 23.34±0.47 to 94.07±7.14 µg/g, with total 3-deoxyanthocyanidin content from 3.9-13.1 mg apigenin equivalents/100 g. Sorghum fractions demonstrated the ability to polymerize ovalbumin to a greater extent than corn masa, and rice exhibited only slight polymerization.

Significance: Elucidating the role of phenolics in protein matrix formation could lead to an understanding of how to form similar matrices in food and cereal products, constraining glycemic response, and forming a delivery method for slowly digestible starch.

P01-108
Reactions of Broiler Sera to Recombinant Flagellar Proteins (FliK and FlID) of Salmonella
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Introduction: Salmonella is the leading foodborne pathogen of human acute bacterial gastroenteritis worldwide. Chickens are regarded as one of major reservoirs of this microorganism. Vaccination is considered as one of the most effective means to control infectious diseases in food animal production. The next generation of poultry vaccines will be sub-unit vaccines. Because bacterial flagella are involved in motility, adhesion, quorum sensing and other virulence activities, we targeted the flagellar proteins as potential subunit vaccine candidates. This experiment describes expression, characterization and antigenicity of two Salmonella flagellar proteins: FlID and FliK.

Method: The Flid and fliK genes were amplified by PCR, and the proteins were over-expressed in an Escherichia coli Expression System. The recombinant proteins were purified by a cobalt-chelating affinity chromatography, and confirmed by nucleotide sequencing of the plasmid, SDS-PAGE analysis, the His tag detection, and MALDI-TOF analysis. Sera from the Flk immunized broilers reacted strongly to Flk, indicating that this protein is immunogenic. Further, we used Flid and Flk as probe to survey prevalence of anti-Salmonella antibodies in broilers.
Results: The ELISA showed >85% of broth sera reacted to FlgK, while about 50% to FlgD. The results implicating that these anti-FlgK antibody may be prevalent in the poultry population.

Significance: These results provide a rationale for further evaluation of these antibodies as vaccine candidates for broiler chickens so that food safety for poultry can be improved. These antibodies may also hold important insights for Salmonellosis commensalism in chickens and pathogenesis in humans.

P01-109
Droplets Coated With Rice Proteins for Controlling the Release Rate of Encapsulated Beta-Carotene During In Vitro Digestion
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Introduction: Site-specific delivery systems are studied to control the release of encapsulated bioactive compounds, e.g., linearly (zero-order) in the small intestine or selectively in the colon. However, few such systems based on food-grade materials have been reported. The objective of this study was to fabricate emulsion-based microcapsules with modified rice proteins (MRPs) to control the release of encapsulated beta-carotene at simulated gastric and intestinal conditions.

Method: MRPs were prepared by incubating an alkaline protein solution overnight at –20°C and milling. Emulsions were prepared by mixing mixtures with soybean oil and a pH 9.0 MRP solution using 1.0 M HCl to pH 7.0–6.2, followed by centrifugation to take the serum phase as final emulsions that were freeze-dried to prepare microcapsules. MRPs, the final emulsions, and the microcapsules were characterized for physicochemical properties. The release of encapsulated beta-carotene from the microcapsules at 37°C was evaluated for up to 2 hours in a simulated gastric juice at pH 1.2 with pepsin and another 2 hours in a simulated intestinal juice at pH 7.0 with pancreatin.

Results: The solubility of MRPs was <10% below pH 6.0 but >90% above pH 7.0. The emulsion droplets had a size of 300–400 nm based on dynamic light scattering and field emission scanning microscopy and a more negative zeta potential between -39.0 and -47.4 mV at a higher pH. The confocal laser scanning microscopy showed irregularly shaped droplets at pH 6.2 and thinner droplet shells at a higher pH between pepsin and pancreatin. During the simulated gastric digestion, the pH 6.2 treatment showed ~25% release of beta-carotene, while others had ~12% release. In the 2-h simulated intestinal digestion, the pH 6.2 treatment showed a complete release of beta-carotene within 10 min, the pH 7.0 treatment showed a zero-order and complete release profile, while pH 6.4-6.8 treatments showed a linear, but <15% release of beta-carotene. Differences in release profiles resulted from the thickness of microparticle shells and the digestion characteristics of MRPs.

Significance: The present findings suggest MRPs can be used to prepare microcapsules that may be used for site-specific delivery of bioactive compounds in the small intestine or colon.

P01-110
Development and Evaluation of the Physicochemical and Sensory Properties of a Shelf Stable Protein-Enriched Ready-to-Eat Banana-Bean Infant Food
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Introduction: Among middle and low-income families in developing countries, foods fed to infants, particularly weaning infants, are very rich in carbohydrates but lacking in protein, fiber, and other essential minerals. The aim of this research was to develop a protein-enriched infant food, analyze key nutrients, and to determine its sensory properties and consumer acceptability in Ghana, Africa.

Method: Bananas and small red kidney beans were purchased, pre-treated, and made into flour. Banana and bean flour were dehydrated using freeze-drying and mechanical oven drying methods, respectively. Banana and bean flour were mixed and made into composite flour in the following banana to bean percentage ratios: 90:10, 75:25, 60:40, and 50:50. The resulting composite flours were analyzed for physicochemical parameters and sensory attributes. sensory panellists were served with 15ml of hot water. 5 g of banana-bean mix powder to make instant porridge. Pre-cooked porridge was prepared by cooking composite flour in boiling water for 10 minutes, and was also evaluated by panellists. Analysis of variance was run using SPSS, v. 20 to determine if there were significant differences between physicochemical and sensory properties of the different composite flours.

Results: All instant and pre-cooked porridge prepared from composite flour were at least slightly liked for all attributes by evaluators. There was however a general preference for instant to pre-cooked porridge. Physicochemical analysis of samples showed a statistically significant difference (p<0.05) in proximate parameters analyzed for all four combinations. The flour showed high levels of crude protein and appreciable levels of crude fiber and inorganic constituents. Protein % had values from 2.55 ± 0.18 to 13.0 ± 0.07 and % ash composition ranged from 3.55 ± 0.03 to 3.75 ± 0.02. Banana composite flour is rich in protein and minerals and would make an excellent food for infants.

Significance: Infant food can help reduce protein energy malnutrition (PEM) among children in developing countries, particularly among low and middle-income families. The product was developed using commonly grown food crops in Ghana. This product will add value to food crops and help minimize post harvest losses due to lack of appropriate storage facilities and underutilization of banana and beans.

P01-111
Analysis of the Wine Spoilage Microorganism Brettanomyces Bruxellensis in Different Types of Oak Barrels
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Introduction: Oak barrels are a primary vector for infections by the spoilage microorganism Brettanomyces bruxellensis in wine. The porous nature of the wood provides an ideal environment where B. bruxellensis can penetrate through xylem vessels and maintain long-term survival. It is therefore vital to the wine industry to develop more efficient sanitation protocols to avoid losses caused by this yeast. To do this, more information is needed regarding penetration of this microbe into barrel staves with respects to oak type, toasting level, and physical location within a barrel.

Method: Sixteen liter barrels made from French or American oaks (Q. petraea and Q. alba, respectively) and processed with two different toasting levels were obtained. The barrels were infected with either B. bruxellensis strain E1 or I1a, and stored for seven months with one un-inoculated barrel of each type serving as controls. Once emptied, the barrels received a general rinsing protocol using hot water and SO2 before being disassembled. Individual staves were first cut into 3 x 10 cm blocks before being subdivided into 4 mm thick layers (inside to outside of barrel). These layers were then placed in a sterile-filtered, nutrient-enriched wine to recover any viable cells present up to 60 days. Differences in yeast populations were analyzed using ANOVA. Additional layers were observed under scanning electron microscopy to compare oak structures and oak microbiota.

Results: B. bruxellensis was recovered from all 0 to 4 mm layers obtained from both bottom and top oak staves. Recovery from 5 to 9 mm layers was only observed for French oak staves located at the bottom of the barrel. Furthermore, yeast populations from heavy toasted staves tended to enter logarithmic growth quicker than similar oak with lighter toastings. Recovery of B. bruxellensis from sterile wine agreed with SEM results regarding infiltration of the yeast into oak staves.

Significance: These data help us understand how B. bruxellensis oak infections differ with respect to oak type, toasting level, and location within an oak barrel. With this knowledge, we can improve upon current oak sanitation protocols used by the wine industry to reduce contaminations by this yeast.

P01-112
Quality Characterization and Improvement of Peanut Butter on the Malawian Retail Market
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Introduction: Peanut butter produced by small and medium producers for the local Malawian market is prone to quality defects including oil separation, discoloration, large particulates, and high levels of aflatoxins. The present study was to see the impact of interventions, such as training on good manufacturing and sanitary practices, on the quality of peanut butters (PB) produced by the participating producers. The study aimed at assessing quality attributes in peanut butter available on the Malawian market before and after intervention as related to quality improvement.

Method: A survey administered to 16 participating PB producers established activities carried out during peanut butter processing. Samples were collected before and after intervention for laboratory analyses according to the Malawi Bureau of Standard for PB. Aflatoxin level, fecal coliform counts, water activity, fat content, color, and fineness of grind were determined. Paired Samples T-Test was used for significance of differences at P-value ≤ 0.05.

Results: Before the intervention, there was a lack of knowledge on post-harvest handling of peanuts, peanut butter processing, and Malawi’s PB standards. High Aflatoxin levels (>150 ppb) and coliforms (>110 MPN/100 ml) were found in the samples. In addition oil separation (>20%), and large particulates (up to 20 ml) characterized the samples. The color measured as L (Lightness) was ≥36, which indicated intense brown color of the samples. A five-day training was conducted on aflatoxin management, good manufacturing practices, PB standards, quality control/assurance, and PB processing.
Samples were then collected for reassessment. The results indicated low aflatoxin levels (0.18–4 ppb) and coliform count (0–3.6 MPN/100 ml). Optimal water activity (0.3-0.5), color (L-value: 47–57), and fineness of grind (9-15 Mils), with very little oil separation.

**Significance:**
This research has contributed to knowledge, expertise in pre- and post-PB processing to the participating processors. Their products can be sold in formal retail markets, competing with other imported brands from South Africa, or could even be exported to neighboring countries. It is also hoped that training as an intervention can be replicated with other small to medium food businesses in Malawi and other countries.

**P01-113**

**Effect of Germination on Immunoreactivity of Black Gram and Mung Bean Seed Phaseolins**

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**Introduction:**
Black gram and mung bean induced food allergies are known. Mung bean major storage protein, phaseolin, is a major allergen (Vg1r 2) known to share 83% sequence identity with black gram phaseolin. During germination, storage proteins are hydrolyzed to provide nourishment for seedling growth. Germination may therefore help reduce or eliminate epitopes contained in the hydrolyzed proteins. The objective of this study was to determine phaseolin immunoreactivity in germinated black gram and mung bean seeds.

**Method:**
Black gram and mung bean seeds were germinated for up to ten days in the dark at room temperature. Sprout length, moisture, and soluble proteins were determined for the germinated seeds. Immunoreactivity of the seed proteins was analyzed by enzyme-linked immunosorbent assay (ELISA) and Western blot using rabbit anti-black gram seed protein polyclonal antibodies (pAbs) and rabbit anti-black gram phaseolin pAb. One-way ANOVA was performed to compare means for difference. Post hoc analysis was performed using Fisher’s least significant difference at P ≤ 0.05.

**Results:**
Upon seed germination, sprout length increased 6.4-111.7 mm for black gram and 10.9-94.1 mm for mung bean while their moisture content increased in the range 53.3-62.2% and 50.4-65.8%, respectively. Soluble Lowry protein content, mg/100 mg dry flour, of germinated black gram and mung bean seeds was 14.6-20.2 and 15.2-16.5, respectively, with corresponding Bradford protein content range of 8.9-13.3 and 9.3-13.4. Electrophoretic analyses of germinated black gram and mung bean soluble proteins exhibited a gradual decrease in 40-60 kDa polypeptides with concomitant increase in 9-26 kDa polypeptides. Phaseolin degradation resulted in generation of 23 kDa polypeptides. Non-germinated samples remained at 30 kDa. The results showed a significant decrease in the corresponding black gram standard designated as 100% immunoreactivity. Upon germination, phaseolin immunoreactivity of black gram remained stable for six days (P > 0.05) while that of mung bean decreased by 41% (P ≤ 0.05) at day one. On Day 10, germinated black gram and mung bean exhibited 55% and 74% phaseolin immunoreactivity decrease, respectively. Western blot and ELISA results were internally consistent.

**Significance:**
Germination significantly decreased, but did not eliminate, immunoreactivity of black gram and mung bean phaseolins.

**P01-114**

**Development of Real-Time PCR Assay for Detection of Total Bacteria in Beverage Emulsions**

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**Introduction:**
It has been observed that freezing negatively impacts the quality of meat resulting in a product with inferior quality to its fresh, unfrozen counterpart. Some of these quality defects include reduced water holding capacity (WHC) and increased drip loss. One explanation of these phenomena is that freezing changes the molecular interactions between water and the meat proteins. These interactions can be explored using nuclear magnetic resonance (NMR) methods to observe the relaxation of the proton (1H) nuclei, which can be associated to the state of water within the system. The objective of this study was to determine how the changes in water state, as probed by NMR micro-imaging, change as a function of freezing and how this affects quality. These measurements can be related to physical changes in the micro-environment of the meat.

**Method:**
Samples of fresh, unfrozen chicken breast meat were obtained and subsamples excised for analysis. The remaining sample was vacuum packaged as frozen at −20 ± 2°C in a still air freezer for 14 to 18 h. Samples were stored at −20°C for about 1 h and removed from the packaging. Subsamples were again excised and the remaining sample re-frozen; the freeze-thaw cycle was repeated multiple times. Micro-imaging was performed on a Bruker 800 MHz NMR with imaging probe. T2 mapping was performed with a 2 mm slice thickness. Images were converted to histograms of the T2 values to determine differences numerically. WHC was measured by press method.

**Results:**
Results showed that the control samples were comprised of a homogeneous proton population. After freezing and thawing, the protons became less homogeneous with a trend of increasing T2 values, representing more mobile water. This effect became more substantial with increased freeze/thaw cycles. Increased freeze/thaw cycles also corresponded with decreased WHC. These results indicate that on a molecular level, freezing is causing a change in the ability of the proteins to bind and immobilize water. This indicates the role of this functional attribute in quality losses in frozen meat.

**Significance:**
By exploring basic mechanisms underlying the freezing process, we can implement more efficient and effective food preservation methods.

**P01-116**

**Effects of Vacuum Tumbling With Chitosan and Water Soluble Chitosan on the Shelf Life of Catfish Fillets in Refrigerated Storage**

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**Introduction:**
Chitosan (CH) is mainly made from crustacean shells and has been reported to have a number of functional properties such as its antimicrobial activity, binding action, and antioxidant activity. CH’s water insolubility restricts the use of this compound in some systems. However, when treated with enzymes, a water-soluble chitosan (WSC) is developed, which overcomes insolubility issues. The aim of this study was to evaluate the antioxidant activity and antimicrobial properties of CH and WSC on refrigerated catfish fillets.

**Method:**
WSC was prepared from enzymatic hydrolysis using Chitonase (Streptomyces sp. N174) and the hydrolysates were separated using an ultrafiltration membrane with molecular weight cut-off of 10 kDa. Three solutions were prepared for this study: (1) a 1% acetic acid (AA) solution, (2) a 0.5% CH solution in the 1% AA solution, and (3) 0.5% WSC in distilled water (DW). DW was used as a control solution. Fresh Catfish fillets were separately tumbled with DW, AA, CH, and WSC solutions for 10 min in a vacuum tumbler and then the catfish fillets were stored in refrigerated conditions (4°C) for 20 days. The fillets were analyzed for cutting force, color, pH, oxidation (thiobarbituric-acid-reactive substances/TVB-N), yeast and molds counts (YMC), and aerobic plate counts (APC). Sampling was done at 0, 5, 10, 15, and 20 days. Triplicate experiments were conducted and the data was statistically analyzed (α=0.05).

**Results:**
Catfish fillets treated with WSC had the lowest lipid oxidation. CH had higher inhibition in APC than the other treatments, and WSC inhibited YMC more than the other treatments during the 20 days in refrigerated conditions. AA treatments had a more rapid decrease in hardness than WSC and DW.

**Significance:**
These results show that the time needed to detect bacterial contamination in beverage emulsions can be reduced significantly using our developed assay. The reduction in the quality inspection lead time would not only increase the flexibility of the supply chain to respond to the market demands, but also increase the cash flow and improve the utilization of the storage capacities at the manufacturing sites. Moreover, the high sensitivity of this assay would improve the food safety standards of beverage emulsions. Further optimization of this assay would allow the determination of viable bacterial cells, extending the scope of its applications in the beverage industry.
Significance:
This study demonstrated that WSC, combined with vacuum tumbling, can be effective at reducing YMC and lipid oxidation in catfish fillets during refrigerated storage.

P01-117
Effects of Water-Soluble Chitosan on Quality Characteristics of Cryogenically Frozen Shrimp
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Introduction:
Chitosan (CH) is a polysaccharide produced by alkaline deacetylation of chitin, a widely available biopolymer found in the exoskeleton of crustaceans. CH can only be dissolved in acids and forms relatively high viscosity solutions. Partial hydrolysis of CH yields water-soluble chitosan (WSC). WSC possesses antioxidant, antimicrobial, and antitumor properties. WSC penetration into shrimp, facilitated by vacuum tumbling, is expected to reduce lipid oxidation and microbial loads. The objective of this study was to evaluate the effects of vacuum tumbling with a WSC solution on quality characteristics of cryogenically frozen shrimp.

Method:
WSC was produced by enzymatic hydrolysis of CH. Two treatment solutions were prepared: (1) a 0.1 M acetic acid solution and (2) a 0.5% WSC in distilled water solution. Shrimp meat was separately vacuum tumbled with treatment solutions, cryogenically frozen, and stored at -20°C. Shrimp meat tumbled with distilled water and shrimp meat without tumbling were used as controls. Water-solubility of CH and WSC was analyzed. Particle sizes of CH and WSC in solution were measured and deconvolution microscopy images were obtained. Fluorescently labeled CH and WSC particles in cross-sections of vacuum tumbled shrimp were obtained. Shrimp were analyzed for aerobic plate counts (APC), yeast and mold counts (YMC), lipid oxidation (thiobarbituric-acid-reactive-substances (TBARS)), color, texture, and moisture content during 120 days of frozen storage. Triplicate experiments were conducted and data was statistically analyzed (α = 0.05).

Results:
WSC had significantly higher water-solubility (89.50±1.28%) than CH (90.95±0.66%). WSC particles were nano-scale (756.33±27.81 nm), while CH particles were micro-scale (5066±154±15 nm). It was observed that fluorescently labeled WSC particles could penetrate into shrimp muscle tissue, unlike CH particles, which were only accumulated at the outer layer of tissue. Shrimp treated with WSC had significantly lower APC (2.41±0.03 log CFU/g), YMC (2.30±0.03 log CFU/g), and lipid oxidation (0.41±0.02 mg malondialdehyde/kg sample) than other treatments at 120 days of storage. Additionally, WSC treated shrimp retained their color, texture, and moisture contents throughout the storage time.

Significance:
This study showed that a WSC solution combined with vacuum tumbling was effective at reducing APC, YMC, and lipid oxidation in shrimp during frozen storage, while maintaining desired physicochemical properties.

P01-118
Optimization of Low-Sodium (NaCl/KCl/Glycine) Roasted Peanuts Based on Sensory Liking, Emotion, and Purchase Intent as Affected by a Health Benefit Statement
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Introduction:
Sensory data on liking and emotional responses are important for designing products to meet consumer expectations. Health benefit statements (HBS) given to consumers likely improves purchase intent (PI) of low-sodium foods. We evaluated sensory liking, emotion, satisfaction, and PI of low-sodium roasted peanuts before and after HBS given to consumers, to optimize salt (NaCl/KCl/Gly) mixture based on sensory liking and emotional responses.

Method:
Ten salt (NaCl/KCl/Gly) mixtures following a three-component mixture design were prepared: (1) a 0.1 M acetic acid solution and (2) a 0.5% WSC in distilled water solution. Each consumer (N=330) evaluated 3 samples per a BIB design, giving 99 replications/sample. Consumers evaluated liking of saltiness and overall-taste, and maintained desired physicochemical properties.

Results:
WSC had significantly higher water-solubility (89.50±1.28%) than CH (90.95±0.66%). WSC particles were nano-scale (756.33±27.81 nm), while CH particles were micro-scale (5066±154±15 nm). It was observed that fluorescently labeled WSC particles could penetrate into shrimp muscle tissue, unlike CH particles, which were only accumulated at the outer layer of tissue. Shrimp treated with WSC had significantly lower APC (2.41±0.03 log CFU/g), YMC (2.30±0.03 log CFU/g), and lipid oxidation (0.41±0.02 mg malondialdehyde/kg sample) than other treatments at 120 days of storage. Additionally, WSC treated shrimp retained their color, texture, and moisture contents throughout the storage time.

Significance:
This study showed that a WSC solution combined with vacuum tumbling was effective at reducing APC, YMC, and lipid oxidation in shrimp during frozen storage, while maintaining desired physicochemical properties.

P01-119
Recommended Statistical Analysis of Replicated Multiple-Samples Sensory Ranked Data Using the Mack-Skillings Test
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Introduction:
 seguridad de los alimentos con contenido de sal bajo (NaCl/KCl/Gly) en el caso de las ensaladas. Se evaluaron las respuestas de los consumidores a los coliflor, lechuga romana, lechuga mesclun, enanas de lechuga, hojas de espinaca, suculenta y frutos del mar. Los resultados se analizaron usando el test de Mack-Skillings (MST) y el test de Friedman (FMT) para datos de preferencia clasificados. Se obtuvieron diferentes conclusiones dependiendo del test utilizado. El test de MST es más adecuado para datos de preferencia clasificados.

Results:
For similar-samples set, higher variations in ranked data from two replications were observed. Regardless of data analysis methods, the larger the sample size, the higher the chi-square value, the lower the P-value (testing Ho: all samples are not different). Analyzing ranked data (#1) separately by replication yielded inconsistent conclusions across sample sizes, hence this method is not recommended. At N=50, consistent conclusions were observed when FMT and MST were used for ranked data (#2, #3, and #4); however, MST was more sensitive. For very-different-samples set, less variation in ranked data from two replications was observed. Although significant differences among samples were found regardless of data analysis methods and sample sizes, MST was more sensitive (lower P-values).

Significance:
This study demonstrated that MST is more appropriate for analyzing replicated sensory ranked data.

P01-120
Visual Cues (Vegetable Name, Green vs. Multi-Color/Variety, Cut Size, and Packaging) Affect Consumer Liking, Emotion, and Purchase Intent: A Case of Ready-to-Eat (RTE) Salads
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Introduction:
The sensory contact with food is mainly via human eyes. Some visual cues affect initial acceptance and purchase intent (PI) of foods. Very few studies have investigated effects of visual cues on emotion and PI. We evaluated effects of visual cues (vegetable-name, green vs. multi-color/variety, cut-size and packaging) on liking and emotion/ willingness of RTE-salads, and predicted PI using liking and emotion/willness associated with different visual cues.

Method:
Twelve RTE-salads were evaluated by 150 salad eaters. Computer-generated salad photos were presented with or without name (iceberg, romaine, spinach). Consumers evaluated liking (9-point hedonic scale) and elicited-emotion/willness (5-point scale) as influenced by visual cues (green-color, small- vs. large-cut, single- vs. variety-vegetable(s), and packaging); then indicated PI (yes/no). Data were analyzed by 2-way-ANOVA, factor analysis (FA) and logistic regression (LRA).

Results:
Sixteen emotion/wellness terms (active, bored, desired, disgusted, energetic, engaging-wellness-lifestyle, good, guilty, happy, healthy, interested, refreshing, safe, satisfied, special, worried) pre-screened using check-all-that-apply survey were selected. With or without name, romaine (7.28-7.29) and spinach (6.52-7.09) were more liked for green-color than iceberg (4.39-6.00); without name, large-cut iceberg (4.39) was less liked for green-color than small-cut iceberg (5.40). Emotion/wellness profiles elicited by green-color (lighter to darker) were different; 14 (excluding guilty) vs. 8 terms were significantly different among salads when presented without vs. with name, respectively.
Emotion “active, energetic, and good” scores were >3.0, while “engaging-wellness-lifestyle and healthy” scores were >3.5. Without name, positive emotion scores elicited by green-color were much higher for romaine and spinach than for iceberg. Variety (with added purple cabbage and carrot) and packaging increased liking scores for overall color of iceberg (5.49 to 6.65 and 6.37, respectively) but had minimal effects on Romaine (6.39 to 6.41). Icons from FA, negative emotions were influenced by cut-size/green-color, while positive emotions were influenced by multi-color/variety/packaging. Emotion/wellness responses elicited by cut-size were not significant for predicting PI. For variety salads presented in a package, a one-unit increase in “active and/or healthy” score would increase PI by 5.02-5.04 times. A one-unit increase in “satisfied” score would increase PI by 4.27 times for a single green-vegetable salad.

Significance:
This study demonstrated that visual cues significantly influenced liking, emotion, wellness, and PI of RTE-salads.

P01-121
Modeling the Effects of Consumer Emotion, Expectation, and Liking on Purchase Intent of Fresh-Cut Apples Using Logistic Regression
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Introduction:
Consumers increasingly demand fresh-cut fruits with more desirable quality and longer shelf-life. Decision to purchase food products is largely driven by product quality that must meet consumer expectation. Emotion elicited by product quality may even be a decisive factor towards purchase intent (PI) rather than expectation and sensory liking. The objective of this study was to evaluate how quality of fresh-cut apples affected liking, expectation, and emotion, and how these parameters affected PI. Method:
High-quality vs. poor-quality fresh-cut Gala apple slices were served to 113 consumers in a balanced and randomized design. Consumers evaluated liking of appearance, sweetness, sourness, juiciness, crispiness, sandiness, and overall liking (a 9-point Hedonic scale), 8 elicited-emotions (active, energetic, good, happy, satisfied, disappointed, disgusted, and frustrated) a 5-point scale), expectation of appearance, sweetness, sourness, juiciness, crispiness, sandiness (a 9-point scale); extremely worse than expected vs. extremely better than expected, and PI (yes/no). Penalty analysis (mean-drop of liking scores) based on JAR (Just-About-Right) scores and logistic regression were performed to identify attributes critical to PI (alpha=0.05).

Results:
Apple quality significantly (P<0.05) affected emotion, expectation, and liking scores. The high-quality sample exhibited higher positive and lower negative emotion scores. It was reported that differences in emotional responses between treatments should be >0.2 units (on a 5-points scale) to have practical meaning. In this study, observed differences were >0.5 for “satisfied, energetic, good, and disappointed”. However, only emotions “satisfied and disappointed” were significant predictors for PI with odds ratio of 2.4-2.8, meaning that one-unit increase of “satisfied” while one-unit decrease of “disappointed” score would increase PI up to 2.4-2.8 times. For textual attributes, sandiness had the highest mean drop (-2.46; too much sandiness), followed by crispiness (-2.13; not enough crispiness), and juiciness (-1.60; not enough juiciness). Increasing one-unit of expectation score for sandiness would increase PI by 1.72 times. One-unit increase of juiciness liking score would increase PI by 1.45 times. Overall, PI was influenced by emotion, followed by expectation, then attribute liking (except overall-liking).

Significance:
This study demonstrated that some emotion terms were more critical than expectation and sensory liking attributes toward PI. Hence, food manufacturers should consider emotional responses when developing consumer-driven products.

P01-122
Emotion and Purchase Intent of Mayonnaise-Type Spreads as Affected by Nutrient Claims for Sodium Content (Low-Sodium, Reduced-Sodium, and Sodium-Free) R. Ardin, Louisiana State University, A. Kiptwosang, K. Pujolis, K. Carabante, P. Chomproungcha, W. Prinyawiwatkul, Email: rardoi7@lsu.edu

Introduction:
Most Americans consume excessive sodium, which elevates the risk of heart and kidney diseases. The Nutrition Facts Label allows consumers to make healthier dietary choices. Most Americans consume excessive sodium, which elevates the risk of heart and kidney diseases. The Nutrition Facts Label allows consumers to make healthier dietary choices. Consumers increasingly demand more sodium-free products when its health benefit is known.

Method:
The objective of this study was to evaluate liking, expectation, and emotion elicited by product quality may even be a decisive factor towards purchase intent (PI) rather than expectation and sensory liking. The objective of this study was to evaluate how quality of fresh-cut apples affected liking, expectation, and emotion, and how these parameters affected PI.

Results:
Consumers evaluated liking of salty and bitter tastes, and overall-liking (a 9-point hedonic scale). Emotion terms were screened using check-all-that-apply online survey. Emotions (bored, calm, disgusted, eager, energetic, guilty, happy, interested, nostalgic, pleased, sad, satisfied, and worried) were selected and evaluated (a 5-point scale).

Emotion and PI (yes/no) were evaluated before and after sodium claims along with negative health effects of excessive sodium consumption were given to consumers. Data were analyzed using ANOVA and logistic regression (alpha=0.05).

Results:
Sodium claims (low-sodium, reduced-sodium, and sodium-free) generally increased positive emotion scores, while decreased negative emotion scores. Emotion “safe” score decreased by 0.83 unit (2.92 to 2.07) for 1.5%-NaCl, but increased by 0.6 unit (2.33 to 2.93) or 2.19 to 2.78, respectively for 1%-KCl or 2%-KCl formulations. The 2%-KCl had the highest “disgusted” score, which was associated with the unacceptable bitter (liking scores=2.43) and salty tastes (liking scores=4.72). Comparing 1.5%-NaCl vs. 1.5%-KCl formulations, the former had a higher “disgusted” score (1.84 vs. 1.67) after sodium claims were given to consumers. The highest increased PI by (15%) was observed for sodium-free claim. Gender, overall-liking, and “disgusted” were the three most significant predictors for PI. Females would likely purchase formulations with sodium reduction more (2.18-2.26 times) than males. One-unit decrease in “disgusted” score would increase PI by 1.9 times. Increasing overall-liking score of 1%-KCl formulation from 5.58 to 6.58 would increase PI 2.67 times.

Significance:
This study demonstrated that sodium claims affected liking, emotion, and PI. The increase in PI of the 1.0%-KCl by 15% indicated consumers’ willingness to purchase a sodium-free mayonnaise spread when its health benefit is known.

P01-123
Tracking Changes in Emotional Responses and Effects on Purchase Intent Caused by Sodium Reduction Claims of Barbecue Sauce J. Alonso-Marenco, K. Pujolis, P. Chomproungcha, K. Carabante, W. Prinyawiwatkul, Email: jalons2@lsu.edu

Introduction:
Barbecue sauce (BBQ-S) has become an ubiquitous condiment in the US. One pack of BBQ-S served at fast food restaurants contains about 260 mg sodium. In our recent survey, consumers used up to 2 packs for each meal, accounting for 22.7% of recommended daily sodium intake (2,300 mg). Sodium reduction claims (SRC) allow consumers to make healthier choices. There is no precedent research on the effects of SRC on elicited-emotions and purchase intent (PI) of BBQ-S, hence this is the main focus of our study.

Method:
Following the 3-component (NaCl/KCl/glycine) mixture design, 10 prototype BBQ-S were prepared with sodium reduction ranging from 38% to 87%, which were qualified for reduced- and/or low-sodium claims. Following a BIB experimental design (t=10, k=3, r=9, b=30), consumers evaluated liking (9-point hedonic) and expectation (9-points; extremely worse than expected vs. extremely better than expected) and PI (yes/no). Penalty analysis (mean-drop of liking scores) based on JAR (Just-About-Right) scores and logistic regression were performed to identify attributes critical to PI (alpha=0.05). Data were analyzed using a mixed model and logistic regression (LRA) (alpha=0.05).

Results:
For BBQ-S with 87% sodium reduction, (1) 63% consumers rated saltiness as JAR (liking score=6.65), and the mean-drop of -2.09 was observed for “not salty enough” (2) 70.4% consumers rated bitterness as JAR (liking score=6.13) and the mean drop of -3.13 was observed for “too bitter” SRC significantly affected emotions, which in turn affected PI. The odds ratio of emotion “satisfied” as a predictor increased from 2.3 to 2.8, while “worried” became significant after SRC with the highest odds ratio=2.94 (meaning that one-unit decrease of “worried” score would increase PI by 2.94 times). Expectation of saltiness and bitterness after SRC did not increase odds ratio values (1.91-2.0). Age, gender and OA were not critical predictors for PI.

Significance:
This study demonstrated that SRC affected expectation, emotion, and PI of BBQ-S. For this reason, manufacturers could develop healthier products and use SRC to drive their sales with minimal impact on consumer satisfaction.

P01-124
Effects of Storage on Sensory and Volatile Compound Profile of Roasted Peanuts S. Wang, The University of Georgia, K. Adhikari, Y. Hung, Email: wsc727@uga.edu

Introduction:
Roasted peanuts are very popular peanut products. During storage, lipid oxidation occurs, which causes accelerated flavor with the development of off-flavors. This phenomenon is also known as “flavor-fade.” In order to extend the shelf life of roasted peanuts, high-oleic varieties have been developed. The major objective of this study was to determine the effects of 8-week storage on the sensory and volatile compound profile of six roasted peanut samples.

Method:
Normal-oleic Georgia 06G kernels (06G), high-oleic Georgia 13M kernels (13M), Runner (mixed) in-shell (Inf) and kernels (P), and Virginia (mixed) in-shell (InVA) and kernels (VA) were roasted to medium doneness and stored for 0, 4, and 8 weeks at 21°C. Consumer
acceptability, descriptive analysis and aroma profile by gas chromatography–mass spectrometry (GC-MS) were performed at each time point. ANOVA followed by post-hoc mean separation (Fisher’s LSD) was used to analyze the data at 5% level of significance.

Results:
GC-MS results showed that after 8 weeks O6G was the most oxidized sample followed by InVA, but descriptive tests found that all 6 samples were still in the early stage of oxidation. Also, the loss of roasted peanutty flavor was not obvious in descriptive analysis. InVA was preferred over VA during the storage. InVA was the most liked sample by consumers at week 0, but as storage time increased it was the only sample that exhibited a decrease in overall acceptability. At week 8, InVA was significantly preferred over InVA. Sample O6G was the least liked sample whereas 13M was the most preferred by the consumers after storage. Also, 13M exhibited significantly lower oxidation with a more stable roasted flavor as indicated by pyrazines.

Significance:
Compared to InVA, InVA was more susceptible to oxidation during storage, and therefore, InVA could be used to manufacture in-shell peanut products for the market. Our results also suggested that high-oleic variety (13M) might be a better cultivar than normal-oleic variety (O6G) given its higher acceptability and better capability to maintain pyrazines and prevent oxidation. The main limitation of the study was that the results are based on a single season harvest.

P02-003
Evaluation of DNA Sequencing Methodologies for the Identification of Fish Species in Consumer Complaint Samples
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Introduction:
Seafood constitutes a multi-billion-dollar industry worldwide and is a common target of species substitution, resulting in both economic deception and food safety concerns. Over the past decade, DNA barcoding has become a powerful sequencing-based tool for fish species identification. While DNA barcoding is known to be successful with uniform fish, consumer complaint samples have typically been processed to various degrees, which can affect the ability to obtain a DNA sequence. The objective of this study was to determine the effects of common cooking methods on DNA sequencing results using both full-length and mini-barcodes.

Method:
Six categories of fish were selected for use in this study: salmon, tuna, mackerel, pollock, catfish and tilapia. Each fish was cooked in triplicate using six common methods: baking, frying, broiling, acid-cooking, smoking, and pressure canning. DNA was extracted from each sample and tested using full and mini-barcoding of the cytochrome c oxidase subunit I (COI) gene. The results were then compared across cooking methods on the basis of sequencing success, percent ambiguities and sequence quality and length using one-way analysis of variance (ANOVA), Tukey's test. The success rates of full and mini-barcoding were compared with a Student's t-test (two-tailed).

Significance:
The results of this study show that DNA barcoding is a robust tool for fish species identification. Both full and mini-barcodes were successful in recovering DNA sequences from samples cooked in a variety of ways, with the greatest success found for full barcodes. However, high-intensity cooking methods, such as canning, can reduce sequencing success and quality.

Results:
Overall, full barcoding showed the greatest sequencing success (95.2%) while mini-barcoding showed a success rate of 90.4%, but there were no significant differences (p > 0.05) between the two methods. Both methodologies showed a significant reduction (p < 0.05) in sequencing success, sequence quality and sequence length for canned samples as compared to other cooking methods. None of the cooking methods significantly influenced the percentage of ambiguities in the samples for either full or mini-barcoding.

P02-004
The Effect of Pre-Freezing Treatments on B-Season Frozen Alaska Pollock Fillets
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Introduction:
Gadoid species, like Alaska pollock (AP), have high levels of endogenous trimethylamine-N-oxide demethylase (TMAOase), which generates formaldehyde (FA) and causes toughness of fish muscle during frozen storage. Fluctuations in storage temperature and FA production can accelerate protein denaturation followed by aggregation during refrigeration and/or frozen storage, resulting in quality deterioration of frozen fillets.

Our objective was to investigate chemical and textural properties of B-season AP fillets as affected by pre-freezing and freezing/thawing (F/T) treatments.

Method:
Fresh B-season AP were harvested from the Bering Sea, frozen at sea, and delivered to the OSU Seafood Laboratory. Frozen whole fish were thawed to -1°C by holding frozen fish at refrigerator (2°C) for 24 h and then, half of the thawed fish were headed/gutted (H&G). Both whole fish (WF) and H&G fish (HF) were filleted after refrigeration for 0, 12, 24, and 72 h and subsequently subjected to various freezing/thawing cycles.
Significance:
Pre-freezing treatments (heading/gutting before refrigeration and/or holding at refrigeration before filleting and freezing) negatively affected AP frozen fillet quality when freezing conditions fluctuated. Increased TMAOase activity in HF group during refrigeration and repeated F/T damaged myofibrillar protein structure, which negatively impacted textural quality of frozen fillets.

Results:
TMAOase activities in all treatments significantly increased as F/T cycles repeated (p<0.05). TMAOase activities of HF group increased as refrigeration time increased at 0-F/T due to breakdown of cell membrane and release of TMAOase during refrigeration. Surface hydrophobicity (So) started to decrease at 6-F/T and significantly dropped at 12-F/T (p<0.05) due to protein aggregation by FA as F/T cycles repeated. Decreases in FA content at 12-F/T compared to 6-F/T possibly resulted from the interaction between FA and protein chains, which potentially converted free form FA to the non-detectable bound form. Differences in textural quality between WF and HF group were not significant at 0-F/T (p>0.05), but differences dramatically increased (p<0.05) at 12-F/T except WFT72h.

Trimethylamine (TMA) and pH results showed similar patterns. A marked peak of pH of HF72h at 12-F/T was possibly caused by microbial reaction, which could have converted trimethylamine-N-oxide (TMAO) into TMA, during initial refrigerated storage and repeated thawing conditions.

P02-005
Effect of Pre-Cooking and Addition of Phosphates on the Quality of Catfish Fillets Baked in a Convection Oven
C. Li, USDA, P. Bechtel, J. Bland, Email: cpatrichi@gmail.com

Introduction:
Frozen fish fillets designed to be baked or reheated in the home oven have been one of the major ways fish are consumed in the US. Examples include frozen salmon, tilapia, pollock, and cod that are precooked, marinated, or breaded, and are pan-fried. However, frozen catfish fillets represent a relatively small portion of the baked and/or reheated market. One objective of this study was to examine the effect of precooking temperature on properties of catfish fillets that were subsequently baked in a convection oven. The second objective was to compare the properties of raw frozen and precooked frozen catfish fillets after baking. Finally, changes in properties as a consequence of a commercial phosphate blend were also evaluated.

Method:
Both fresh and frozen (containing a commercial phosphate blend) fillets were purchased from a commercial Mississippi catfish processor and stored frozen. Fillets (5-7 oz) were trimmed and cut into three pieces each weighing approximately 30 g. For the experiment 6 fillet pieces were used for each treatment. Treatments included plus and minus phosphate (46°C, 60°C, and 71°C) and plus and minus phosphate. After a final baking in a convection oven, sample analysis included weight loss, moisture content, color (L*a*b*) using a Minolta colorimeter, pH, and mechanical texture (hardness). Precooked pieces of fish were prepared by cooking the fish in a 121°C oven until the desired internal temperature was obtained, followed by storing frozen until analyzed or reheated to 71°C in a convection oven.

Significance:
This study will be used to develop precooked catfish products that can be reheated by baking.

Results:
A target internal temperature of 60°C was determined as the best precooking temperature for fish fillets based on preliminary results. The pH values were lower for fillets containing phosphate. Both raw frozen and precooked frozen fillets (containing phosphate) showed significantly lower moisture loss after baking (−3%), relative to the fillets without phosphate, which had a 4.6-6.2% moisture loss. There was no significant difference in texture properties between treatments, however, an overall harder texture (~1.4 times, determined by average peak force per thickness) was determined for fillets without phosphate.

P02-006
Increased Stability and Activity of Alcohol Oxidase at High Hydrostatic Pressure
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Introduction:
Alcohol oxidase (AOX) in the presence of oxygen catalyzes the bioconversion of short-chain alcohols into hydrogen peroxide and the corresponding aroma active aldehydes and ketones. This enzyme has also been used for electrochemical biosensors and bioassays of alcohol. However, due to AOX poor stability its practical application in food processing and biosensors is very limited.

Application of high hydrostatic pressure (HHP) has increased the stability and activity of some enzymes. The aims of this study were (1) to determine the HHP that best stabilizes AOX at selected temperatures and (2) to determine the increase in catalytic activity at selected temperatures, in the range of pressures that stabilize the enzyme.

Method:
A heat-sealed plastic pouch with 100-ml of AOX (Pichia pastoris) was submerged in a temperature-controlled HHP reactor. Samples were treated at 0.1 – 400 MPa, 47 – 58°C. Samples were treated at five processing times adjusted for each temperature to result in an approximate 80% reduction of the residual activity after the longest incubation time of each pressure-temperature combination. A two-fractionic block design with the temperatures as blocks was used. All treatments were done in duplicate. Pseudo-first order rates of inactivation were calculated using linear regression. Linearized Eyring’s and Arrhenius equations were used to calculate the activation volume of inactivation and activation energy of inactivation respectively.

Significance:
Knowledge obtained from this study will permit for rapid and cost-effective biosynthesis of natural flavors and diagnostic technologies for process control and quality assurance.

Results:
Alcohol oxidase was most stable at 120 MPa. No significant (p<0.05) activity decrease was observed within four minutes at 52.6°C and 120 MPa. At 52.6°C there was at least a 91% decrease in the rate of inactivation with HHP as compared to atmospheric pressure. The plot of the logarithm of the residual activity vs. time revealed two linear regions of inactivation, indicating two populations of enzyme with different stability. Because versus time of inactivation, this indicates that a thermodynamic structure of AOX quickly dissociates into active subunits that are stabilized by pressure. The effect of increased activity of AOX at HHP and high temperature is reported.

P02-007
Evaluation of Alginate and Chitosan for Immobilization of Permeabilized Cells of Lactococcus Lactis Containing a Hyper-Thermostable Beta-Galactosidase Enzyme for GOS Production
L. Yu, University of Minnesota, D. O’Sullivan, Email: shadow0106@hotmail.com

Introduction:
Galacto-oligosaccharides (GOS) are prebiotics that are proposed to increase the levels of bifidobacteria in the colon. Recently, we developed an efficient production strategy for GOS using a hyper-thermostable beta-galactosidase enzyme from Sulfolobus solfataricus expressed in permeabilized cells of Lactococcus lactis. The purpose of the current study was to develop an immobilization process for these whole cells such that they can function at high temperatures and can be removed following GOS production.

Method:
Permeabilized whole cells containing this hyper-thermostable beta-galactosidase enzyme were encapsulated in either 2% chitosan or 2%. Both immobilized cells showed a higher thermostability at 100°C than the whole cells alone. However, during extended high temperature processing the alginate dissolved over time whereas the chitosan beads retained a stable structure. This indicated that the chitosan beads may be the only ones suitable for GOS production with the ability to remove them following production. A UV treatment was developed to degrade all DNA in the whole cells, such that any recombinant DNA could not be detected using PCR.

Significance:
In conclusion, these chitosan immobilized whole cells can be used to produce a GOS enriched whey ingredient which would be free of any whole cells.

Results:
The optimum pH for GOS synthesis using the chitosan beads was lower (pH = 5.5), than the free whole cell (pH = 6). In addition, the optimum temperature for GOS synthesis using the immobilized cells increased to 90°C from 85°C with the free whole cells. A potential food application for these beads would be to convert a whey based ingredient into a GOS enriched food. To evaluate its potential for this, a 5% lactose solution was used to make GOS with the beads. Approximately 60% of the lactose was converted into 3-5s and 4-OS and while the majority of the remaining 40% lactose may be 2-OS products, they could not be quantified using the LC/MS approach used here. The enzyme beads retained ~50% activity after 2 cycles of GOS production.

P02-008
Site Directed Mutagenesis of the IanR1 Gene From the Bisan Lantibiotic Gene Cluster in Bifidobacterium Longum DJ010A
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Introduction:
Bisan is a broad spectrum lantibiotic which is produced by bifidobacterium longum DJ010A. It was previously demonstrated to offer this strain a competitive advantage against both E. coli and Clostridium difficile in situ in a simulated fecal environment. However, lantibiotic production in vitro can only be demonstrated on agar media and at very low levels. The IanR gene within this lantibiotic gene cluster was previously proposed to be a putative transcriptional repressor controlling expression of the bisan gene cluster. To further investigate its function, it was necessary to develop a site directed mutagenesis approach to inactivate this gene.

Method:
Recently, the genome editing technology based on CRISPR-Cas9 has been adapted for site directed mutagenesis in many different organisms. The primary difficulty in adapting this approach for bifidobacteria is the difficulty with gene transfer in to
specific strains. However, we recently developed a conjugative approach for efficient gene transfer into all bifidobacteria strains and in this study we combined this with a specifically engineered CRISPR-Cas9 system to target the lanR1 gene.

Significance:
The understanding of the function of all genes encoding bisin will enable strategies to be developed for bisin production by B. longum DJ010A in vitro. Given the broad scale antimicrobial spectrum of this lantibiotic, this could result in the use of a probiotic culture in foods with natural antimicrobial capabilities.

Results:
The CRISPR/Cas9 genome editing plasmid pDOJHR-WD6-Y was constructed and comprises a target-specific guide RNA for lanR1, a codon-optimized cas9 gene, and an RP4-specific oriT. To optimize gene expression, a modified 16s RNA promoter was constructed upstream of the cas9 gene, as well as for the guide RNA and a transcriptional terminator was inserted downstream of these unique regions. This novel CRISPR-Cas9 based gene knockout system has now been used for the introduction of a frame-shift mutation into the lanR1 gene of B. longum DJ010A. This can now be utilized to characterize the function of LanR1 in bisin production by B. longum DJ010A.

P02-009
Biotechnological Treatments of Olive Oil By-Products for Maximum Conversion and Recovery
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Introduction:
Two solids waste can be produced during the extraction of olive oil depending on the process used; a three-phase process olive pomace (3PP-OP) and a two-phase olive pomace (2PP-OP). Economically-efficient and environmental friendly management of those polluting wastes have yet to be identified. Enzymatic treatment and/or microbial fermentation have been pointed out as the most promising strategies for the recovery and conversion of these wastes into valuable compounds. The central hypothesis of this work was that properties of the OP will impact the ability of carbohydrases to release sugars from OP and therefore its potential to become a suitable media for microbial growth. While the monitoring and recovery of polyphenols (possibly high-values compounds) have gathered lot of attention, little has been done to study their fate during enzymatic treatment or fermentation.

Method:
Various enzymes including cellulase, xylanase, hemicellulase, pectinase (Bio-CAT), added individually or as a cocktail, and enzymatic and fermentation conditions using Saccharomyces cerevisiae were assessed on both a 2PP-OP and a 3PP-OP recovered from California olive oil milling plants. Sugar profile and concentrations and total phenolic compounds were characterized using HPLC and colorimetric assay, respectively. Experiments were performed in duplicate and statistical analysis performed with Anova.

Significance:
This work emphasizes the importance of understanding composition of OP in order to tailor better conversion treatments. It also demonstrates the possibility of OP to be to be a source of fermentable sugars. OP is a major waste of the olive oil industry and its conversion might be a better benefit than its current landfill disposal.

Results:
Enzymatic treatments of 3PP-OP yielded an increase of sugar concentration up to 120% after 48h. Simultaneous saccharification and fermentation (SSF) of 3PP-OP resulted in the maximum ethanol produced (26.6 g/L). Both enzymatic treatments and fermentation were strongly inhibited in the case of 2PP-OP which was attributed to high concentration of phenolic compounds. The amount of sugars other than glucose (mainly xylose and arabinose) was in the range of 20 to 55% of the total amount of sugars after enzymatic treatments. Loss in total phenolic content was observed for all experiments except the fermentation and SSF of 3PP-OP.

P02-010
Coating of Different Polysaccharides on Egg Yolk LDL to Form Complex Nanogels Improves Delivery Applications
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Introduction:
Egg yolk low-density lipoprotein (LDL) nanoparticles are naturally-occurring nanoscale delivery systems for nutrients, however, their efficacy is often comprised by poor stability, due to the gelation and aggregation under various conditions. Polysaccharides are ideal coating materials on protein nanoparticles to improve their stability and efficacy for encapsulation and delivery applications. The first objective of our study was to compare the capability of different polysaccharides as coating material to form complex nanogels with egg yolk LDL. The second objective was to explore encapsulation and delivery potentials of nanogels prepared by various polysaccharides and egg yolk LDL.

Method:
Five polysaccharides, pectin, gum Arabic, carboxymethyl cellulose (CMC), carrageenan and alginate were selected in this study. Nanogels were prepared by electrostatic interactions and heating-induced complexation between LDL and polysaccharides, and comprehensively characterized for their physicochemical properties, including particle size, polydispersity index (PDI), zeta potential, and morphology. Nanogels were spray-dried by Nano Spray Dryer to obtain dry powders to compare the role of polysaccharides on drying process. Curcumin was adopted as a model compound to explore the encapsulation potential of as-prepared nanogels.

Significance:
Polysaccharides coated egg yolk LDL nanogels are proved in this study as nanoscale delivery systems that are prepared from natural biopolymers, and thus hold a great future for their applications to deliver nutrients in functional foods.

Results:
Sodium alginate and carrageenan were not suitable to form nanogel with egg yolk LDL, as their high zeta potential (-50 mV) disrupted protein-phospholipid structure, resulting in heterogeneous particles. In the contrast, pectin, gum Arabic and CMC which were moderately charged showed better complexation with LDL, giving homogeneous size distribution. Optimal nanogels fabricated with these three carbohydrates had diameter of 60-80 nm and zeta-potential of ~30-50 mV. After nano spray drying, all the nanogels showed regular particulate powder morphology, except gum Arabic/LDL nanogels which were collapsed powder particles with dented surface under SEM. CMC/LDL and pectin/LDL nanogels showed the best encapsulation efficiency among all polysaccharides. When the curcumin loading ratio reached 1.5%, only the CMC/LDL and pectin/LDL nanogels maintained below 100 nm, but the size of other nanogels was significantly increased to larger than 300 nm.

P02-011
Preparation and Evaluation of a Free-Radical Based Novel Process to Prepare a Polyyphenol-Chitosan Derivative
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Introduction:
Chitosan is linear polysaccharide comprised of D-glucosamine and N-acetyl-D-glucosamine units linked by β(1→4) linkages, derived from deacetylation of chitin. Although chitosan is a biodegradable and biocompatible macromolecules, the poor water solubility is one of the major obstacles for its applications in the fields of food, pharmaceutic, and biomedicine. Conjugation of polyphenols with chitosan is a newly developed process to fabricate water soluble chitosan derivatives. Our major objective was to develop a green and facile process to prepare gallic acid-chitosan conjugate and comprehensively evaluate the physicochemical properties and biological activities of as-prepared water soluble chitosan derivatives.

Method:
A free radical induced grafting approach was adopted to synthesize gallic acid-chitosan conjugate, using ascorbic acid/hydrogen peroxide redox pair under ambient condition. The obtained conjugate was characterized by Fourier transform infrared (FT-IR) spectroscopy, UV-vis spectroscopy, and scanning electron microscopy as well. The reaction condition was optimized by measuring grafting degree and zeta potential of the obtained conjugates. The antioxidant activities were evaluated by DPPH, ABTS, and reducing power assays.

Significance:
Our study demonstrated a green and facile synthesis approach to prepare a novel water soluble chitosan derivative through the conjugation of gallic acid. This simple and toxic-free method has promising potentials in the food industry to synthesize chitosan derivatives with excellent antioxidant activity.

Results:
The FT-IR and UV-vis spectroscopy confirmed the successful conjugation of gallic acid onto the backbone of chitosan molecules. The mass ratio between gallic acid and chitosan played a vital role in determining the grafting degree and zeta potential of the conjugates, with the ratio of 0.5:1 being the optimal ratio that resulted in the highest grafting degree. The antioxidant assays demonstrated that conjugation significantly improved the antioxidant activities, being dramatically higher than that of free chitosan. It was notable that the DPPH and ABTS scavenging activities of conjugate at 0.4 mg/mL reached the same level as the free gallic acid at the equivalent concentration.

P02-012
Structural Properties of Branched α-Limit Dextrins From Waxy Corn Starch and Their Differing Slow Glucose Generation Rates by Mammalian Mucosal α-Glucosidases
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Introduction:
For starch digestion, α-amylase first hydrolyzes the starch structure to linear maltoligosaccharides, mainly maltose and maltotriose, and branched α-limit dextrin (α-LDx) by an endo α-1,4 hydrolytic property. Complete hydrolysis to glucose then takes place through the combined action of the mucosal α-glucosidases in the small intestine.

Method:
In this study, we hydrolyzed waxy corn starch (WCS) by human pancreatic α-amylase fully α-amylolyzed WCS was separated by size exclusion chromatography (SEC), and the analyzed chromatogram showed four main hydrolyzate fractions. Each peak was collected and debranched by isoamylose and pullulanase for 48 h to determine the α-1,6 branched pattern in the α-LDx using high performance anion-exchange chromatography.
Significance: This study shows the possibility to produce slowly digestible carbohydrates that may decrease postprandial glycemic response and control glucose delivery to the body which is related to metabolic syndrome-associated diseases.

Results: The first three eluted SEC peaks (regions I-III) corresponded to branched α-LDx’s, while region IV was the linear maltoligosaccharides. Region I, II, and III had multiple [2] 2, two, and one to 3,6 branched linkages in the structure, respectively. Notably, region I was the most slowly digested to glucose by mammalian mucosal α-glucosidases (glucose generation rate: Region I < II < III < IV), indicating that the multi-branched α-LDx’s have a slowly digestible property.

P02-013
Kernel Composition, Popping, Enzyme Digestibility, and Starch Characterization of High-Amylase Popcorn
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Introduction: Popcorn is one of the largest and most universal nutritious snack foods for human consumption in the world. Cereal products produce a glycemic index as high as that of corn processed foods. Instead, dietary fiber as part of an intact botanical structure, expressed in high-amylase corn, is effective in reducing glycemia. The objective of this study was to characterize and compare the expansion volumes, chemical structures, physical properties, and enzymatic digestibility of high amylase popcorn (GEM-07048 line) kernel and starch with that of commercial popcorn.

Method: High-amylase popcorn (GHAPC) had orange color kernel separated from GEM-07048 popcorn line, and the rest of the kernels were used for normal popcorn (GNPC).

Significance: The results suggest that high RS content in GHAPC may be beneficial for human health since RS is generally chosen by the consumer for its low caloric properties over commercial popcorn.

Results: GEM-07048 popcorn line consisted of 36.3% (normal popcorn, GNPC) amylase-content and 61.4% (high amylase popcorn, GHAPC) amylase-content, which is greater than that of those commercial popcorn (CPC, 30.7%). GHAPC and B73 corn displayed the lowest expansion volume, whereas CPC had the highest expansion volume (11.8, 11.6, and 34.9 cm³/g, respectively). Total kernel number of CPC was the highest (70.1 no/10 g), but B73 corn was the lowest (32.5 no/10 g). The protein content was positively correlated with unpopped kernels (r = 0.904, p < 0.01), but negatively correlated with expansion volume (r = -0.862, p < 0.05), except B73 corn. Amylopectins of the GHAPC starch had the smallest proportions (12.5% and 41.2%, respectively) of short branch chains (DP 6−12 and DP 13−24), but the largest proportions of long branch-chains (11.8% and 34.5%, respectively) of DP 25−36 and DP ≥ 37. GNPC, CPC, and B73 corn starches showed typical A-type X-ray patterns, whereas the other GHAPC starch showed a B-type pattern. GHAPC had the highest gelatinization temperature and the lowest gelatinization enthalpy. After popping kernels and cooking starch, RS (resistant starch) content was higher in GHAPC than both the GNPC and CPC samples. These differences could be attributed to a greater proportion of long branch-chains (DP ≥ 37), and the higher amylase-content.

P02-014
Evaluating the Efficacy of Hydrodynamic Cavitation for Inactivation of Thermophilic Sporeformers in Skim Milk
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Introduction: Various Bacillus species are thermotolerant in nature and survive pasteurization. They are capable of forming endospores post pasteurization and can survive various physical and biochemical treatments. Their ability to adhere to the surfaces of process equipment resulting in biofilm formation make them important contaminants in dairy processes. The objective of this study was to evaluate the application of controlled hydrodynamic cavitation in a continuous mode on inactivating thermophilic sporeforming bacilli in skim milk. We hypothesized that the cavitation effect that generate localized high heat and pressure zones along with shear effect would cause rupturing of the bacterial cell wall resulting in cell death.

Method: Vegetative cells of Bacillus coagulans (ATCC® 12245) were grown up to their mid exponential phase and were inoculated in sterile skim milk at log 5 cfu per mL. The spiked milk samples were passed through API Cavitator (SPX, Denmark) with 4 row rotors in 6mL housing at 60 Hz frequency and 200 L H⁻¹ flow rate with 120 kPa back pressure. The flow from cavitation inlet to outlet was considered as one pass or one cavitation effect (exposure time of 22 sec). Each pass resulted in an average temperature rise of about 15°C. Passes were continued till the outlet temperature was raised to 72°C, simulating the pasteurization temperature. Brain Heart Infusion Agar was used to plate the survivors using standard plating technique. Effect of cavitation on protein denaturation was also studied by measuring denatured protein percentage at pH 4.6 using Kjeldahl method. Experiments were conducted in replicates of two, and were repeated thrice. Statistical significance of the data was determined using SAS software. A significant post treatment reduction (P < 0.05) was observed in the bacterial counts.

Significance: It can thus be concluded that continuous hydrodynamic cavitation effect, along with the rotor-liquid friction, which generated controlled heating, was highly effective in inactivating thermally resistant vegetative cells of Bacillus coagulans by 99.99% with only 2.65% increase in denatured protein percentage.

Results: After 6 passes, only 1.70 log survivors were detected. The average denatured protein percentage was 75.75% before cavitation, which only went up to 78.40% after cavitation.

P02-015
Radio Frequency Dielectric Heating Affects Functionality of Nonfat Dry Milk
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Introduction: Radio frequency dielectric heating (RFDH) is a dry heating method that provides rapid and uniform heating throughout the products’ mass, which is used in baking, drying and defrosting or foods. Studies have shown that when RFDH treatments induced a 5-log reduction of Salmonella spp. in nonfat dry milk (NFDM), whey protein nitrogen index decreased, suggesting that functional properties of the NFDM might be impacted. Thus, this research was conducted to determine if RFDF treatment affected functional properties of NFDM [low-heat (LH) and high-heat (HH), respectively].

Method: Nonfat dry milk powders were treated at 75, 80, and 85°C in the RFDF, held for 125, 63, and 43 min for LH-NFDM, and 115, 52, and 43 min for HH-NFDM (times were set to give 5-log reduction of Salmonella spp.), respectively, and cooled to ~23°C. Powders were evaluated for color, rehydrated to 3.5% protein (w/v), adjusted to pH 7.0, and evaluated for functional properties. Three replications were conducted and data analyzed with a two-way ANOVA and Tukey mean differences (p < 0.05).

Significance: These results indicated that RFDF may be a processing technology that can change the functional properties of milk powder, which may be useful for product development.

Results: NFDM (both HH and LH) treated at 85°C had 7.1% greater viscosity, 6.8% greater overrun, and 27% greater foam stability than the control (non-treated). Also, NFDM treated at 85°C produced gels that were 21% less firm compared with the control. The NFDM treated at 75 and 80°C did not differ from the control for viscosity, foaming properties nor gelling properties. However, the reduction of 3-[1-[(phenylamino)-carbonyl]-3,4- tetrahydro-4-benzylisobenzofuran-6-nitrobenzene sulfonic acid hydride (XTT) increase by 129% in the LH-NFDM samples treated at 85°C compared with the control, indicating that Maillard reaction had been initiated. The XTT reduction was similar in the LH-NFDM samples treated at 85°C and HH-NFDM powder (control, 75, 80, and 85°C).

P02-016
Lipid Oxidation Assessment in Cheddar Cheese Fortified With Micro-Encapsulated Ferrous Sulfate
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Introduction: Milk, an important part of the human diet, historically provides low amounts of iron. As iron deficiency among Americans remains a health concern, iron fortification of cheese could potentially help increase iron intake. The addition of iron (Fe 2+) salts are known to enhance lipid oxidation, acting as a catalyst in the transformation of fatty acids to aldehydes, ketone, and peroxides. These by-products contribute to off flavors ultimately reducing consumer’s acceptability. Due to sensory changes that occur when fortifying iron (Fe 2+) in food products, microencapsulated mineral salts were incorporated into the cheese due to its ability to fortify foods without altering properties. The objective of this study was to assess lipid oxidation changes in Cheddar cheese fortified with microencapsulated ferrous sulfate salts. Two sizes of ferrous sulfate salts were used, including 0.7 to 1 µm for Treatment 2 and 0.22 to 0.422 µm for Treatment 3, the control (unfortified cheese was labeled Treatment 1).

Method: Thioarbituric Acid (TBA) analysis was done to assess whether lipid oxidation rates were affected by ferrous ions. Although, TBA assessment measures MDA formation, thiobarbituric Acid (TBA) analysis was done to assess whether lipid oxidation rates would provide ~30% of the RDA. Future research could assess potential changes in lipid oxidation past the 90-day period.

Results: MDA content in the CH-NFDM samples treated at 85°C increased 1.5-fold compared with the control, indicating that MDA content was effective in reducing glycemia. The objective of this study was to characterize and compare the expansion volumes, chemical structures, physical properties, and enzymatic digestibility of high amylase popcorn (GEM-07048 line) kernel and starch with that of commercial popcorn.

Significance: These results indicated that RFDF may be a processing technology that can change the functional properties of milk powder, which may be useful for product development.

Results: NFDM (both HH and LH) treated at 85°C had 7.1% greater viscosity, 6.8% greater overrun, and 27% greater foam stability than the control (non-treated). Also, NFDM treated at 85°C produced gels that were 21% less firm compared with the control. The NFDM treated at 75 and 80°C did not differ from the control for viscosity, foaming properties nor gelling properties. However, the reduction of 3-[1-[(phenylamino)-carbonyl]-3,4- tetrahydro-4-benzylisobenzofuran-6-nitrobenzene sulfonic acid hydride (XTT) increase by 129% in the LH-NFDM samples treated at 85°C compared with the control, indicating that Maillard reaction had been initiated. The XTT reduction was similar in the LH-NFDM samples treated at 85°C and HH-NFDM powder (control, 75, 80, and 85°C).
Introduction:
Coffee is among the most widely consumed beverages in the world. Coffee industry uses the parameters of pH, water activity (aw), color, and caffeine content as quality parameters. In addition, the roasting process leads to the formation of compounds such as 5-hydroxymethylfurfural (HMF), 2-furural (FURF) that have raised safety concerns (0.04). Current analytical methods to assess coffee quality are time-consuming, expensive, labor-intensive, and requiring complex sample pretreatment. Mid-infrared spectroscopy and chemometrics provide an alternative for coffee quality assurance with no sample preparation and direct measurements on ground coffee. The aim of this study was to investigate the feasibility of a portable mid-infrared technique combined with pattern recognition analysis for evaluating the key quality parameters of ground coffee.

Method:
A total of 100 dark, medium and light roasted Arabic coffees were purchased from ground stores in Columbus, OH. Two portable mid-infrared spectrometers with different attenuated total reflection (ATR) accessories (single-reflection vs. triple-reflection) were evaluated. Multiple-reflections increase the signal intensity and improve spectral band resolution. Reference concentrations were determined using approved analytical methods including HPLC, Hunter LCh colormeter, pH meter, and aw meter. Samples were randomly divided into calibration (80%) and external validation (20%) sets and partial least squares regression (PLSR) was used to develop calibration and external validation models for predicting quality traits.

Significance:
The proposed technology is a rapid tool for screening and quality assurance applications that requires minimal sample preparation and personnel training and can be amenable for in-plant or in-field applications.

Results:
Samples showed a wide range of variability for color hue angle (13.5-51.7), pH (5.1-6.3), aw (0.04-0.18), caffeine (0.25-13.6ppm), and HMF (2.5-260.5ppm). The predicted quality parameters showed strong correlation with values from reference tests based on PLSR models (R2valid=0.94) for both multiple and single-reflection techniques. Color characteristics, pH, aw, and the chemical characteristics of the samples were successfully modeled with our techniques. A single mid-infrared measurement allows us to predict all 7 characteristics of the ground coffee in less than 1 minute. Successfully predicted models gave low standard error of predictions (SEP) that would allow the coffee industry to use this technique for quality control applications.

P02-018 Matrix Effect on the Thermostability of Parvalbumin From Mullet and Salmon
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Introduction:
Parvalbumin is the major fish allergen. It has been reported that IgE from 90% of fish allergic individuals reacts with this protein. In general, parvalbumin is thermostable; however, its thermostability varies among different fish species. Therefore, the objective of this study was to compare the matrix effect on the thermostability of parvalbumin from mullet and salmon.

Method:
Three sample systems from each species prepared in water were studied: partially purified parvalbumin (PP), protein extracts (PE) and ground meat (GM). Parvalbumin was partially purified using size exclusion chromatography. The samples from each system were heated for 0, 2, 5, and 8 min at 100°C, respectively. Indirect non-competitive ELISA, Hunter LCh colormeter, pH meter, and aw meter. Samples were randomly divided into calibration (80%) and external validation (20%) sets and partial least squares regression (PLSR) was used to develop calibration and external validation models for predicting quality traits.

Significance:
In summary, PP was most stable in both species. Mainly due to heat-induced protein interactions, the matrix effect on the thermostability of salmon parvalbumin was greater than that of mullet parvalbumin. This study demonstrates that the sample matrix effect can significantly affect in vitro studies related to food allergenic proteins.

Results:
Overall, from ELISA, in three mullet systems, the immunoreactivity was not significantly different over the heating time (P > 0.05). In salmon systems, the immunoreactivity of PP significantly increased as a function of heating time (P < 0.05). However, the immunoreactivity of PE decreased over the heating time. In GM, parvalbumin immunoreactivity decreased about 83% after heating for 2 min. From SDS-PAGE and WB, for PP, parvalbumin dimer was observed in salmon but not in mullet. Interestingly, its antigenicity increased as a function of heating time. In addition, from WB, parvalbumin tetramer was immunodetectable in unheated PE and GM samples from both species, while it was not visible after heating. From SDS-PAGE, water solubility of parvalbumin in PE from mullet and salmon decreased about 64% and 93%, respectively, after heating for 8 min. It is noted that both molecular integrity and water solubility of mullet PP did not significantly change as a function of heating time (P > 0.05).
In this work, we consider if the presence of ethanol may facilitate the loading of casein. Studies have shown that ethanol affects the conformation of the casein micelle, and molecules (e.g., pharmaceuticals), and this might be an attractive option. Previous is a demand for alternatives. Casein has been shown to solubilize hydrophobic small molecules (i.e., piperine). When ethanol and water are removed, we hypothesize that the resultant powder can be readily rehydrated to produce an aqueous suspension of piperine-loaded casein with a total piperine concentration in considerable excess to its aqueous solubility limit.

**Method:**
A large excess of piperine was mixed with 2% (w/w) sodium caseinate in imidazole buffer (pH 6.7, 20 mM) containing varying ethanol concentrations (0%, 10%, 20%, 40%, v/v).

This solubilization step ensured the aqueous phase remained saturated with piperine and the concentration of piperine in solution increased with ethanol concentration. The mixture was stirred for 24 h and subsequently lyophilized to remove ethanol and water. The resultant powder was rehydrated in buffer to achieve a 2% casein suspension; excess insoluble piperine was removed by gentle centrifugation. The concentration of soluble piperine (i.e., dissolved in water, plus that which was solubilized by the casein) was determined by UV-spectroscopy following extraction into acetonitrile. ANOVA is applied for statistical analysis.

**Significance:**
This approach could be adapted to produce a range of formulations appropriate to disperse insoluble food ingredients.

**Results:**
The solubility of piperine in water was 49 mg/L, but in the presence of 2% casein (i.e., no ethanol used in preparation), the solubility was improved to 134 mg/L (i.e., 174% increase). As the ethanol present at the solubilization step increased, the amount of solubilized piperine increased to a maximum of 342 mg/L (598% increase) at 40% ethanol. We hypothesize that the additional piperine is solubilized by casein and that ethanol either facilitates mass transport to the protein by increasing the aqueous solubility of piperine, or changes the conformation of the protein polymer to increase binding.

**P02-024**
**Effects of Water on Physical Properties of Rice Bran Wax Oleogel**
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**Introduction:**
Government agencies are recommending the reduction of trans and saturated fats in food in favor of unsaturated fat. However, changing the type of fat may lead to undesirable quality of food products. Organogelators such as rice bran wax have recently been studied as a food-safe ingredient to structure oil. However, the current research is focused on pure lipid systems, and not much is known about the role of oleogels in high moisture containing foods. This study looks at how increasing water content may affect the structure of oleogel matrices, and how the addition of an emulsifier can influence its behavior.

**Method:**
Oleogel samples were made with rice bran wax (10% w/w), glycerol monooleate (0 or 1.67%), and water (0, 5, 10, or 20% w/w). Soybean oil made up the rest of the mixtures. Samples were prepared and stored at 5°C and were tested for moisture content, melting point, G' and G', hardness, and microstructure over a 27-day storage period. All tests were carried out at least in duplicate, and ANOVA with Tukey-HSD testing was one to determine differences.

**Significance:**
This information will help food manufacturers predict how the moisture content of their product might affect the functionality of rice bran wax oleogels replacing saturated or trans fats.

**Results:**
After documenting similar melting profiles for all the mixtures, it was found that all the samples maintained their initial water content over 27 days. We did not observe any significant differences in the samples' rheological properties with an increase in water content, emulsifier content, or storage time. All the samples' microstructure was examined during and after cooling. Crystal development began around 70-80°C and continued rapidly in about 1 minute. No further crystal growth was seen after about 67°C. The presence of numerous needle-like crystals, with small water droplets dispersed through the gel, was documented. The samples with 20% water had larger water droplets than those with less water content. It is likely that at 10% rice bran wax, water is not affecting the behavior physical and structural properties of the system.

**P02-025**
**The Ability of Gallic Acid to Generate Reactive Oxidative Species (ROS) Upon Exposure to UV Light**
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**Introduction:**
Our ongoing research shows that the antimicrobial activity of gallic acid (GA) (3, 4, 5-trihydroxybenzoic acid), a phenolic compound naturally present in fruits and vegetables, significantly increased upon exposure to UV light. The mechanism responsible for this has been attributed to the ability of GA to generate ROS such as hydrogen peroxide upon exposure to UV light. However, current literature lacks a comprehensive quantitative and qualitative understanding of the ROS generated from UV exposure of GA. In addition, the effect of UV wavelength on the ability of GA to produce ROS is also not known. The objective of this study is to investigate the ability of GA to generate ROS (hydrogen peroxide, hydroxyl radical and singlet oxygen) upon exposure to UV-A (365nm), UV-B (312nm) or UV-C (245nm).
Method:
GA (500 µM) solutions in deionized water (pH 3.5) or phosphate buffer (pH 7.5) were treated under UV light, and ROS were analyzed at certain time intervals. Hydrogen peroxide was detected using ferrous oxidation xylanol orange (FOX) assay. Singlet oxygen was quantified by the oxidation of added furfural alcohol. Hydroxyl radicals were detected by using hydroxypyphenyl fluorescein (HPF), a fluorescent probe specific for hydroxyl radicals.

Significance:
Since GA is generally regarded as safe by FDA, GA has the potential to be a novel antimicrobial treatment for sanitation food products and food-contact surfaces.

Results:
Hydrogen peroxide, hydroxyl radicals and singlet oxygen were detected from GA solutions prepared in deionized water as well as phosphate buffer. After an exposure of GA to UV-A, UV-B or UV-C for 15 min, the amount of hydrogen peroxide generated was 0.14±0.04, 1.7±0.27 and 28±2.62 µM in water and 4.1±0.05, 38.7±4.01 and 87.5±0.61 µM in phosphate buffer, indicating that UV-C was most effective in producing hydrogen peroxide. The higher pH of phosphate buffer increased the production of hydrogen peroxide. Hydroxyl radicals and singlet oxygen were also detected from GA solution and again, UV-C was found to be the most effective wavelength to produce these ROS. These results showed the ability of GA to generate ROS under the treatment of UV light of various wavelengths.

Method:
Using a BioBasic AX anion-exchange column and a gradient mobile phase, the compounds of interest were successfully separated from extracts of almond meal and almond hulls within 20 min of sample injection. Detection was carried out by a Waters® quadrupole time-of-flight micro™ mass spectrometer equipped with an ESI interface operating in the negative-ion mode. Comparisons of parent molecular ions in samples were made against those of a hydrolyzed phytic acid standard containing all six InsPs. Adenosine monophosphate was chosen as an internal standard for quantification.

Significance:
The successful application of this method on a complex food such as almonds highlights its potential to be used for many other foods, especially those containing phosphate sources other than InsPs.

Results:
As predicted, the new method demonstrated that the use of total phosphorus content for InsP6 determination significantly overestimates the InsP6 content in almonds. Although InsP6 was dominant in almonds, pentakisphosphate still accounted for more than 20% of the total InsPs. Myo-inositol tetrakis-, tris-, bis-, and mono phosphate were also present at detectable concentrations.
phase. The study of the effects of emulsifiers in the lipid systems is of great interest for improving functionality particularly in relation to fat for use in chocolate and confectionery products.

**Method:**
The effects of mono and diglycerides, lactic acid esters, distilled mono glycerides and sorbitan tri stearate on melting and crystallization behavior and solid fat content of palm (non-lauric) and palm kernel (lauric) oil was evaluated using differential scanning calorimetry (DSC) and solid state magnetic resonance spectrometer (p-NMR). The effects aforementioned emulsifiers in retarding bloom in confectionery coatings was also studied.

**Significance:**
The results of this study can be used to optimize crystallization and melting behavior of confectionery fats using emulsifiers during processing to improve their functionality, sensory properties (snap, texture) and visual appearance (gloss).

**Results:**
On the basis of DSC results it was clear that all emulsifiers accelerated crystallization in lauric fats but reduced it in non lauric fats. The solid fat content of both lauric and non-lauric fats was not affected by the addition of emulsifiers. Lauric fat and sorbitan tri stearate gave the best bloom resistance and highest gloss among all treatments in a 6 month shelf-life study.

**P02-030**

**Natural Wax Organogels for Cookies**

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**Introduction:**
Organogelators formed from vegetable oil and an organogelator have drawn great interest as alternatives to trans fats. Unlike the current alternatives to trans fats such as tropical oils, fully hydrogenated oils and their transesterified oils containing high contents of saturated fats, organogels can be prepared with a variety of oils containing high contents of mono- and polyunsaturated fats. Although organogels have been recognized as promising alternatives to fats containing trans fats and saturated fats, very few studies have been conducted on actual food products. Our research group prepared organogels with natural waxes and vegetable oils and evaluated them as alternatives to the commercial margarine in cookies.

**Method:**
Four different waxes including sunflower wax, rice bran wax, beeswax, and candleilla wax and three vegetable oils including olive oil, flaxseed oil and soybean oil were used in this study to investigate effects of wax and vegetable oil on properties of cookie dough and cookie. Firmness and melting behavior of organogels, hardness and melting behavior of dough and hardness, spread factor, and fracturability of the cookie were evaluated. All means of organogel firmness, dough hardness, cookie hardness, cookie spread, cookie fracturability, and DSC data were compared by Tukey-Kramer HSD test with statistical significance at P < 0.05 using the program JMP 9. All correlation tests were conducted with simple linear regressions using the same JMP program.

**Significance:**
Although more studies including sensory attributes of cookies containing wax-VO organogel should be conducted, this study shows high potential of practical application of organogels in food products such as cookies.

**Results:**
Firmness and melting behavior of organogels were significantly affected by type of wax and vegetable oil. Properties of dough prepared from these organogels such as hardness and melting behavior were also affected by type of wax and vegetable oil. However, when cookies were prepared and tested, it was found that cookie properties such as hardness, spread factor and fracturability were not significantly affected by type of wax and vegetable oil. In fact, cookies made with several combinations of wax and vegetable oil showed very similar properties to cookies made with a commercial margarine.

**P02-031**

**Biopolymer Coating and Chemical Crosslinking Improve the Stability of Solid Lipid Nanoparticles Under Gastrointestinal Conditions**

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**Introduction:**
Solid lipid nanoparticles (SLNs) have been extensively studied as oral delivery vehicles for nutrients. However, solid lipids are known to segregate at acidic condition, such as stomach, and therefore greatly compromise their delivery efficacy as an oral delivery vehicle. Cooling and crosslinking are commonly used to prevent this concern. The first objective of this study was to develop a novel formulation of SLNs coated by casein/pectin. The second objective was to investigate the effects of two different methods of chemical crosslinking, including glutaraldehyde (GA) and 1-Ethyl-3-(3-dimethylaminopropyl)-carboadiimide (ECD) / N-hydroxysuccinimide (NHS), on the stability of SLNs under simulated gastrointestinal conditions.

**Method:**

The SLNs were prepared by a combined solvent-diffusion and hot homogenization method, with sodium caseinate as emulsifier and pectin as coating. Organic phase containing ATO 888 was emulsified in aqueous phase containing sodium caseinate and pectin under homogenization at 80°C. The adsorption of pectin onto caseinate was induced by reducing pH to 5.0 followed by thermal treatment. The particle size, polydispersion index (PDI), zeta potential, and stability in simulated GI tract of SLNs were comprehensively characterized. Nano spray drying technology was applied to obtain powders of SLNs, and the morphology of powders was observed under scanning electron microscope (SEM). The SLNs were characterized by Fourier transform infrared (FT-IR) and differential scanning calorimetry (DSC) for their physical properties.

**Significance:**
The improved the stability of biopolymers coated SLNs under simulated gastrointestinal condition may greatly enhance their delivery efficacy of nutrients through oral administration.

**Results:**
The final particle size, PDI and zeta potential of the SLNs were 300 – 500 nm, 0.2 – 0.3, and –35 to –40 mV, respectively, depending upon coating formulation and crosslinking method. EDC/NHS crosslinked SLNs exhibited more homogeneous and smaller particle size than GA crosslinked ones. FT-IR and DSC indicated that electrostatic and hydrophobic interactions were the driving forces to form biopolymers coated SLNs. Both crosslinked SLNs showed more spherical and compact structure after spray drying. Both crosslinked SLNs were stable in simulated gastric and intestinal fluid. However, the non-crosslinked nanoparticles were not stable in either simulated gastric or intestinal fluid, forming severe aggregated particles.

**P02-032**

**Improved Freeze Drying Efficiency by Ice Nucleation Proteins With Influence on Ice Morphology**

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**Introduction:**
Freeze drying is a dehydration process used to preserve substances by freezing water into ice crystals and removing ice crystals through sublimation. Freeze drying has been favored for products that require high quality, such as biological materials, food, and pharmaceutical products. However, the cost of this process is relatively high due to the long duration of the drying step, which is closely related to the previous freezing step. The influence of ice nucleation proteins (INPs) on the freezing process has been studied by our group for many years, but their effect on freeze drying efficiency remains unknown. Thus, this study aims to investigate the effect of INPs on the efficiency of freeze drying and the related mechanism.

**Method:**
10% wt/vol sucrose solution was used in this freeze drying study as a typical model. Primary drying rate and total drying time were measured to indicate the process efficiency. Three dimensional non-destructive X-ray Computed Tomography (CT) was used to observe and measure the structure of frozen samples to explore the mechanism.

**Significance:**
This study demonstrates the ability of INPs to improve freeze drying efficiency through their alteration of ice morphology, which has significance for reducing the cost of the freeze drying process. The use of X-ray CT in this study also suggests its applicability to study microstructural properties of frozen matrices.

**Results:**
Our results showed that the primary drying rate was improved by 21% at INP concentration of 10-2 mg/mL. Such improvement was more significant at higher subzero temperatures (i.e. -8°C) when a control sample without INPs was unable to freeze. Reduction of total drying time by 20% was achieved by INPs which suggested significant potential for energy savings. The radiographs of X-ray CT data showed that INPs could induce the growth of an ice crystal with a longer dimension and a lamellar shape, which led to the frozen structure of INP samples with more direct vapor flow paths toward the top. So the mechanism for the improvement might be the facilitation of heat and mass transfer under such ice morphology as induced by INPs.

**P02-033**

**Mechanistic Modeling of Non-Spherical Bacterial Attachment and Deposition on Plant Surface Structures**

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**Introduction:**
Bacterial attachment to the surface and passive internalization to fresh produce is the first step in contamination of food. Understanding the mechanism of attachment and internalization could lead to the prevention of future outbreaks on fresh fruits and vegetables.

**Method:**
The goal of this model was to validate and use a Lagrangian particle tracking simulation of a spherocylinder shaped bacteria, *Escherichia coli*, to determin the effect plant surface structures have on attachment. Rotation and transport of the cells was validated versus theoretical and experimental data. Also, simulation results of attachment were validated versus experimentally measured cellular attachment to microfabricated plant structures: stomata, trichomes, and grooves.

**Significance:**
The simulation mechanistically explains how plant surface microstructures affect bacterial contamination.

**Results:**
The simulation results show how trichomes decrease attachment by lowering shear
stress within the microarray while stomata and grooves enhance attachment by creating small regions of increased shear stress triggering shear enhanced adhesion. Highest attachment was on the trichome sides perpendicular to the flow where the shear stress gradient was highest. Attachment to stomata and grooves was upstream and downstream where the shear stress gradient was highest. Microstructures affecting the local fluid shear stress, and not residence time, increased attachment.

P02-034

Effect of Glass Transition Phenomenon on the Shrinkage of Sugar Kelp (Saccharina Latissima) During Hot Air Convective Drying

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Introduction:
Sugar kelp, a brown marine macro-algae, due to its high moisture content (92% wet basis) is highly perishable. It is dehydrated under the sun or using convective drying to produce shelf-stable products. Drying creates void space and stress at the cellular level, leading to shrinkage that affects the quality of the dried seaweed. Since shrinkage is governed by glass transition temperature (Tg), the objective of this study was to evaluate the effect of glass transition phenomenon on shrinkage of sugar kelp.

Method:
Freeze-dried sugar kelp was placed in hermetic jars with different water activities (0.1–0.9). Moisture sorption isotherm was fitted non-linearly to BET and GAB model. Equilibrated samples were analyzed using a differential scanning calorimeter for Tg and freezing point (Tf). Samples were scanned from -90 to 100°C at the rate of 5°C/min. A state diagram was developed using Gordon-Taylor and Chen's model. For studying the plasticization effect during shrinkage, an image processing algorithm was developed in MATLAB for estimating the superficial area reduction using the Suzuki model. Drying kinetics of fresh samples were studied under controlled relative humidity (25-80%) and temperature (40-70°C).

Significance:
This is the first study to report the effect of Tg on shrinkage during drying of sugar kelp. This study also demonstrated the potential application of dehumidified drying in the food industry as it might preserve the heat-sensitive nutrients. Results will also help the seaweed industry in determining storage and processing conditions.

Results:
The BET and GAB constants were 0.161 and 0.201 kg H2O/kg dry solids, respectively. The thermogram exhibited two different Tg. The first and second Tg varied from 7.34°C to -69.12°C and 67.66°C to 36.93°C (midpoint), respectively, corresponding to moisture content of 0.05≤ Md≤ 0.3. The first Tg can be attributed to salt, sugar and water whereas the second is more prominent and corresponds to polysaccharides. Since the drying temperature was above Tg at 70°C, the shrinkage was 30% higher, exhibiting higher matrix mobility in the rubbery state. At the same temperature, lower humidity facilitated drying, reducing overall drying time by 5h. The drying rate was doubled 70°C compared to 40°C, at the same humidity level.

P02-035

Influence of Cooling Rate on Moisture Diffusion in Structured Lipids

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Introduction:
During storage, moisture diffusion in foods can result in microbial growth and unwanted changes in color, appearance, and texture. To control moisture migration, the food industry uses added ingredients, packaging modifications, non-edible and edible barriers. The effectiveness of edible barriers is mainly dependent on their composition. Instead of changing composition, the moisture barrier efficiency of lipid-based edible barriers can be altered by changing crystallization conditions. While it is known that crystallization conditions of a lipid influence its structure; the link between cooling rate of a lipid and its moisture barrier property remains unclear. The objectives of this investigation were: (a) to model and simulate moisture diffusion in a lipid network with defined structural parameters, (b) to measure structural attributes of lipid samples prepared under different cooling rates, and (c) to measure moisture diffusion in lipid samples to confirm the response of the model.

Method:
A model based on Fick's second law was used to describe moisture diffusion in a lipid system where effective diffusivity was a function of mass diffusivity in liquid oil, spatial distribution of oil fraction given by fractal dimension, and the effective porosity. Blends of trilaurin and triolein (100:0, 80:20, 60:40, and 0:100 w/w) were crystalized at the same shear rate (1000 rpm) and two different cooling rates (0.65°C/min, 12°C/min) to 38°C. Structural inputs of the model were obtained using pulsed-nuclear magnetic resonance for solid fat content, and polarized light microscopy for effective porosity as well as fractal dimension. To confirm the model, experimental moisture concentration profiles were measured using high resolution nuclear magnetic resonance.

Significance:
With this knowledge, manufacturers can preferentially structure lipid barriers and develop multi-component foods with a variety of textures without the use of extraneous packaging or added ingredients.

Results:
It was seen that as the solid fat content of the samples decreased, the amount of moisture uptake increased. Next, for each blend, diffusivities in samples crystallized under a higher cooling rate will be compared to those prepared with slower cooling rate. This will provide a clear link between crystallization conditions (cooling rate) of a lipid-based barrier and its moisture barrier property.

P02-036

Determination of Moisture Diffusivity of Ultrasound Pretreated Apple Tissues by Thermogravimetric Analysis

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Introduction:
In ultrasonication treatment, cavitation-induced activities may help to increase the transmembrane flux by changing plane cell membrane permeability and cell wall integrity. Moisture diffusivity is an important parameter for the design of drying process. Changes in the tissue structure caused by ultrasonication pretreatments might change the moisture diffusivity of plant tissues. This study was undertaken to examine moisture diffusivity of apple tissues pretreated by ultrasonication.

Method:
Excised cylinders (0.51 cm diameter) of apple tissues (Red Delicious, Golden Delicious and Granny Smith) were placed in distilled water (DW) with a sample-to-water ratio of 1:30 and agitated for 1 min at 100 rpm and 25°C. Washed cylinders were placed between two ultrasonic plates (10 cm spacing at 25 kHz) in a water tank and treated with ultrasound for 0, 10 and 30 min. Treated cylinders were cut and weighted, and drying experiments were immediately conducted. The effective moisture diffusivities (Deff) of apple tissues were determined from drying curves produced with a TA Instruments Q50 thermogravimetric analyzer, using the slope method. The drying experiments were conducted at 70°C for 200 minutes.

Significance:
Ultrasonic treatment can increase cell membrane permeability or cell wall damage, and may find use in drying enhancement for plant materials.

Results:
Two falling rate periods were observed. The Deff for the three apple varieties and three ultrasonication pretreatment levels ranged from 3.98 x 10-8 to 5.0 x 10-8 m2/s for the first falling rate period and 3.7 x 10-8 to 5.1 x 10-8 m2/s for the second falling rate period. Ultrasonic pretreated samples exhibited a faster drying than the Control. Significant different Deff values were observed between apple varieties. A significant higher Deff during the second falling rate was achieved in the ultrasound-treated granny smith samples, and no significant differences were observed within red delicious and golden delicious varieties.

P02-037

How to Design an Effective Delivery System: Mobility of Curcumin Nanoparticles Within a Polysaccharide Network

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Introduction:
Incorporation of nutraceuticals such as edible polymer films into food matrices provides a simple way to develop novel functional foods. Nano scale nutraceutical formulations are preferred to achieve high bioavailability and efficacy. However, there is no data available regarding interaction between nanoparticles and food matrices. In this study, we present a new technique to quantify behavior of nutraceutical nanoparticles within the model food matrix. From this research, we obtained quantitative data of nanoparticles mobility at different concentrations of polymers, thus, allowing rational design of nutraceutical delivery system.

Method:
We develop a model food system using food grade polymer hydroxypropyl methylcellulose (HPMC) and we use curcumin as a model hydrophobic nutraceutical. Curcumin nanoparticles are developed by ultrasonication with anionic surfactant sodium dodecyl sulphate (SDS) and cationic surfactant cetyl trimethylammonium bromide (CTAB), respectively, then thoroughly mixed with diluted polymer solution. Quantitative data of nanoparticles mobility in systems were obtained by combining evaporative concentration of polymer with scaling theory and real time monitoring by means of diffusing wave spectroscopy.

Significance:
The results here provide the framework for further studies involving edible nutraceutical film formulation design for improved food delivery system.

Results:
The mobility of positively and negatively charged curcumin nanoparticles was studied by comparing elasticity and viscosity of different systems. Results indicated that not only electrostatic interaction but also intermolecular distance of nanoparticles and polymers contributed to mobility of nanoparticles in the system.
P02-039

Preparation and Characterization of Water-Redispersible Gallic Acid-Chitosan/Gum Arabic Nanoparticles

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Introduction:
Polyelectrolyte complex (PEC) nanoparticles between chitosan and biomacromolecules have excellent physicochemical properties compared with other chitosan-based nanoparticles. However, the redispersibility of such PEC nanoparticles is the major obstacle limiting their practical applications, due to the poor water solubility of chitosan. Therefore, the nanoparticles between water soluble chitosan derivatives are rarely researched. Our major objective was to fabricate water-redispersible nanoparticles from PEC between the water soluble gallic acid-chitosan conjugate and gum arabic for future encapsulation and delivery applications.

Method:
The water soluble gallic acid-chitosan conjugate was prepared by a newly-developed free radical induced grafting approach, using ascorbic acid/hydrogen peroxide redox pair under ambient condition. PEC nanoparticles were formed via ionic gelation. The mass ratios of chitosan conjugate and gum arabic were optimized by evaluating particle size, count rate, polydispersity index, and zeta potential, as well as the stability of the PEC nanoparticles. The effect of addition of polyethylene glycol (PEG) and pH adjustment on particle formation was also studied. Fourier transform infrared spectroscopy was performed to determine the intermolecular interactions and the transmission electron microscopy was conducted to observe the morphology of nanoparticles. Nano spray drying technology was evaluated to obtain the ultra-fine powders of nanoparticles and their re-dispersibility in water was also measured.

Significance:
Our results demonstrated PEC nanoparticles between gallic acid-chitosan conjugate and gum arabic were successfully fabricated with promising physicochemical properties. The as-prepared PEC nanoparticles hold great potential for their applications in food and pharmaceutical industries.

Results:
The mass ratio between chitosan conjugate and gum arabic played a vital role in determining the particle size and count rate of the nanoparticles, with the ratio of 3:1 and pH 5.0 being the optimal conditions that resulted in the 111.6 nm and 149.7 kcps. It was found that the presence of PEG was critical to maintain the spherical and homogeneous morphology during spray drying, as evidenced by scanning electronic microscopy (SEM). It was notable that the most homogeneous nanoparticles with the smoothest surface were obtained when the mass ratio of chitosan and PEG was 1:0.5. The spray-dried powders of nanoparticles showed good redispersibility in water.

P02-040

Design of a Benchtop Clean-In-Place System Using Computational-Fluid Dynamics

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Introduction:
Clean-in-place (CIP) is critical for food plants in preventing food safety crisis and maintaining regular processing. Scalable CIP system plays an important role in studying and optimizing CIP process. Modeling and simulation of CIP equipment can predict parameters which are hard to achieve experimentally. Computational-fluid-dynamics (CFD) modeling has been proven to predict the fluid dynamic fairly well. In the past, there have been only a few attempts towards (CFD) modeling of CIP benchtop units. The objective of the present project are (1) designing a benchtop CIP unit which could mimic the conditions of pilot scale CIP system and easy to operate; and (2) development of a CFD model to simulate the fluid dynamic of the detergent in the unit to achieve the wall shear stress (WSS) and Reynolds number values.

Method:
Fluid velocity distribution and WSS value on the fouled stainless steel coupon is modeled using a commercial CFD code FLUENT 6.3. Impellers are explicitly described in three dimensions using a multiple reference frame model. Fluid dynamics of the turbulent water are modeled using a dispersed k-ε turbulent model and modified standard drag coefficient for the momentum exchange.

Significance:
The designed unit can mimic large scale CIP system with control of essential CIP parameters. And the developed CFD model provided solid predictions of the fluid dynamics of the designed unit. These results are important reference for scale-up and processing optimization.

Results:
The designed benchtop system contains a jacketed beaker with four stainless steel coupons, a water bath which allows the temperature to be controlled, and a double turbine baffled stirrer to provide certain level of fluid flow. All the essential CIP parameters – flow characteristic of detergent, detergent temperature, detergent concentration and cleaning time could be adjusted using the designed unit. According to the CFD model, WSS achieved on the top of the stainless steel coupon ranged from 0.11 to 2.02 Pa when the rotational speed of the impeller was from 300 to 900 rpm respectively. And the Reynolds number of the CIP system ranged from 15,000 to 190,000, which is in a similar range of a typical cleaning pipe system.
P02-042
Enzyme-Assisted Aqueous Extraction of Coriander Vegetable Oil from a Twin-Screw Extrusion Press Cake
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Introduction:
With a continuously growing population and steadily depleting fossil resources, the need for novel renewable resources and sustainable processing has become a prominent concern in recent years. *Coriandrum sativum* L., an annual herb belonging to the family of Apiaceae, may present such a new and interesting resource. Coriander vegetable oil has recently been approved as a novel food ingredient (NFI) and is of particular interest as it is primarily composed of petroselinic acid, a positional isomer of oleic acid, which makes up about 73% of all fatty acids. Vegetable oils are most commonly extracted through solvent extraction owing to its high extraction efficiency. However, this method often involves hazardous solvents such as hexane, rendering the process environmentally unfriendly and leading to the presence of solvent traces in the end products.

Method:
As a more sustainable alternative, coriander vegetable oil was obtained through mechanical pressing of the fruits using twin-screw extrusion. This resulted in an oil recovery of 52% and a press cake with a residual oil content of 11% of the cake dry matter. In order to extract the residual oil, the cake was subjected to an enzyme-assisted aqueous extraction (EAAE). Different enzymes (cellulase, hemicellulase, xylanase, and a mixture of endo- and exo-proteinase) were applied at 1 and 3% of the cake dry weight for different time periods (3, 5, 8, and 48 hours) to a mixture of press cake and water (L/S ratio 10, 45°C, 200 rpm). Sugar concentrations were determined through HPLC analysis of the liquid phase. All experiments were conducted in duplicate and results are presented as the mean ± the standard deviation. Means were compared through ANOVA and deemed significantly different at P < 0.05.

Significance:
The use of enzymes on the residual cake after extrusion was therefore determined as an efficient means for cell lysis, potentially leading to an increase in the residual oil extractability.

Results:
When a mixture of cellulase (5%), hemicellulase (5%), and xylanase (5%) was applied, the glucose concentration of the liquid phase reached 1.6 mg/mL after only 8 hours, illustrating the enzymatic hydrolysis of cell wall structures.

P02-043
Design of a Precooler for Cryogenic Grinding of Spices
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Introduction:
Spices are known for their flavoring and preserving characteristics, which are mostly consumed in the powder form. The high volatile oil content in the spices poses problems in grinding, such as, sieve choking, loss of the flavoring components, etc. Cryogenic grinding is a promising technology for producing the best quality (color, aroma, taste, size, etc.) spice powder. Precooler is the essential component of the grinding process. The precooler performs the task of removing the heat from the spice with the application of cryogen, usually liquid nitrogen (LN2), so that the brittle type of problems in grinding, such as, sieve choking, loss of the flavoring components, etc. Cryogenic grinding is a promising technology for producing the best quality (color, aroma, taste, size, etc.) spice powder. Precooler is the essential component of the grinding process. The precooler performs the task of removing the heat from the spice with the application of cryogen, usually liquid nitrogen (LN2), so that the brittle type of failure (below glass transition temperature) occurs during the grinding. In this study, a precooler of maximum 25 kg/h capacity was designed and developed. The precooler comprises of a star valve feeder (stainless steel), an LN2 nozzle and dewar, an air compressor, and a power transmission system.

Method:
For calculation of cooling load, freezing time and size of various components of the feeder, some of the data were assumed based on available literature and logical considerations. Maximum bending moment and section modulus of plate were also taken for determination of the dimensions of the different component of the feeder. Further, the developed precooler was tested for different feed rate and temperatures those were controlled by monitoring LN2 flow rate and speed of the rotor shaft.

Significance:
Better control over the feed rate and grinding temperature can be achieved during the cryogenic grinding process.

Results:
The precooler was fabricated with the following design dimensions: diameter of casing (inner 132 mm and outer 140 mm), 140 mm diameter of the head plate with 4 mm thickness, six rotary blades, 50 mm length of the blade with 25 mm breadth and 4 mm thickness, 30 mm diameter of the rotor shaft with 225 mm length. The cumin, clove, and black pepper were passed through the precooler at the feed rate of 2 to 25 kg/h and temperatures of -130 to -50°C. Results obtained were satisfactory and were in close agreement with the precoolers designed by other researchers. Therefore, the precooler can be successfully utilized for accurate metering and lowering the temperature of spices before grinding.

P02-044
Engineering and Characterization of Novel Compressed, Calorically Dense Bars
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Introduction:
The US Military requires operational components that are lightweight and portable, but calorically dense with balanced macronutrients. Our objective is to develop and test product concepts and model prototypes of compressed calorie-dense bars with caloric densities >5.0 Kcal/g and protein contents > 8%.

Method:
Model, small particle size vanilla, mocha, and cheese bars with caloric densities > 5.0 Kcal/g were formulated from a toasted rice flour/cream powder/shredding/syrup base and compressed using a Carver Press. Products were evaluated in consumer focus groups, rated for sensory attributes using just-about-right scales, submitted to projective mapping with commercial energy bars, and rated for quality (9-point scale), including assessment after 6 months’ storage at 100°F. Optimization modeling was employed to design prototype formulations of the most acceptable bar flavor having a range of designated caloric densities between 5.0 and 5.6 kcal/g.

Significance:
Results showed the feasibility of producing balanced nutrient, calorically dense bars with high quality, and demonstrated methods for characterizing this novel product.

Results:
A PCA on the projective mapping data showed prototypes to be most similar to commercial Halvah bars and less sweet and more grainy than the other commercial bars. The focus group confirmed that crunchiness was the least desirable textural attribute. Attribute assessment of vanilla prototypes showed that perceived hardness, mouth-coating, and breakdown in the mouth was within 0.2 standard deviations of optimal, with cohesiveness driving quality scores. Cheese and mocha bars had high initial quality (> 7.0 on 9-point scale), with the mocha variable retaining quality after 6 months’ accelerated storage. Least squares optimization of constituent levels of the mocha variable provided new model formulations with caloric densities between 5.0 and 5.6 kcal/g and protein levels > 8% for further sensory, physical, and stability testing.

P02-045
Solution Blow Spinning of Food-Grade Zein Nanofibers
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Introduction:
Solution blow spinning is a novel technique that uses blown gas to elongate polymer solutions into nanofibers. Solution blow spinning can be used to efficiently produce natural nanofibers, which can be used for controlled release applications, tissue engineering and texturized food ingredients. The primary advantage of nanofibers over larger diameter fibers is the larger surface area to volume ratios. Zein is a promising nanofiber material with good biocompatibility for food and medical applications. Zein, a major protein from corn, is being used by the food industry as an edible coating. Zein is insoluble in aqueous ethanol, a food-grade solvent for blow-spinning, but the resulting zein nanofiber mats have very poor mechanical properties. Glacial acetic acid has also been used to solubilize zein to produce nanofibers.

Method:
This study evaluated solution blow spinning for obtaining food-grade zein nanofibers and characterized their acetic acid solutions and resulting blown spun fibers. Five concentrations (20 to 40% w/w) of zein in glacial acetic acid were used to produce nanofibers by solution blow spinning at a flow rate of 0.06 mL/min and air pressure of 70 Psi.

Significance:
Most nanofibers have been produced from synthetic polymers and non-edible solvents, mostly through electrospinning. In contrast, there have been very few studies on nanofibers produced from natural polymers derived from agriculture products or byproducts and food-grade solvents. Solution blow spinning is a novel and practical technique to produce nano- and microfibers.

Results:
Surface tension and viscosity of the zein solutions varied from 28.0 to 29.8 mN/m and 0.5 to 12.0 Pa.s, respectively. Blow spun nanofibers were obtained from 25% zein solution (28.5 mN/m and 1.0 Pa.s), while no fibers were obtained with the highest and lower zein solution concentrations. Diameter of blow spun zein nanofibers was 174.6±32.8 nm. Type II adsorption water vapor isotherms were obtained from zein powder and nanofibers. BET surface area of blow spun zein compared to zein powder increased from 107.3 to 116.4 m2/g, indicating their potential applicability as active compounds carrier.

P02-046
Growth and Biofilm Formation by Listeria Monocytogenes at High and Low Concentrations of Cantaloupe Extract
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Introduction:
Low Concentrations of Cantaloupe Extract
107.3 to 116.4 m2/g, indicating their potential applicability as active compounds carrier.
Salmonella aggregate with the length at least 1.4 μm with lecithin concentration from 0.5 mg/100 small spherical and relatively monodispersed dense particles (d ≈ 30 nm) to large differences. Cryo-TEM pictures showed the eugenol-lecithin structure changed from (p<0.05). However adding more than 1 mg/100ml (up to 10 mg/100ml lecithin) significantly improved the antimicrobial properties of eugenol against E. coli investigated.

Significance: Lm strains can grow and form biofilms at a very low concentration of cantaloupe extract on different food processing surfaces. High concentration of cantaloupe extract and high temperature promoted a faster cell growth and higher biofilm formation compared to low concentration of cantaloupe extract and low temperature on different processing surfaces.

Results: The cell density of Lm BUG600 increased to 8.1 log CFU/ml in 64 h at 22°C compared to 3.5 log CFU/ml within 72 h at 10°C in 1% cantaloupe extract. In 25% cantaloupe extract, the cell density of Lm increased to 8.5 log CFU/ml within 24 h at 22°C compared to 6.5 log CFU/ml in 72 h at 10°C. All the strains tested formed biofilms on stainless steel with some differences. Lm biofilm formation was faster (~7 log CFU/coupon within 4 days) in 25% cantaloupe extract at 22°C and slower (~ 4 to 5 log CFU/coupon in 7 days) in 1% cantaloupe extract at 10°C. The biofilm formation by Lm 2011L-2625 was lower on buna- rubber compared to the other cantaloupe processing surfaces under all environmental conditions tested with a few exceptions.

P02-047 Low Concentration of Lecithin Enhances the Antimicrobial Activity of Eugenol Against Escherichia Coli
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Introduction: Essential oils (EOs) are effective natural antimicrobials. However, their hydrophobicity and aroma make them difficult to be incorporated into food systems. It is essential to develop methods to increase the stability of EOs in water-based systems as well as to improve their antimicrobial efficacy. Lecithin is a generally recognized as safe (GRAS) emulsifier which has been widely used in food and non-food application. Some studies have indicated the effective use of lecithin to promote more stable EO in water emulsions without increasing their antimicrobial efficacy. However, our preliminary research showed that the use of soy lecithin at concentrations well below 10 mg/100ml significantly improved the antimicrobial properties of eugenol against E. coli O157:H7. The objective of this research was to demonstrate that very low concentration of lecithin (<10 mg/100ml) could synergistically enhance the bactericidal effect of eugenol against different non-pathogenic and pathogenic strains of E. coli. The potential mechanism of the synergistic effect between very low concentration of lecithin and eugenol was also investigated.

Method: E. coli K-12 strain C600, O1229 and O157:H7 strain ATCC 70028 were treated with different homogenized eugenol-lecithin solutions in a shaking incubator at 37°C for 30 minutes. Surviving cells were enumerated on tryptic soy agar and log CFU/ml reductions within 30 minutes were calculated. Eugenol-lecithin samples were also imaged by cryo-TEM. Data sets were analyzed statistically using one way ANOVA and Fisher’s test.

Significance: This research highlights the potential bioactivity of lecithin when utilized in different systems to effectively control foodborne pathogens or deliver the functional components to target cells.

Significance:

Results: Significant increments in log reduction (1.01 log, 2.33 log and 1.26 log) were observed for E. coli C600, O1229, and ATCC 70028 with 0.5, 0.7 or 1 mg/100ml lecithin respectively (p<0.05). However adding more than 1 mg/100ml (up to 10 mg/100ml lecithin) diminished the enhanced antibacterial effect. This may due to the dramatic structure differences. Cryo-TEM pictures showed the eugenol-lecithin structure changed from small spherical and relatively monodispersed dense particles (d = 30 nm) to large aggregate with the length at least 1.4 μm with lecithin concentration from 0.5 mg/100 ml to 5 mg/100 ml.

P02-048 Controlling Salmonella in Dry Pet Food Using Natural Antimicrobials
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Introduction: Salmonella is a major human pathogen in the US, with contaminated food products as the major source of infection. However, contaminated pet food and contact with infected companion animals can potentially transmit salmonellosis to humans. Recent multisate human outbreaks of salmonellosis linked to commercial contaminated dry dog food underscore the need for controlling the pathogen in pet food for protecting pet health and human health.

In this study, the efficacy of five GRAS-status, plant-derived antimicrobials (PDAs), namely trans-cinnamaldehyde (TC), carvacrol (CR), thymol (TY), eugenol (EG), and caprylic acid (CA) applied as a vegetable oil or chitosan based antimicrobial spray on dry pet food for reducing Salmonella Schwarzengrund was investigated.

Method: Three hundred gram portions of a commercial dry dog food were inoculated with a two-strain mixture of nalidixic acid (NA) resistant S. Schwarzengrund (~5 log CFU/g), followed by a spray treatment with 0.5, 1, or 2% of TC, CR, TY, EG, or CA in vegetable oil or 1% chitosan as a carrier. Pet food samples sprayed with only vegetable oil or chitosan, and feed subjected to no treatment (baseline) were also included as controls. The control and treated dog food samples were stored at 25°C for 28 days. On days 0, 1, 3, 5, 7, 14, 21, and 28, Salmonella in pet food was enumerated on XLD agar + NA. Triplicate samples of treatment and control were included, and the study was replicated twice.

Significance: Results suggest that the PDAs could potentially be used as an antimicrobial spray to reduce Salmonella on dry dog food. Future studies on the acceptance of PDA-treated dry food by dogs will be conducted.

Results: All PDAs at 1% and 2% applied in vegetable oil or chitosan reduced S. Schwarzengrund by at least ~2 log CFU/g on day 3 of storage when compared to baseline (p<0.05). No significant reductions in Salmonella were observed on feed sprayed with only vegetable oil or chitosan (>p>0.05). Overall, 2% TY in vegetable oil and 2% TC in chitosan were the most effective treatments, where at least ~3 to 3.5 log CFU/g reduction in pathogen counts was observed during storage (<p<0.05).

P02-049 Inactivation of Salmonella on Cucumbers by Pectin-Based Coating With Natural Phytochemicals
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Introduction: Cucumbers constitute a healthy part of our diet, especially salads. However, during the last decade, cucumbers have been linked to several multi-state disease outbreaks, chiefly salmonellosis, resulting in adverse health impact in consumers. Several factors potentially contribute to pathogen contamination of cucumbers, including proximity to soil, irrigation water, animal feces and contaminated processing facilities. Thus, it is critical to develop practical interventions to improve the microbiological safety of cucumbers for protecting public health and ensuring the economic viability of cucumber agriculture.

This study investigated the efficacy of four GRAS-status phytochemicals, namely beta-resorcylic acid (BR), carvacrol (CR), eugenol (EG), and thymol (TY) applied as a pectin-based coating for reducing Salmonella on cucumbers.

Method: Cucumbers were inoculated with a three-serotype mixture of nalidixic acid resistant Salmondrells (S. Baldion, S. Newport) at ~6.0 log CFU/cucumber. The inoculated cucumbers were coated with pectin (1.5% w/v) or pectin containing each phytochemical (0.5% and 0.75%). Additionally, cucumbers with no coating were included as baseline. The cucumbers were stored at 4°C for 7 days, and surviving Salmonella were enumerated on days 0, 1, 3, 5, and 7 of storage by plating on Xylose Lysinine Deoxycholate agar containing 50 µg/ml of nalidixic acid. The study was replicated twice with triplicate samples of each treatment and control.

Significance: The results indicate that BR, CR, EG, and TY could potentially be used as an effective coating to reduce Salmonella on cucumbers. However, detailed studies on the sensory and quality attributes of cucumbers are necessary before recommending their use.

Results: All four phytochemical coating treatments reduced Salmonella counts on cucumbers by at least 5 log CFU/cucumber/day by day 7 (F < 0.05). Carvacrol and TY (0.5% and 0.75%) were the most effective treatments, which decreased Salmonella populations to undetectable levels on day 1. However, ~2.5 log CFU of Salmonella/cucumber was recovered from inoculated controls (baseline) and pectin only coated cucumbers on day 7.

P02-050 Pimenta Essential Oil Reduces Salmonella Heidelberg Attachment to Turkey Skin
D. Valsala Devi Thankappan Nair, University of Minnesota, J. Vazhakkattu Thomas, A. Kollanoor Johny, Email: valsa002@umn.edu

Introduction: Salmonella Heidelberg has been causing foodborne outbreaks associated with turkey products. Cross-contamination during processing could result in high numbers of Salmonella exiting the chiller. Attachment of S. Heidelberg to turkey skin is a critical factor that determines the microbiological safety of turkey products. Natural and
safe approaches that reduce S. Heidelberg attachment to turkey skin are needed. The objective of the study was to determine the effect of pimenta essential oil (PEO) on reducing S. Heidelberg attachment to turkey skin surface.

**Method:**
Turkey skin samples (1 inch x 1 inch) were inoculated with S. Heidelberg at 4.0 log CFU/ sq. inch and dipped in 0.5 or 1 % (v/v) PEO for 30 sec, 3 min, or 5 min at 4°C, simulating chilling conditions during processing. Skin samples dipped in deionized water served as controls. In addition, PEO nano-emulsion was prepared using energy ultrasound method and tested against the pathogen at 4°C. The antimicrobial effect of 1% PEO on S. Heidelberg was tested under refrigerated storage (4°C) and temperature abuse (10°C) conditions for 2, 24, and 48 hrs after application with the essential oil. Duplicate samples were included for all treatments and the experiment was repeated two times. Differences among the means were detected at P<0.05.

**Results:**
PEO application resulted in reduction of S. Heidelberg attached to skin surface. PEO at 1% resulted 1.4-, 2.2- and 3.3-log CFU/sq. inch after dip treatment for 30 sec, 3 min and 5 min, respectively (P<0.05). Similarly, PEO nanoemulsion resulted in 1.5-, 1.7-, and 1.8-log reduction of S. Heidelberg from skin surface after 30 sec, 3 min, and 5 min, respectively (P<0.05). Moreover, PEO maintained its antimicrobial activity for 48 hrs at both 4°C and 10°C (P<0.05). Results indicate that PEO and its nanoemulsion could reduce S. Heidelberg attachment to turkey skin.

**Significance:**
Antimicrobial treatments that are natural and safe for the consumer are needed. Use of essential oils to control pathogens in food is a relatively new approach. Our results indicate that PEO could be used as an alternative antimicrobial treatment to reduce S. Heidelberg on turkey carcasses, improving microbiological safety.

**Results:**
Antimicrobial treatments that are natural and safe for the consumer are needed. Use of essential oils to control pathogens in food is a relatively new approach. Our results indicate that PEO could be used as an alternative antimicrobial treatment to reduce S. Heidelberg on turkey carcasses, improving microbiological safety.

### P02-051
**New Culture Methods Optimizing Growth of Candidatus Arthromitus H. Reiland, University of Minnesota, D. Baumber, Email: reil024@umn.edu**

**Introduction:**
*Candidatus Arthromitus (CA)* is a Gram-positive, segmented, filamentous bacterium that is found in the gastrointestinal tract of arthropods and mammals. The rationale behind studying CA stems from its necessity in the healthy turkey microbiome. Birds without these commensal bacteria develop a disease called Light Turkey Syndrome (LTS). The cause of this disease is unknown; however, it is believed that the impairment in the microflora of the gut is a key factor in the development of the disease. It is proposed that the imbalance of the gut flora is related to the development of disease in susceptible hosts. The model for CA originating from turkey includes three unique carbon sources: sugar, sulfur, and phosphorous. The objective of this study was to determine a novel culture medium that optimizes CA growth in order to study its metabolic characteristics and nutrient utilization both experimentally and in-silico.

**Results:**
Results from in-silico models predict growth on Melibiose and D-Mannose regardless of host origin. The model for CA originating from turkey includes three unique carbon sources that can be used to produce growth.

**Significance:**
This study contributes to the understanding of the role of CA in the healthy turkey microbiome. The development of a novel culture medium for CA growth will provide insights into the metabolic characteristics and nutrient utilization of this bacterium.

### P02-052
**Microbial Quality of Shiitake Mushrooms (Lentinula Edodes) Acquired From the Internet and Local Retail Markets**
*Ch. Kim, Virginia State University, Y. Xu, T. Nartea, S. Pao, E. Sismour, Email: ckim@vsu.edu*

**Introduction:**
Consumer demand for shiitake mushrooms (*Lentinula edodes*) has increased due to their potential health benefits. Recent studies demonstrate that consuming shiitake mushrooms enhances cancer prevention and immune responsiveness. However, food safety information regarding the prevalence of microbial pathogens on the products sold via the Internet or at local retail markets is limited. The present study was conducted to assess the microbial load on shiitake mushrooms sold through the Internet and at local (central Virginia) retail markets.

**Method:**
A total of 90 shiitake mushroom products, consisting of locally-purchased whole (LW) and sliced (LS) and Internet-procured whole (IW), sliced (IS), and powdered (IP) forms, were tested. Microbial counts (aerobic mesophiles, *Bacillus* spp, yeast and mold, and coliform) obtained from duplicate samples of each purchase were log-transformed, averaged, and then analyzed using Analysis of Variance and Duncan’s Multiple Range Test (SAS Institute, Cary, NC) to determine the significance of differences (P ≤ 0.05) between mean values.

**Significance:**
Our findings suggest that consumers should take appropriate precautions when handling fresh shiitake mushrooms to prevent cross-contamination and possible foodborne illness in the home.

**Results:**
Significantly higher levels of aerobic mesophiles, yeast and mold, and coliforms were found in locally acquired products compared to those from the Internet. Among locally acquired products, the occurrence of aerobic mesophiles (> 7.70 log CFU/g) was 35.0% in whole product samples and 62.5% in sliced product samples. One LW sample and 2 of LS contained *Listeria* spp. The occurrence of *Listeria* spp. and the higher prevalence of microbial counts on samples acquired from local grocery stores may suggest a need for mushroom producers and retailers to exercise good agricultural and manufacturing practices that help to reduce microbial loads.

### P02-053
**Inactivation of a Human Norovirus Surrogate (MNV-1) in Phosphate-Buffer Saline and Tuna Salad by X-Ray**
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**Introduction:**
Human norovirus (HuNoV) causes the most common foodborne illnesses in the United States. The CDC estimates 5,461,731 cases of illnesses, 14,663 hospitalizations and 149 deaths annually related to this pathogen.

**Method:**
The aim of this study was to determine the sensitivity of MNV-1 (widely used HuNoV surrogate) to X-ray irradiation in pure culture and tuna salad. The phosphate-buffer saline (pH 7.4) and tuna salad samples were inoculated with propagated MNV-1 virus stock solution. Tuna salad samples were then packaged in sterilized plastic bags prior to X-ray treatment. Samples (phosphate-buffer saline and tuna salad) were treated with 0.0, 1.0, 2.0, 3.0, 4.0, and 5.0 KGy X-ray.

**Results:**
MNV-1 was significantly (P<0.05) reduced from 6.3±0.4 log PFU ml-1 to 5.4±0.2, 4.0±0.4, 3.2±0.4, and 2.6±0.3 log PFU ml-1 after treatment with 1.0, 2.0, 3.0 and 4.0 KGy X-ray, respectively, in phosphate-buffer saline. Treatment with 5.0 KGy X-ray achieved a 4 log PFU ml-1 reduction in phosphate-buffer saline. The log PFU g-1 was significantly (P<0.05) reduced from 5.3±0.1 to 4.8±0.2, 4.6±0.3, 4.2±0.4, and 3.3±0.4 after treatment with 1.0, 2.0, 3.0, and 4.0 KGy X-ray, respectively, in tuna salad samples. Exposure to 5.0 KGy X-ray achieved approximately 2.9 log PFU g-1 reduction on tuna salad samples.

**Significance:**
Using X-ray is feasible to significantly reduce the risk of norovirus foodborne illness, which is the most common foodborne illness in the United States.

### P02-054
**Efficacy of a Washing System and Commercial Produce Washes to Reduce Escherichia Coli Surrogates on Green Leaf Lettuce Surfaces**
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**Introduction:**
Our study investigated the efficacy of a continuous water motion washing system and chemical wash solutions for controlling *Escherichia coli* surrogates on the surface of green leaf lettuce and increasing shelf life of green leaf lettuce throughout a 6-day storage period after treatment application.

**Method:**
Lettuce leaves were inoculated with a five-strain cocktail mix of rifampicin-resistant derivatives of *E. coli* surrogates and then washed with tap water (as control), a 5% vinegar solution, or a commercial antimicrobial for fruit and vegetable treatment (CAVFT) for 120 s with agitation by using a continuous water motion system or by hand.

**Results:**
On day 0, log reductions achieved by CAFVT (2.25 log10 CFU/g) were greater (P=0.0145) than without agitation (1.53 log10 CFU/g). Lettuce leaves washed with all other treatments slightly decreased over time. In

**Significance:**
Washing lettuce with continuous agitation achieved higher (P=0.0072) *E. coli* surrogate reductions (2.62 log10 CFU/g) than without agitation (1.53 log10 CFU/g). *E. coli* surrogate populations on lettuce leaves washed with CAFVT and water with agitation remained steady during storage, whereas *E. coli* surrogate populations on lettuce leaves washed with all other treatments slightly decreased over time. In
conclusion, *E. coli* populations on day 0 were significantly affected by the wash solution and washing action (agitation), and storage of green leaf lettuce at refrigeration temperatures (4 ± 1°C) after washing reduced the risk of potential proliferation of *E. coli* surrogates.

**Significance:**
This study expands knowledge of wash treatments as an alternative for produce decontamination and its potential value for preventing cross-contamination during produce washing. Food service managers should be encouraged to use antimicrobial wash treatments for produce and should consider investing in a wash system to improve the microbial quality of produce and reduce the risk cross contamination between produce batches.

**P02-056**

**Metagenomics Based Investigation of the Bacterial Community and Metabolites Analysis in Kimchi Fermentation Using Novel Leuconostoc Mesenteroides Isolated From Muk Eun Ji**

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**Introduction:**
The ingredients of kimchi vary by season, so it sometimes makes it difficult to produce kimchi with uniform quality. Therefore, the use of *Leuconostoc mesenteroides* as a starter culture has been considered to produce uniform quality commercial kimchi in Korea.

**Method:**
We isolated lactic acid bacteria from Muk Eun Ji and screened 406 strains for selecting a proper starter by metabolibes and metagenomics.

**Significance:**
Many studies have been reported only for each part. But, we linked the relationships among microbial communities, metabolites, sensory characteristics, acid/salt tolerance, low-temperature growth activity, and safety, which will give good rationale for selecting of a suitable starter isolated from Muk Eun Ji to produce good and well fermented quality commercial kimchi.

**Results:**
First step screening was conducted on 406 strains including end-point pH, fructose- mannitol conversion ability as a result, 16 strains were selected. Second step screening and a sensory test applied to Baek Mat kimchi were performed, and 6 strains starters were selected. The selected strains were inoculated to baechu-kimchi (Chinese cabbage Kimchi) respectively, and metabolite analysis showed that kimchi fermentation with 6 strains as starters came earlier, with increases in acidity and bacteria cell count and decreases in pH. Similarly, metagenomics analysis showed that bacterial communities differed between starter-inoculated and non-inoculated kimchi at early stages of fermentation, but overall there were no significant differences in the late phases (7°C, 30 days). The HPLC results of organic acids showed that starter kimchi produced less lactic acid and more acetic acid than non-starter kimchi, which indicates that starter kimchi gives a better flavor (L/A ratios:2). Analysis of free sugar results also showed that mannose production of starter kimchi (16545.13 mg/L) was twice that of non-starter kimchi (8099.83 mg/L). Low-temperature growth activity, the most important factor in commercial starter kimchi, of 6 strains of LABs was high (4, 10, and 15°C). Also, acid tolerance (pH 5.0, 4.2, and 3.8) and salt tolerance (3%, 5% were good. We performed safety assessment, and no strains were found to have antibiotic resistance, haemolysis, gelatinase activity, and biogenic amine production.

**P02-057**

**Effect of Replacing All-Purpose Flour With Coconut Flour on Texture and Moisture in Iced Lemon Cookies**

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**Introduction:**
Lemon biscuit cookies are a popular dessert item in the US. Coconut flour is flour made from coconut solids that have been ground into powder. The coconut solids are left over after the extraction of coconut milk from the coconut. Compared to all-purpose flour there is a higher level of protein and fiber and provides opportunity for gluten-free product development of baked products. The purpose of this study was to evaluate all-purpose flour replacement with varying levels of coconut flour to provide improved nutrient content and gluten-free alternative for the lemon biscuit product.

**Method:**
Three standardized recipes were developed including: Control 100% all-purpose flour, Treatment 1: 50% coconut flour 50% all-purpose flour, and Treatment 2: 200% coconut flour. A six member sensory panel was organized to assess randomized samples to test for texture, moisture, and flavor. In addition, triplicate replicate samples were prepared for objective measurements of L, a, b readings of the surface color of the cookies using a Konica Minolta CR410 Colorimeter. Texture measurements of firmness using a Koehler Penetrometer (Model K19500) with a stainless steel cone (DIN 51804).

**Significance:**
Based on the strong sensory results and a healthy products perspective, Treatment 1 is recommended as the substitution of half the all-purpose flour for coconut flour due to its health benefits of high fiber, protein, vitamins, and minerals. The majority of the sensory panel agreed that the 50% replacement was palatable and a positive nutritious improvement to an enjoyable breakfast cookie.

**Results:**
The sensory results for Treatment 1 showed a slightly higher mean score for firmness vs. Treatment 2. The mean penetrometer measures showed the substitution of half the all-purpose flour for coconut flour resulted in a more tender sample, yet demonstrated the same acceptability for texture across samples in the sensory testing. The objective color results showed differences in L values across treatments; however, sensory results report the same acceptability across treatments for color as well as appearance. Control showed L values of 59.18, Treatment 1 values were 57.68, and Treatment 2 were 46.13.

**P02-058**

**Development of a Spoilage Sensor to Detect Microbial Metabolic Products in Seafood Packaging**

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**Introduction:**
Seafood spoilage is primarily caused by microbial contamination, and this causes severe safety concerns. Typically, methods to detect pathogens involve incubation for days, hence, an easy-to-read and real-time sensor on monitoring spoilage metabolites is beneficial to in-package detection for consumers. The purpose of the present study was to develop a spoilage sensor to indicate microbial contamination metabolites, including both trimethylamine (TMA) and carbon dioxide, and then apply it to monitor the quality of seafood products.

**Method:**
A dual sensing label, including bromocresol purple (BP) and methyl red (MR), was formulated to detect TMA and carbon dioxide, respectively, and the sensing reagents were then immobilized on hydrophilic gums to fabricate a sensor. To prevent cross-interfering, the TMA reagent was adjusted to acidic, and carbon dioxide to alkaline. Color change on the sensor due to pH change was used as an index of microbial growth.

**Significance:**
A spoilage sensor based on detection of TMA and carbon dioxide was developed, and visual color difference on sensor was related to growth of *Pseudomonas fragi* on fish.

**Results:**
Results showed that color of TMA sensor changed from yellow (containing BP alone) to blue-purple as TMA/BP = 10, where b value ranged 50 to –10. However, no further significant change in color was observed till TMA/BP = 50. Additionally, the MR impregnated sensor imparted a color change from orange to red (a and b values ranging 25-50 and 50-30) when exposed to 10% carbon dioxide. Production of spoilage metabolites was found in association with growth of *Pseudomonas fragi* on fish, and caused a visual color difference on the spoilage sensor.

**P02-059**

**Preparation of a Freshness Indicator for Quality of Nuts in Smart Packaging**

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**Introduction:**
Reports have demonstrated that rich unsaturated fatty acids in nuts are beneficial to prevention of cardiovascular and hypcholesterolemic diseases. However, the high polyunsaturated fatty acids content easily causes off-flavor when exposed to air, thus leading to less freshness quality and a loss of acceptance. The aims of the present study were to develop an oxidation indicator for monitoring the extent of oxidation, and then use it to evaluate the real-time freshness of nuts.

**Method:**
An oxidation indicator was formulated using redox compounds immobilized on cellulose carrier, and this indicator was then used to study the interaction with oxygen and color development in model package. Oxidation of trilinolenin was applied to simulate lipid oxidation in nuts, and reaction rates were determined using oxygen consumption and TBAr's test. Finally, the Arrhenius equation was used to calculate activation energy of oxidation in indicator and nuts, and analyze the difference in reaction rates between the two systems.

**Significance:**
The oxidation indicator in smart package developed in this study is beneficial to freshness quality of nuts.

**Results:**
The redox-type indicator was prepared by using sodium asparagine as sulfonate, sodium hydrosulfite, and sodium hydrosulfite, and the composition of sodium asparagine as sulfonate, sodium hydrosulfite, and sodium hydrosulfite = 0.59 : 9.47 : 1.89 showed the optimal color development when exposed to air. A linear relation between storage duration and oxygen interaction on sensor was obtained, and led to an increase in AE for 2 month. Additionally, TBArs value was determined to be 0.92 ~ 1.16 µg MDA/g nuts during storage. The color development reaction and oxidation had similar temperature dependence according to activation energy analysis; this demonstrated the indicator can be accurately used to monitor the freshness of food products.

**P02-060**

**Preparation and Deodorizing Effects of LDPE-Baking Soda Deodorizing Composite Films for Kimchi-Packaging Application**

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**Introduction:**
At room temperature, a high concentration of Leuconostoc mesenteroides on fish, and

**Results:**
The sensory results for Treatment 1 showed a slightly higher mean score for firmness vs. Treatment 2. The mean penetrometer measures showed the substitution of half the all-purpose flour for coconut flour resulted in a more tender sample, yet demonstrated the same acceptability for texture across samples in the sensory testing. The objective color results showed differences in L values across treatments; however, sensory results report the same acceptability across treatments for color as well as appearance. Control showed L values of 59.18, Treatment 1 values were 57.68, and Treatment 2 were 46.13.
Introduction:
Continuous fermentation by microorganisms in over-ripened Kimchi results in a sour and bitter taste, off-flavor, and texture softening. Acetic acid formed during the process is believed to be primarily responsible for the off-odor of Kimchi. The objective of this study was to examine the deodorizing effects of baking soda (BS) on Kimchi off-odor and evaluate the potential of low density polyethylene (LDPE)-BS composites in Kimchi packaging.

Method:
We evaluated the effect of thermal decomposition during extrusion process by heating BS in a furnace at 180°C for 10 min, then compared the heated and the original BS. LDPE-BS master batch at ratio of 80:20 and LDPE-BS composite films in 5 compositions were prepared by melt extrusion. The prepared films had a thickness of 70 ± 2 μm.

Significance:
Our results suggest that BS can be used as an additive in general melt-extrusion process. The deodorizing effect increased with an increase of the BS content in LDPE-BS films confirming that the LDPE-BS composite films have great potential in deodorizing Kimchi-packaging applications.

Results:
The BS exhibited cylinder morphology with an average particle size of 64.45 μm. FT-IR analysis indicated that the hydroxyl group (3,353 cm⁻¹) had disappeared after the heating process. TGA and DSC analysis of BS showed a 5% weight loss at a decomposition temperature of 146.6°C while the Tg was 171.6°C. Above 50°C, BS decomposes into sodium carbonate, which has a higher deodorizing effect than sodium bicarbonate. The deodorizing effects of BS were thoroughly investigated using the indicator tube method with acetic acid as a carrier gas at 30 min intervals for 150 min. The acetic acid removal rate (%) of both the original BS (0%, 31.3%, 61.3%, 70.0%, 81.3%, 86.3%) as well as the heat-treated BS (0%, 95.9%, 97.5%, > 99.9%, > 99.9%) increased with time. Acetic acid removal rate of pure LDPE films was 12.2%. Deodorization effects of LDPE/Baking soda films, as a contents of baking soda increased, increased from 30.8% to 45.0%.

P02-061
Effect of PEGylation on the Antibacterial Activity of a Cysteine-Terminated Antimicrobial Peptide Cecropin P1 Tethered to a Surface
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Introduction:
Antimicrobial packaging is a novel development that incorporates or immobilizes antimicrobial agents into packaging film to deactivate the activities of a targeted microorganism. The efficiency of antimicrobial packaging film is largely determined by the effectiveness of antimicrobial agents and the antimicrobial agents-surface incorporation methods. Antimicrobial peptides (AMPs) belong to a class of relatively short peptides family that have the ability to penetrate the cell membrane, form pores which eventually lead to cell death. Cecropin P1 (CP1, sequence SWLSTAKKLENSAKKRLSEGIAIAIQGGPR), an AMP with 31 amino acids and with a net negative charge of -5, was found to exhibit much higher antimicrobial activity against Gram-negative bacteria E. coli O157:H7 EDL933 compared to Gram-positive bacteria Listeria monocytogenes F4244.

Method:
Cysteine-terminus modified Cecropin P1 (CP1C) was chemically immobilized onto silica nanoparticles with a Maleimide-PEG-NHS Ester cross-linkers of different molecular weight respectively. Minimum inhibitory concentration (MIC) was determined by plate count. Secondary confirmation of CP1C was determined by circular dichroism.

Significance:
Thus, characterization of a cysteine-terminated antimicrobial peptide Cepcropin P1 tethered to a surface by use of suitable cross-linker is quite important for the rational design of the antimicrobial peptide packaging film.

Results:
MIC of CP1 against E. coli O157:H7 EDL933 was 3.125 μg/ml and exhibited the same antimicrobial activity against E. coli O157:H7 EDL933 when adsorbed onto silica nanoparticles. This was found to be consistent with preservation of α-helical secondary structure of CP1 upon adsorption as indicated by circular dichroism (CD) and all-atom molecular dynamics (MD) simulation. The secondary structure of tethered CP1C as characterized by Fourier Transform Infrared Spectroscopy (FTIR) and Circular Dichroism (CD) was found to be the same as that of CP1C in solution and adsorbed. However, the tethered Cecropin P1C exhibited much lower antimicrobial activity against E. coli O157:H7 EDL933 compared to those in solution and adsorbed. The interactions of 12 DOPG/DOPC mixed membrane (mimic of bacterial cell membrane) as well as DOPC pure membrane (mimic of mammalian cell membrane) with free CP1C and CP1C tethered with different cross-linker were characterized using all-atom MD simulations and results compared with experiments.

P02-062
Extrusion of Soy Flour-Apple Pomace Blends: Extrudate Characteristics and Optimizing Process Conditions
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Introduction:
Extrusion cooking is recognized as a smart technology for food processors. It requires low cost, high temperature, short-time process, and few ingredients to create a puffied snack. The only drawback is that it contains multiple parameters that need to be rigorously trialed to develop an optimal process. This study investigated the effects of two extruding parameters (die head temperature and screw speed) and examined the addition of apple pomace into a soy flour-based extruded snack formulation.

Method:
The soy flour-apple pomace mixed in different ratios were extruded in a co-rotating twin-screw extruder. Response surface methodology using a central composite design was used to evaluate the effects of independent variables, namely die temperature (120–160°C), screw speed (150–200 rpm) and pomace level (2–10%), on product responses (expansion, bulk density, texture and color). The moisture content of the blends were kept constant (20%) db. Sensory analysis was carried out for selected extrudates for appearance (color, porosity), taste (bitterness and sweetness), and texture (crispness and brittleness) and overall acceptability.

Significance:
The results suggest that apple pomace can be extruded with defatted soy flour into an acceptable and nutritional snack food. As apple pomace and soy flour are naturally gluten free, the extruded product would appeal to people who suffer from intolerances, allergies and celiac disease.

Results:
Multiple regression equations were obtained to describe the effects of each variable on product responses. Screw speed was found to have the greatest effect on extrudate quality, e.g. bulk density increased as the screw speed increased (p < 0.001). Both apple pomace addition and screw speed impacted expansion ratio; as they increased, expansion ratio decreased (p < 0.001). Blends of 2% apple pomace extruded at 160°C, 200 rpm and 10% apple pomace extruded at 160°C, 150 rpm had higher preference levels for parameters of appearance, taste, texture and overall acceptability. However, graphical optimization studies resulted in 150–160°C, 4.56–6.78% pomace level and 150–186 rpm screw speed as optimum variables to produce acceptable extrudates.

P02-063
A Comparison of Physical and Chemical Attributes of Strawberry Cultivars and Advanced Breeding Selections From the University of Florida
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Introduction:
Postharvest performance is an important consideration when developing a new strawberry cultivar. A strawberry that has excellent qualities on the plant might deteriorate quickly after harvest, particularly if exposed to adverse environmental conditions. The objectives of this study were to evaluate the overall quality of advanced strawberry selections and compare them to commercial standard cultivars at harvest and after storage, and to determine which advanced selections performed as well or better than the standard cultivars.

Method:
Two strawberry commercial standards, “Florida Radiance” and “Florida 727,” and 11 advanced selections from the University of Florida breeding program were evaluated over seven harvests between December 2014 and March 2015. Each cultivar and advanced selection was evaluated for subjective appearance, weight loss, analytical texture, soluble solids content (SSC), titratable acidity, total phenolic (TPC) and ascorbic acid (AA) contents on the day of harvest and after a 7-day storage period at 2°C.

Significance:
Results from this study showed that there is a significant interaction between genotype and specific quality attributes. The results also provide information valuable to the selection process by identifying new genotypes with improved compositional attributes combined with suitable quality characteristics after cold storage.

Results:
Overall, during storage there was a significant decline in each attribute evaluated, regardless of the strawberry cultivar or genotype. On average, “Florida Radiance,” and genotypes FL 10-166 and FL 12-5-103 received the highest ratings for appearance at harvest; however, FL 12-5-103 had the least percent decrease in appearance by the end of storage. Weight loss was significantly high after storage with FL 12-5-103 having the least amount of weight loss. FL 12-26-49 was the firmest strawberry on the day of harvest and remained the firmest after the 7-day storage period. FL 12-70-55 had the lowest SCC after storage despite having the highest initial SCC. The highest titratable acidity was measured in FL 12-55-220, FL 12-70-55, and FL 12-121-5 on the day of harvest. The highest TPC was measured in FL 10-166, which also had the highest TPC at the end of storage. Compared to the other strawberry genotypes, FL 12-55-220 maintained the highest levels of AA throughout storage.

P02-064
Rapid Assessment of Sugars and Organic Acids in Tomato Paste Using Portable Mid-Infrared Spectroscopy and Multivariate Analysis
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Introduction:
Portable Mid-Infrared Spectroscopy and Multivariate Analysis
Introduction: Sugars and organic acids, which are responsible for the sweetness, tartness and influence on tomato flavor, are the major factors affecting consumer acceptability and are crucial for successful processing of tomato-based products. In addition, Vitamin C content (l-ascorbic acid and L-dehydroascorbic acid) is an attractive index of the quality of tomato product both as a source of antioxidant and vitamin. Classical analytical techniques to determine sugars and organic acids of tomato paste rely on chromatography, which is time-consuming and labor-intensive. Cutting edge infrared sensor technologies can provide a valuable window into in-process food manufacturing to permit optimization of production rate, quality and safety of tomato products. The objective of this study was to develop a rapid and robust technique for simultaneous determination of sugars (glucose, fructose, and total reducing sugars) and organic acids (citric acid and total Vitamin C) in tomato paste using a portable FT-IR spectrometer combined with multivariate analysis.

Method: Tomato paste products (n=120) were kindly provided by several tomato processing companies. The spectra were directly collected by a portable FT-IR spectrometer equipped with a triple reflection diamond ATR sampling device. High-performance liquid chromatography (HPLC) was used to determine the reference levels of simple sugars (glucose and fructose) and organic acids (citric acid and Vitamin C). Partial least squares regression (PLSR) was used to generate calibration models to predict the concentration of sugars and organic acids in tomato paste.

Significance: Portable FT-IR would be a revolutionary tool for in-plant assessment of the quality of tomato-based products, which would provide the industry with accurate results in less time and lower cost since no reagents nor sample preparation are required.

Results: Paste compositional ranges obtained for glucose (6.5-13 g/100g), fructose (6.8-14.3 g/100g), citric acid (2.9-5.9 g/100g) and Vitamin C (74-107 mg/100g) were similar to those reported previously in literature. The PLSR models showed good correlation (R²=0.88) between the FT-IR predicted and HPLC reference values, and low standard error of calibration (SEC=5.04 g/100g glucose and fructose, 1.1 g/100g for total reducing sugars, 0.29g/100g for citric acid and 0.02mg/100g for total Vitamin C).

P02-065
Sensory and Flavor Characteristics of Tomato Juice From Florida Tomato (Garden Gem and Roma) Commercial Products
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Introduction: Despite a high nutrient content, tomato juice is among the least liked fruit/vegetable juices due to poor flavor. To date, Florida tomatoes are primarily produced for the fresh market and have not been widely used in processed tomato products (sauces, pastes, juices, etc.). The objective of this study was to characterize the flavor of a superior Florida tomato variety that may produce a high quality processed juice product.

Method: A high quality Florida plum tomato variety (Garden Gem), and a typical grocery store plum tomato variety (Roma) were thermally processed into tomato juices without added salt, sugar or flavors. The two pilot products (Garden Gem and Roma) and a popular commercially available tomato juice (low sodium with sugar and flavor added) were compared using sensory evaluation and flavor analysis. Flavor compounds in these products were analyzed using dynamic headspace (purge and trap)-gas chromatography mass spectrometry and were semi-quantitated using internal standards. Analysis of variance, mean comparison, and principle component analysis were used to analyze both sensory and flavor data.

Significance: This research reports the detailed flavor profile of a processed Garden Gem tomato juice and how its flavor profile demonstrates a potential market advantage over current commercial products.

Results: Among the three products, Garden Gem juice was rated significantly (p<0.05) higher for overall liking, tomato flavor, and sweetness by 119 panelists. Uniformity and color were significantly linked with the commercial product. Garden Gem juice was found to contain significantly (p<0.05) higher sweet fruity related aroma compounds: 6-methyl-5-hepten-2-one (684 ppb), linalool (34 ppb), and β-ionone (1 ppb). Commercial tomato juice contained a high amount of the Maillard reaction-related note furfural (283 ppb), dimethyl sulfide (6.7 ppb) and the least amount of green-related note (hexanal, E-2-hexenal and Z-2-heptenal). Despite less fruity and green-related notes, the commercial tomato juice contained ethyl acetate, which was not found in the tomato juices without additives. The flavor profile of Roma tomato juice was close to that of Garden Gem juice except it contained substantially lower amount of hexanal, 2-isobutylthiazole, and 3-methyl-heptenone. No fruity and sweet-related β-ionone were detected in both commercial and Roma juice.

P02-066
Black Goji (Lycium Ruthenicum Murr.) as a Potential Source of Natural Color in a Wide pH Range
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Introduction: Lycium ruthenicum Murr. is a traditional Chinese herb widely distributed in Tibet. The fruit, known as black goji, has a pleasant aroma and flavor, and is popular in traditional Chinese medicine for disease treatment, such as cardiovascular disease and cancer. Its health benefits have been associated with the antioxidant activities of the anthocyanins, which are responsible for the black-blush color of the fruit. In contrast to other fruits, black goji anthocyanins are primarily acylated, suggesting they may serve as a good source of natural color. The objective of this study was to investigate the profile and the color characteristics of the anthocyanins in black goji, providing a new potential natural color source for the food industry.

Method: Anthocyanins were extracted from black goji, purified by C-18 cartridge, and dissolved in buffer at pH 3-10. UV-Vis spectra between 400-700 nm and Hunter CIElab values (L*a*b*) were obtained after 30 min equilibration and after 1, 3, 6, and 24 hours refrigeration storage. The color changes were calculated as ΔE. HPLC-PDA-MS analysis was performed to investigate the anthocyanins profile under acidic condition.

Significance: The results indicated that black goji anthocyanins could produce vivid red color in acidic conditions, and display attractive violet-blue colors in alkaline conditions, making them promising candidates for natural color source in a wide range of pH conditions, without undesirable flavor or aroma.

Results: Black goji contained 500mg/100g fruit weight anthocyanins, 80% of which were acylated. Petunin-3-rutinoside-5-glucoside derivatives were the major pigments, followed by delphinidin and malvidin derivatives. In acidic pH they exhibited intense red color (L%=84.8, a%=24.5, b%=6.4, L*max=527nm), while a purple color (L%=88.8, a%=4.6, b%=6.6, L*max=537nm) was obtained at pH 6. The solution turned violet-blue color at pH 8-9 (L*=79.2, a%=6.1, b%=18.8, L*max=571nm and L*=81.9, a%=5.7, b%=16.1, L*max=580nm, respectively). The violet-blue color was significantly more stable at pH 9 (ΔE=0.52±0.01) than those at pH 6-8 (ΔE=0.10±0.02, 0.74±0.01, 1.12±0.01, respectively) over the 24 hours refrigeration storage period.

P02-067
Quality of Cucumbers Fermented in Calcium Chloride Brine for Reduced Environmental Impact
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Introduction: Commercial fermentation of cucumbers is conducted using 0.9-1.4 M sodium chloride (NaCl), resulting in wastewater with high salt concentrations. An alternative process using 0.1 M calcium chloride (CaCl₂) has been developed to eliminate NaCl from fermentation brines, reducing the environmental impact of brining operations. This study evaluated the quality of fermented cucumbers produced commercially using the CaCl₂ brining process.

Method: Over the 2013 and 2014 production seasons, 41 fermentations were conducted in brines prepared to equilibrate at 0.1 M CaCl₂, 6 mM potassium sorbate, and 10⁻⁵ CFU/ml. Commercial cucumber fermentations were conducted for 27 fermentations using standard industry practices. Production variables included commercial processor (n=6), tanking date (June-September), tank size (10,000-40,000 L), cucumber size (2.7-5.1 cm diameter), and bulk storage time before processing into finished products (55-280 days). Cucumber mesocarp tissue firmness was measured using a puncture test with a 3 mm probe on a 6 mm slice from 30 cucumbers/fermentation. Mesocarp color was measured using the L*+a*+b* color scale, and bloater defects were scored on 25 cucumbers/fermentation. Brine samples were used to measure pH and quantify organic acids and residual sugars using HPLC.

Significance: Additional research is warranted to understand the tissue softening observed in the CaCl₂ brined cucumber fermentations and identify process variables for quality improvements in this environmentally friendly fermentation process.

Results: Complete lactic acid fermentations were achieved with terminal fermentation pH values of 3.23 ± 0.09 and 3.30 ± 0.12 for CaCl₂ and NaCl brines, respectively. Increased bulk storage time was also correlated with less green and less yellow cucumber mesocarp color (p < 0.0004). Increased bulk storage time was also correlated with less green and less yellow cucumber mesocarp color (p < 0.0004).
Introduction: Roasting is a process employed to remove the skin of Anaheim pepper (Capsicum annuum L.), and improve sensory attributes for better acceptability. However, the temperature during this process affects the texture of the final product. Some pretreatments, such as blanching, can be used to minimize the lost texture and other important properties of the product. The aim of this study was to determine the effects of time and blanching temperature prior to roasting on physicochemical properties of Anaheim pepper.

Method: Peppers were washed and submitted to blanching at different temperatures (50, 55, 60, 65, and 70°C), and times (5, 20, 35, 50, and 65 min). Then, roasted at 350°C for 250 s. After that, the peppers were cooled with water at 10°C to remove the skin. The roasted peppers were evaluated in color, texture, total phenolic content, antioxidant activity, and capsaicinoids content by HPLC. Experiments were carried out under a second order rotatable central composite design, and the results analyzed using response surface methodology.

Significance: The implementation of blanching at low temperature for long times, prior to the roasting process, significantly improves the texture of the roasted peppers. The results showed that texture and phenolic content were affected (p<0.05) by both time and blanch temperature. The best texture was obtained at 50 min and 55°C of blanch temperature. Peppers were also subjected to a combined preheat at 60°C for 30 min., while capsaicinoids content, antioxidant activity, and color parameter showed no significant variation with the experimental variables.

P02-069 Formation of Furan in Fruit and Vegetable Juices Subjected to Combined Pressure-Thermal Treatments
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Introduction: Furan, a volatile organic compound, is reasonably anticipated to be a human carcinogen. It can be formed in an array of thermally processed foods with constituents including ascorbic acid and its salts, sugars, and amino acids. Therefore, understanding the combined pressure-thermal effect is critical to mitigate furan in processed foods.

Method: Freshly prepared fruit and vegetable juices (pH 3.3 – 6.75) were transferred to aluminum pre-packed tubes (1.5 mL) and heated (80°C) for 5 min. E. coli O157:H7, L. monocytogenes, and TV in lettuce. Of these, Salmonella was least sensitive to the ACP treatment. L. monocytogenes continued to decline in post-treatment cold storage. Reducing-oxygen MAP gas composition reduced the effectiveness of ACP. Both rigid and flexible conventional plastic packages were suitable for in-package decontamination of lettuce using ACP.

Significance: The results indicate that ACP in air effectively inactivated E. coli O157:H7, Salmonella, L. monocytogenes, and TV in lettuce of these, Salmonella was least sensitive to the ACP treatment. L. monocytogenes continued to decline in post-treatment cold storage. Reducing-oxygen MAP gas composition reduced the effectiveness of ACP. Both rigid and flexible conventional plastic packages were suitable for in-package decontamination of lettuce using ACP.

Results: ACP treatment inhibited E. coli O157:H7, Salmonella, L. monocytogenes, and TV by 1.1±0.4, 0.4±0.3, 1.0±0.5 CFU/g, and 1.3±0.1 PFU/g, respectively. Without environmental modification with moisture and gas in packages, the inhibition of bacteria was not significantly affected by the type of lettuce packaging or moisture vaporization (P=0.05). Modifying gas composition inside package using the N2-O2 mixtures reduced the inhibition rates of E. coli O157:H7 and TV. Following storage, L. monocytogenes declined by an additional 0.4 log CFU/g, suggesting a sublethal injury.

P02-071 Forecasting Market Volumes of Top Categories in Peas and Lentils
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Introduction: There has been an increasing demand for plant protein in the United States. Specifically, manufacturers have been interested in replacing traditional (animal) protein with plant protein due to IgE mediated allergies, increasing cost and changing consumer preferences. Legumes including pea, lentil, and other pulses are an important source of protein in addition to carbohydrates, vitamins, and minerals. In light of consumer preference and interest in a healthy diet, and increasing demand for plant based protein (pulses), it is important to explore and quantify the market potential for pulses especially peas and lentils as food ingredient. Two objectives were addressed in this study. First, we sought to analyze the growth/increase of market product launches that contain pea and lentil as their main ingredients (i.e., as the top or in the top 5 ingredients). Second, the top growth categories of pea and lentil were compared to overall market categories and their growth in order to identify and forecast market categories through different forecasting techniques.

Method: We used forecasting techniques such as exponential smoothing and/or autoregressive integrated moving average methods to analyze and evaluate the accuracy of the forecasts involving top market categories of peas and lentils.

Significance: The results provide manufacturer and/or researchers an insight into pulse-based products performance and guide them in replacing the traditional protein concentrates/ isolates with cost-effective pulse proteins.

Results: Results indicate that the top market categories for peas and lentils are savory snacks, soups, bakery and cereals, frozen food, and dog food, etc. Among these categories, the overall market for dog food, frozen food, and savory snacks show an increasing trend, while bakery and cereals show a decreasing trend in the ingredient market. For instance, the overall dog food market forecast show an increase from 3077 million kilograms in 2014 to 3366 million kilograms in 2018, while breakfast cereals market forecast show a market loss from 1533 million kilograms in 2014 to 1512 million kilograms in 2018.

P02-072 Effects of Sulfuric Acid Sodium Sulfate on Natural Spoilage Microflora, Lean Discoloration, and Off-Odors of Pork Boneless Loins and Back Ribs
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Introduction: Fresh pork is highly perishable and maintenance of desirable attributes is imperative. Hence, extending shelf life of fresh pork is important to maintain profitability and quality of product. Although a variety of attributes can determine pork shelf-life, reducing spoilage microflora is an important quality control point. Therefore, this study was conducted to detect the effects of a sulfuric acid sodium sulfate (SA) spray on the natural spoilage microflora, off odor characteristics, and discoloration properties of pork subprimal during vacuum storage and simulated retail display.

Method: Boneless pork loins and bone-back ribs were obtained from a commercial pork

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processing facility and treated with a topical spray of: SA at 1.5 pH, 1.0 pH, or an untreated control. After treatment, all samples were placed in dark, refrigerated storage for 14 or 21 d. After each dark storage interval (14 or 21 d), one half of the samples were removed from storage, overwrapped with polyvinyl chloride film, and placed into retail display cases maintained at 4°C (±2°C) for up to 96 h. At 12 h intervals for the duration of simulated retail display, trained panelists evaluated percent discoloration. Additionally, at 0, 48, and 96 h of display, trained panelists evaluated intensity of off odors and plated and enumerated populations of Psychrotrophic, Pseudomonas, Lactic acid bacteria, and yeast and molds.

Significance:
Overall, SA can be used to extend shelf life of pork subprimals and subsequent retail cuts by reducing natural spoilage microflora and promoting desirable odor, but impacts on color need to be addressed.

Results:
After 14 and 21 d of dark storage, both boneless loins and backribs sprayed with 1.0 pH SA had lower (P < 0.05) Psychrotrophic, Pseudomonas, Lactic acid bacteria, and yeast and mold populations than control or 1.0-pH treated samples at 0, 48 and 96 h of display. The percent of discoloration of boneless loin chops increased over the duration of retail display for products stored for 14 and 21 d before simulated retail display. Boneless loin chops treated with 1.0 pH SA had a greater percent discoloration at each simulated retail display test time than untreated chops or those sprayed with 1.5 pH SA.

P02-073
Functional Properties of Bicarbonates on Physicochemical Attributes of Ground Beef
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Introduction:
New consumer trends suggest that phosphate content presents a conflict for consumers desiring to reduce dietary sodium in their food. In light of the current consumer demand, the meat industry has begun to search for alternative functional ingredients that may provide similar or enhanced functional properties of phosphate in meat products. Bicarbonate compounds are being considered as a new, promising alternative functional ingredients that may provide similar or enhanced functional properties as phosphate. Little research has documented the influence of bicarbonate effects on physicochemical properties of the processed bulk raw ground beef. Therefore, the objective of this research was to investigate the effects of potassium bicarbonate, sodium bicarbonate, and starch, on pH, water holding capacity, and textural attributes of processed raw bulk ground beef.

Method:
This study investigated the effects of sodium bicarbonate, potassium bicarbonate, and NaCl, alone or in combination, in raw ground beef. Raw ground beef was mixed with NaHCO3 (0.5%; 1.0%), KHCO3 (0.5%; 1.0%), and/or NaCl (0.5%), and the results of the treatment(s) were compared with modified food starch (2.0%) and potato starch (2.0%). The experimental design was a randomized complete block with repeat measures and type-3 tests of fixed effects for pH, WHC, and color changes during retail display, and textural attributes were analyzed using the MIXED procedure of SAS. The experiment was repeated four times at four different occasions. The significant differences were detected when respective F-tests were significant at (p<0.05).

Significance:
The findings of this study suggest that using bicarbonates can increase WHC because of increased pH, producing raw ground beef that is more tender and adhesive.

Results:
Addition of bicarbonates significantly enhanced (p<0.05) the pH and water-holding capacity of the processed bulk raw ground beef. Inclusion of salt in bicarbonate formulation improved the water-holding capacity of meat more than both modified food starch and potato starch. Potassium bicarbonate with salt formulation was highly effective and provided the best adhesiveness values in raw ground beef.

P02-074
Evaluation of the Reduction of E. coli in Beef Strip Loins at Temperatures Lower Than 54.4°C
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Introduction:
According to the CDC, Salmonella is a leading cause of gastroenteritis in humans and continues to be significant in relation to public health concerns for the food industry. This may be attributed to inadequate heating/cooking. The lowest temperature and longest temperature held by USDA recommends in Appendix A to achieve a 6.5-log reduction in Salmonella is 54.4°C for 121 minutes. There is limited research in utilizing lower temperatures for strip loins in order to increase juiciness and perceived tenderness. This study evaluated the reduction of Escherichia coli in strip loins cooked to internal temperatures of 54.4°C or lower.

Method:
A local company provided their proprietary brine and rub ingredients and raw meat materials for the experiment. A cocktail of five stains of Escherichia coli (ATCC® BAA-1427, 1428, 1429, 1430, 1431) were utilized (surrogates for Salmonella). The combination of temperatures and times held were 54.4°C for 2 and 3 hours, 51.7°C for 3 and 5 hours, and 48.9°C for 10 and 12 hours. Times were determined utilizing a model from the North American Meat Institute. Temperatures were monitored with Type-K Thermocouples. Inoculations were prepared by inoculating TSB with each E. coli strain and allowed to grow at for approximately 24 hours. Bacteria survival was analyzed on MacConkey agar. Data (three replications/two samples per replication) were analyzed using the GLM procedure of SAS.

Significance:
Results suggest that lower temperatures could possibly achieve a 6.5-7.0-log reduction in accordance with Appendix A if the product was held at the temperature for the correct time. This information is useful for companies that wish to use other temperature/time relationships than those stated in Appendix A.

Results:
Strip loins had a 6.5-log reduction at 54.4°C when held at both 2 and 3 hours. When the cooked and held to an internal temperature of 51.7°C a 5.5-log reduction could be achieved when held for 3 hours and a 6-log reduction when held for 5 hours. Strip loins that were cooked to 48.9°C and held for 10 hours resulted in a 5.7-log reduction and holding for 12 hours resulted in a 5.3-log reduction.

P02-075
Structural Changes Induced by Pulsed Electric Field Treatment on Red Onion Bulb and the Impact on Onion Volatiles Formation
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Introduction:
Onions are widely used in daily cooking as a flavor ingredient. The characteristic onion flavor is dominated by the organosulfur volatile compounds. Intact onions have little flavor since the sulphur volatiles are only generated as a result of allinase-catalyzed reaction on flavor precursors upon tissue disruption. Pulsed electric field (PEF) processing could lead to changes in membrane permeability of plant cells. A consequence of increased membrane permeability is the loss of compartmentalization of the cell. Therefore, this may result in the interaction of enzymes and substrates that allow various biochemical reactions relating to food quality taking place. This research aimed to study the effect of electric field strength intensity (0.68kV/cm vs. 1.24kV/cm with energy input of 6kJ/kg, 20μs pulse width and 50Hz square-wave pulse) on the structural changes of onions and their relationship with the formation of volatile compounds in intact onion bulb.

Method:
Cryo-scanning electron microscopy (cryo-SEM) technique was used to examine the site of PEF-induced damage. The volatile compounds were isolated from PEF-treated onion bulbs using solid-phase microextraction and detected using gas chromatography-mass spectrometry.

Significance:
This study showed that the distinctive sulfur volatiles were generated in situ of an intact onion bulb after PEF. It could be explained that PEF changes the cell membrane permeability leading to disruption of onion cell walls that favor the allinase-catalyzed reaction and consequently improving the formation of sulfur volatiles. These findings allowed the exploitation of PEF in developing onion-related food products with enhanced onion flavor.

Results:
Cryo-SEM images showed that the cells remained intact and turgid for untreated onions. The integrity of onion cell wall, after PEF at 0.68kV/cm, was found to partially deteriorate showing an increase in intercellular spaces, while the shape of some cell walls was maintained. PEF at 1.24kV/cm led to complete cell disruption with no turgid onion cells visible. The content of all detected volatile compounds increased after PEF, particularly dimethyl disulfide which increased significantly (p<0.05) by at least 30- and 60-fold at 0.6 and 1.24kV/cm, respectively, compared to untreated onions.

P02-076
The Effect of High Voltage Atmospheric Cold Plasma on the Microbial, Physical, and Chemical Properties of Orange Juice
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Introduction:
There is an increasing need for non-thermal process for fruits and vegetables without food quality change. Atmospheric cold plasma as a non-thermal technology has been demonstrated to effectively eliminate bacteria, spores, and biological contaminants from food and non-food surfaces. There have been few reports on the application of this technique to treat the liquid foods within the package.

Method:
The goal of this project is to explore the decontamination efficiency of high voltage atmospheric cold plasma (HVACP) on Salmonella enterica serovar Typhi (S. Typhi) in orange juice (OJ) and evaluate its effect on the physical and chemical properties. HVACP was generated by dielectric barrier discharge in air and modified atmosphere (MA65) in sealed bags. 25 and 50ml OJ was exposed both directly and indirectly to a high voltage (90kV) for up to 120 s, followed by 24 h of refrigerated storage (4°C). The reactive gas
species generated were monitored by Optical Emission Spectroscopy (OES) during HVACP treatment. The ascorbic acid content and color properties were measured by HPLC and Hunter Colorimeter.

Significance:
This indicates that HVACP both direct and indirect treatment can be an effective non-thermal technology to control or even eliminate Salmonella populations in OJ.

Results:
Results: For 25 mL OJ show a 5 log10 reduction in S. Typhir at 30 s for both direct and indirect treatment with air and MA65 gas. For 50 mL OJ, after 120 s, the microbial analysis indicated a 2.9 log10 reduction (air), a 4.2 log10 reduction (MA65) in direct treatment and a 3.8 log10 reduction (MA65) in indirect treatment for S. Typhi. No significant color, Brix, nor pH change was observed within 120 s HVACP treatment. The concentration of ascorbic acid reduced by 75% after 120 s HVACP direct treatment in 25 ml air packed OJ compared with non-treated OJ. The activity of pectin methyltransferase (PME) had been reduced by 74% (air) and 82% (MA65) after 120 s HVACP direct treatment, respectively.

P02-077
Effect of HPP Treatment on the Destruction of E. Coli O157:H7 in Beef Steak Intended for Sous Vide Cooking
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Introduction:
Sous vide cooking is a "low temperature long time" method of cooking in heat-stable, vacuumized pouches, which can potentially enhance the taste and nutrition of muscle foods like beef, pork, shrimp, etc. However, the long time required to reach the target temperature and holding times may allow for pathogen growth and cause the safety issue. Thus, alternative processes such as high pressure processing (HPP), a non-thermal microbial inactivation technology with advantages of retained ingredient quality, reduced the cooked time, and extended shelf life, are desirable. The aim of this study was to determine the effect of HPP treatment on the destruction of E. coli O157:H7 in beef steak intended for sous vide cooking.

Method:
Beef samples (85 ± 5 g) from the triceps brachii muscle were cut, weighed, and inoculated via pin pad with a solution containing ~10 Log CFU/ml E. coli O157:H7. Two opposite surfaces of each sample were exposed to a radiant heat source for 1 minute to sear, then triple vacuum packaged, and stored for 12-24-24 at 4°C prior to high pressure processing. Samples were treated for up to 15 minutes at 650 MPa and 600 MPa by HPP. After treatment, samples were aseptically transferred to 50 ml of 0.1% peptone water in and then stomached for 90 s before plating onto APC and EEC petriflms. Each experiment was completed in triplicate.

Significance:
High pressure processing can achieve microbial reductions in excess of the 5-log reduction of pathogen surviving, allowing the potential for the creation of convenience products to reduce the potential risk in home sous vide cooking. Additional work, currently underway, will examine the necessary questions surrounding shelf-life, consumer acceptability, and organoleptic properties.

Results:
While approximately 0.5 log CFU/g reduction could be achieved by searing alone, HPP treatment at 450 MPa for 15 minutes resulted in reductions of 1.7 ± 0.44 and 4.74 ± 0.47 log CFU/g in APC and E. coli respectively. At 600 MPa, APC and E. coli levels saw reductions of 6.19 ± 0.53 and 6.13 ± 0.32 log CFU/g after just 10 minutes. Relevant to time, microbial destruction appeared linear in nature at a given pressure.

P02-078
Effects of Different Fruit Drying and Drink Processing Methods on Vitamin C, Total Phenolics, Cellular Antioxidant Activity, and Mogroside V of Luo Han Guo (Siraitia Grosvenorii) Drink
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Introduction:
Luo Han Guo fruit (LHG), native to Guangxi province of China, is rich in mogroside, polyphenols, vitamins, and many other nutrients. It has been shown to exhibit beneficial functions such as anti-diabetic and anti-carcinogenic effects. This fruit is traditionally consumed by making a drink via thermal processing from dried fruit. Fruit drying and drink processing methods may impact the final quality of drink. In this study, two LHG drying methods and two LHG drink-processing methods were studied. Two high-heat air-dried Luo Han Guo (HA-LHG) and novel low temperature-vacuum dried Luo Han Guo (LTV-LHG) were used to make LHG aqueous drink using thermal pasteurization and high pressure processing (HPP). Unpasteurized LHG drink was used as a control.

Method:
The vitamin C content, total phenolic content, cellular antioxidant activity (CAA), and mogroside V content were evaluated for LHG drinks. Vitamin C was measured via 2,6-dichlorophenolindophenol (DCPIP) assay with PVP modification, CAA was measured in HepG2 cells with queretin as standard, and the major sweetener mogroside V was measured using HPLC.

Significance:
Results from the study will provide scientific supports for processors to produce high quality LHG products.

Results:
Results showed that LTV-LHG drink had 15 to 35 times more vitamin C and 30% to 80% more mogroside V content than HA-LHG drink. While HA-LHG drink exhibited 2 to 3 times more total phenolic content than LTV-LHG drink. Drink processing methods showed insignificant effects on total phenolic and mogroside V content. CAA values of HA-LHG drink were slightly lower than that of LTV-LHG drink. CAA value of both HA-LHG drink and LTV-LHG drink decreased after thermal pasteurization when compared to HPP and control drinks. This research showed that low temperature vacuum drying better preserved Vitamin C and mogroside V content than hot air drying of LHG fruit. However, total polyphenols increased during hot air drying. HPP preserved cellular antioxidant activity of LHG drink better than thermal pasteurization.

P02-079
Physicochemical Properties of Pea Protein Isolate (PPI)-Starch Nanocomplexes Treated by Ultrasound at Different pH Values
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Introduction:
In recent years, pea protein has drawn increasing attention as a novel hypoallergenic food ingredient with high nutritional value and a low price. An amphipathic molecule, the protein is known as a natural and bio-safe emulsifier. Creating a protein-poly saccharide conjugate to be the emulsifying agent, rather than the protein alone, can markedly enhance its stability. However, the use of ultrasound to modify the physicochemical properties of the pea protein isolate (PPI)-starch nanocomplexes has not been well documented. This study was undertaken to investigate the effects of ultrasound treatments on the physicochemical properties of PPI-starch nanocomplexes.

Method:
The pea protein isolate (85% pea protein based on dry basis) was provided by Roquette (Geneva, IL, USA). The PPI-starch complexes were treated with 5 min ultrasonication (100% amplitude) in mixtures at different pHs (2-12). The soluble protein content was determined by the Bradford method using BSA as the standard. The turbidity of the treated solutions was measured using a spectrophotometer (Lambda 1050 UV/VIS/NIR Spectrometer, PerkinElmer, Waltham, MA, USA). The volume-weighted mean diameters (D4, 3) of the soluble proteins were determined by dynamic light scattering (DLS).

Significance:
The present study clearly demonstrated that applying ultrasonication to PPI-starch nanocomplexes under different pH conditions can significantly improve the solubility and emulsifying properties of the PPI.

Results:
Increasing the pH from 2 to 12 resulted in increased protein solubility. The highest solubility was 60.2% for the sample treated with ultrasonication at pH 12, while the lowest (8.17%) was observed in the control (pH 1). For the pH condition, the protein solubility values ranged from 38.43 to 49.65%. The ultrasound treatment significantly decreased the particle sizes of the PPI-modified starch nanocomplexes. The turbidity of the samples treated by ultrasound was significantly lower than that of the control.

P02-080
High Hydrostatic Pressure Processing for Enhancing Microbiological Safety and Consumer Acceptance of Hard-Cooked Peeled Eggs
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Introduction:
The consumption of hard-cooked peeled eggs (HCE) is increasing with growing demand from modern consumers for ready-to-eat foods. However, outbreaks associated with Salmonella Enteritidis are on the rise with consumption of HCE. Commercially available HCE are past processed by steam-heat. The development of greenish-black coloration at egg yolk surface using steam-heat negatively influence consumer acceptance of HCE. The objective of this study was to find a substitute treatment of HCE to inactivate S. Enteritidis and improve yolk color and textural properties for higher consumer satisfaction. The efficacy of high hydrostatic pressure (HHP) non-thermal technology was investigated against the conventional steam-heat post-processing.

Method:
HCE were inoculated with S. Enteritidis (wild type) at initial counts of about 7.5 log CFU/g. S. Enteritidis inoculated HCE samples were subjected to steam-heat at 95°C for 40 min, and HHP at 500 to 600 MPa for 1 s to 15 min at 25°C. Each post-processed HCE group was cultured on both non-selective agar and selective agar to evaluate percent injured (PI). CIELAB (L*, a*, b*) values were measured for egg yolk surface. Texture profile analysis (TPA) was carried out for egg white. In addition, sensory evaluation of whole egg was performed by an untrained consumer panel.

Significance:
HHP showed potential for effective control of S. Enteritidis on HCE compared to traditional steam-heat. Furthermore, HHP showed ability to prevent discolouration of egg yolk surface and alteration of texture of egg white. Therefore, HHP can be applied as alternative commercial post-processing treatment of HCE with enhanced microbiological safety and consumer preference.

Results:
Microbiological analysis showed that steam-heat post-processing achieved 5.18 log reduction of S. Enteritidis on non-selective agar, whereas HHP at 600 MPa for 5 min completely inactivated S. Enteritidis. HHP processed HCE showed higher PI than steam-
heat processed HCE. Discoloration on yolk surface was only shown in steam-heat treated HCE following considerably low values of lightness (L*) and yellowness (b*). Significant changes were observed in TPA with reference to hardness and chewiness particularly in steam-heat processed HCE, indicating lower consumer acceptance. Sensory panelists showed preference towards color and texture of HHP post-processed by HCE rather than steam-heat processed HCE.

**P02-081**

Hyperbaric Storage of Highly Perishable Food Products as an Alternative and Improvement of Refrigeration Storage

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**Introduction:**

Studies concerning a new preservation methodology called hyperbaric storage (HS) have been performed, and promising results were obtained for highly perishable foods such as fruit juices, cooked ham, and carrot soup, among others. This new preservation methodology consists of food storage under pressure (usually 25-150 MPa), and it can be applied at variable/uncontrolled room temperature (RT). Since it only requires energy for the compression/decompression process, HS/RT has great potential for energy savings.

**Method:**

The aim of this work was to evaluate the HS feasibility of highly perishable food products: whey cheese (24 h/100 MPa/RT), watermelon juice (21 days/75 MPa/15°C), and chocolate milk (30 days/50 MPa/RT).

**Results:**

The microbiological analyses confirmed that the microbial counts under HS, total aerobic mesophiles (TAM), and yeasts and molds (YM) remained unchanged and decreased, respectively. Thus, an inhibition effect in the first and an inactivation effect in the second were detected. Otherwise, samples stored at 0.1 MPa (0/4°C and RT), presented an increase to values closer to the unacceptable limit (6.0 log CFU/g). Watermelon juice preservation by HS allowed a shelf-life increase to at least 21 days (i.e. with a reduction of ≈2 log CFU/ml for TAM), while control samples (0.1 MPa/RT and 0/4°C) presented values above the unacceptable limit at the end of 3 days. HS could also improve the microbial stability of chocolate milk over 30 days of storage, as a decrease of all microbial counts analyzed (i.e. ≈1.5 log CFU/ml for TAM) was verified. Samples stored at 0.1 MPa (RT and 0/4°C) presented values above the unacceptable limit.

**Significance:**

Altogether, these studies proved the feasibility of HS preservation at room temperature, with almost no energy costs and a lower carbon footprint, allowing additional shelf life compared to refrigeration.

**P02-083**

Astaxanthin From Shrimp Byproducts as an Antioxidant for Stabilization of Flaxseed Oil

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**Introduction:**

Astaxanthin (AX) is a fat-soluble carotenoid and powerful antioxidant with many health protective characteristics. AX can be extracted from shrimp byproducts (discards excluding meat) using edible oils such as flaxseed oil (FO). FO is a health promoter, albeit being prone to lipid oxidation during storage. Addition of AX from shrimp byproducts to FO could minimize oxidation. The objective of this study was to investigate the changes in the GABA content after 72 hrs of germination under hypoxic and aerobic stresses. The germinating grains were treated with ultrasound (25 KHz) for 0, 1, 5, 15, and 30 min after soaking. Moreover, they were treated with N2 during 66-72 hrt of germination.

**Results:**

The ultrasound treatment (1-30 min) significantly enriched the GABA content in the germinating brown rice, red rice, white wheat, and yellow corn, but not the oats, compared to germination under normal conditions. Sonication for 5 min and 30 min were found to be suitable stress times for GABA accumulation. Grain samples treated with ultrasound for 5 min grew better than those treated for 15 min. The GABA produced was higher under hypoxic stress than normoxic conditions for each cultivar (P < 0.05). The dehulled rice was more responsive to the ultrasonic and hypoxic stresses than the other grains.

**Significance:**

This study proposes treatment of germinated grains with power ultrasound and N2, and their combinations, which could be widely utilized in commercial applications to increase the GABA accumulation and improve the sprout growth in germinating grains.

**P02-085**

Comparison of Response Surface Methodology (RSM) and Artificial Neural Networks (ANN) Modeling Towards Optimum Extraction of Functional Compounds From Stevia Rebaudiana (Bertoni) Leaves

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**Introduction:**

Stevia rebaudiana (Bertoni) ranks first due to its highest sweetening potential as replacers of artificial sweeteners owing to presence of dietetically important natural sweetening compounds (stevioside and Reb-A) in its leaves with important biological activities. Traditional cold extraction (CE) process assisted by magnetic stirring for the stevia extracts consumes more solvent, time and energy with lower efficiency. Therefore, this study aimed at the development of optimized reflux extraction (RE) process by response surface (RS) and artificial neural network (ANN) modeling approaches.

**Method:**

Effects of RE process variables were investigated including ethanol concentration (0-99%), extraction temperature (55-75°C) and extraction time (45-75 min). Response variables, such as total phenolics content (TPC), total flavonoids content (TFC), antioxidant activities (DPPH, ABTS and FRAP) and stevioside and Reb-A from dried stevia leaves were optimized by RSM and ANN values. Moreover, modeling efficiencies of RSM and ANN were also statistically compared.

**Results:**

The predicted optimal conditions for the highest values were conc. ethanol, 65°C, and 60 min showing the corresponding responses: (TPC = 88 mg GAЕ/100 g DM; TFC = 75 mg CE/g DM; DPPH = 738 μM TEAC/g DM; ABTS = 2,841 μM TEAC/g DM; FRAP = 1,555 μM TEAC/g DM, Stevioside = 82.85%, Reb-A = 74.87%). The efficiency comparison of both models by using determination coefficient (R2) and absolute average deviation (ADD) indicated that ANN was superior (R2=0.98, ADD= 1.31%) to RSM model (R2=0.91, ADD= 3.94%) in terms of their predictive modeling.

**Significance:**

Awareness of plant-derived zero-calorie sweeteners has increased recently to combat life-style related disorders and adverse health impacts due to excessive sugar and artificial sweeteners consumption. Optimized reflux extraction process by using RSM and ANN approaches for the functional compounds from Stevia rebaudiana can help to meet commercial needs of natural sweeteners with better qualities compared to traditional cold extraction process.
of beneficial lactic acid bacteria. However, the structural diversity of mannoproteins, in terms of molecular weight (MW), the relative ratio of mannan to protein and their branching, can affect their functional properties. Understanding the relationship between the structural characteristics and the functional properties of mannoproteins can help to better modulate their properties and improve their applications. The present study was aimed at the enzymatic isolation of mannoproteins from five different Saccharomyces cerevisiae yeast-based products with different approximate compositions (brewer’s and baker’s whole yeasts; three yeast cell wall by-products), and the characterization of their structural and functional properties.

Method: We used mass spectrometry, NMR, and chromatography in our experiment.

Results: Higher recovery yields of crude mannoprotein extract were achieved using brewer’s whole yeast (31.37-65.31%) compared to baker’s (25.01-32.92%) upon zymolase enzymatic treatment (h=180 U/g; 6-24 h); while the recovery-yields were between 26.72% to 47.55% using the derived baker’s yeast cell wall product. The mannoproteins were purified from crude extract using HiTrap Con A 4B column. The mannoproteins content was similar in both baker’s and brewer’s whole yeast-based extracts (35.4, 35.2%), while the mannoproteins content in the baker’s yeast cell wall extract was low (13.92%) under similar conditions. Mannan/protein ratio of the isolated mannoproteins (11.89-42.69) was dependent on the conditions of the enzymatic treatment (67-167 U/g; 4-20 h) among brewer’s and baker’s whole yeast and the three yeast cell wall by-products. More than 60% of mannoproteins with a MW lower than 10 kDa were recovered after zymolase treatment; however, the mannoproteins isolated from baker’s and brewer’s yeasts still showed different MW distribution. Indeed, mannoproteins derived from brewer’s yeast contain a high MW fraction up to 3724 kDa; while the high MW fraction of mannoproteins from baker’s yeast and its corresponding cell wall did not exceed 400 kDa. The functional properties of mannoproteins will be discussed, as they are related to the structural properties.

Significance: This research contributes to laying out scientific ground for the development of innovative ingredient.

P02-087

Effect of Simulated In Vitro Digestion on Polyphenolic Contents and Antioxidant Activity in Basil and Ginger

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Introduction: Herbs and spices possess excellent antioxidant activities that are attributed to their polyphenol contents. However, studies on their bioefficacy do not take into consideration changes to the composition and chemical structure due to processes such as digestion which may alter these compounds and hence, their bioactivity. The objective of this study was to determine the effects of simulated in vitro digestion on antioxidant activity as well as total flavonoid and phenolic content in basil and ginger.

Method: Basil and ginger were subjected to a simulated gastrointestinal digestion model that consisted of an oral phase, gastric phase and post gastric phase. Antioxidant capacity was assessed using, ferric reducing antioxidant power (FRAP), trolox equivalent antioxidant capacity (TEAC), and oxygen radical antioxidant capacity (ORAC). Total phenolic content (TPC) and total flavonoid content (TFC) were also determined. Results from the in vitro digested samples were compared to non-digested samples.

Results: TPC (mg GAE/g) in basil was significantly (P<0.05) decreased (3.52 to 1.05) after in vitro digestion, while TFC (mg CE/g) was significantly (P<0.05) increased (4.32 to 15.37). In ginger, there were no significant differences between the digested and non-digested. TEAC (mM Trolox equivalent/g) and FRAP (µmol FeSO4/g) were significantly (P<0.05) decreased after in vitro digestion in both basil and ginger. There were no significant differences in ORAC between digested and non-digested basil and ginger.

Significance: Results suggest that the decrease in total polyphenols could be a result of changes in pH during in vitro digestion, thus modulating their solubility and chemical structure.

P02-088

Quinoa Flavanoids: Identification, Quantification, and Bioaccessibility Following Simulated Gastrointestinal Digestion

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Introduction: Dietary flavonoids are a group of bioactive compounds that are beneficial to human health by alleviating the progression of chronic diseases. Quinoa, an ancient grain of the Incan civilization, is considered as a rich source of flavonoids and phenolic acids. Identification of these compounds using chemical extraction methods has been well established in the literature. However, stability of these compounds under physiological conditions has not been previously reported. In quinoa, flavonoids exist mainly in the form of glycosides. The quantity of these compounds, released from the food matrix during the human digestion process (bioaccessibility) may differ significantly from those that are extracted using chemical techniques. The objective of this work was to characterize major flavonoid compounds in quinoa that are released after enzymatic digestion under physiological conditions.

Method: An in vitro model that simulates gastro intestinal digestion using enzymes pepsin, bile, and pancreatin was used for this purpose.

Results: HPLC- MS3 analysis of extracts from gastric phase (pepsin digestion) and gastro-intestinal phase (pancreatic digestion) showed the presence of five major Kaempferol and quercetin triglycosides. Of the five flavonoids, the most abundant flavonoid that was found at the end of the gastro-intestinal digestion was Kaempferol 3-O-(2,6-di-O-α-L-rhamnopyranosyl)-β-D-galactopyranoside. Results from the enzymatic digestion were compared to chemical extraction using aqueous methanol. Release of these compounds was significantly higher (p<0.05) after enzymatic digestion than extracted using methanol. This may be due to bound phenolics being liberated under enzymatic conditions that may have not been completely released using methanol. The antioxidant activity of enzymatic extracts, measured using DPPH and ORAC assay, also yielded higher antioxidant capacity than chemical extracts. The results suggest that flavonoids present in quinoa are stable under gastro intestinal digestion and are potentially bioavailable for absorption by the cells.

Significance: Quinoa can be used as an ingredient to formulate new products with added health benefits from flavonoids.

P02-089

Sulforaphane, A Dietary Component From Broccoli, Enhances the Anticancer Activity of Paclitaxel Against Triple Negative Breast Cancer by Inhibiting Cancer Stem Cells

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Introduction: Triple negative breast cancer (TNBC, estrogen receptor-, progesterone receptor-, and human epidermal growth factor receptor 2-negative) is a particularly aggressive breast cancer subtype with high mortality rates. Traditional chemotherapy have had minimal benefits, which may be due to the existence of breast cancer stem cells, a small population that is resistant to chemotherapy and can initiate tumors after treatment. Our previous work has shown that sulforaphane, a natural dietary component from broccoli, effectively kills breast cancer stem cells. Therefore, the objective of the project was to combine sulforaphane and paclitaxel to effectively kill both differentiated cancer cells (the bulk population) and cancer stem cells (the small population) in TNBC.

Method: MTS assays were used to evaluate cytotoxicity of sulforaphane and paclitaxel, alone or in combination, in three TNBC cell lines, SUM-149, SUM-159, and MDA-MB-231. Aldefluor assays and mammosphere assays were utilized to determine the effects of sulforaphane and/or paclitaxel on cancer stem cell population and their self-renewal capacity, respectively. Both assays are standard methods for characterizing cancer stem cells.

Results: The MTS results showed that IC50 values of sulforaphane in these cell lines ranged from 10 to 15 μM, and the IC50 of paclitaxel from 1 to 10 nM. A combination of low-dose sulforaphane (5 μM) enhanced the killing effect of paclitaxel. The results from Aldefluor assays showed that sulforaphane (2.5 and 5 μM) reduced the aldehyde dehydrogenase positivity (ALDH+) cell population by approximately 50%. While paclitaxel (5 and 10 nM) dramatically raised ALDH+ population by 130% to 190%, addition of sulforaphane (2.5 and 5 μM) and paclitaxel significantly inhibited mammosphere formation, compared to single agent treatments, suggesting the enhanced impairment of cancer stem cell self-renewal capacity. A combination of 5 μM sulforaphane and 10 nM paclitaxel completely eradicated the mammosphere.

Significance: These results support the combination of sulforaphane with paclitaxel to enhance the anticancer efficacy against TNBC. This work provides a basis for future preclinical and clinical evaluation of broccoli extracts combined with chemotherapy to improve cancer treatment outcomes.

P02-090

In Vitro and In Vivo Anti-Hyperglycemic Effects of Korean Mistletoe (Viscum Album var. Coloratum) Extracts

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Introduction: Mistletoe is a semiparasitic plant studied for cancer prevention and this research evaluates the potential of mistletoe extracts for type-2 diabetes prevention.

Method: Korean mistletoe was extracted in water (MWE) and 70% ethanol (MEE) and evaluated for their total phenolic contents, HPLC phenolic profiles and in vitro carbohydrate-hydrolyzing enzyme inhibitory activities (rat alpha-glucosidase, sucrase, maltase, and glucoamylase). Furthermore, the postprandial glucose-lowering effects

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of MWE and MEE were assessed in vivo using male Sprague-Dawley (SD) rats and compared to acarbose (a known pharmacological α-glucosidase inhibitor), by evaluating the post-prandial blood glucose levels for 2 hrs after sucrose loading (2g/Kg).

Results: The ethanol extract (MEE) yielded to a higher total phenolic content (12.97 g/100 g GAE) compared to MWE (1.38 g/100 g GAE). When the two extracts were evaluated in vitro for their ability to inhibit carbohydrate-hydrolyzing enzymes MEE resulted to higher inhibitory activities. When the IC50 values of the inhibitory activities were determined, MEE had higher inhibitory effect than MWE, however the degree of higher inhibition did not correlate to the 10-times higher phenolic content. Both extracts showed higher inhibitory effect against sucrase, followed by glucoamylase. Both extracts exhibited similarly to each other and significantly different to the control blood glucose reduction effect when tested at the same dose (0.1 g/Kg). Even though MEE had higher phenolic content and higher in vitro inhibitory activity against carbohydrate-hydrolyzing enzymes, the observed blood glucose levels throughout the 2 hrs of MWE and MEE were not significantly different. The HPLC phenolic profile of both extracts at 280 nm revealed a major peak eluting around 70 min that was present in higher levels in MEE. Also we observed two unique peaks to MWE eluting around 50 and 55 min. Our findings suggest that even though MEE has almost 10-times higher phenolic contents compared to MWE, both extracts have similar in vivo effects in terms of post-prandial blood glucose effects. This could be due to the two unique peaks observed in MWE. Currently, efforts to purify and characterize these two compounds are underway.

Significance: This research provides evidence for the further evaluation of mistletoe extracts for the potential development of ingredients for Type 2 diabetes prevention.

P02-091
Ursolic Acid Inhibited Cell Proliferation and Invasion in MDA-MB-231 Human Breast Cancer Cells Through Suppressing the Expression of STAT3 Transcriptional Factor
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Introduction: Breast cancer is the second leading cause of cancer death among American females. Increased intake of fruits and vegetables has been suggested by epidemiological studies to be one of major dietary factors reducing the risk of breast cancer. The health benefits were largely attributed to phytochemicals. Ursolic acid (UA), a widely distributed triterpenoid in peels of fruits, herbs and spices, has been reported to have anti-cancer activities. However, its mechanisms of action against breast cancer remain unclear. The objective of this research was to investigate anti-proliferation and anti-invasion effects of UA in MDA-MB-231 human breast cancer cells, and to determine its mechanisms of action.

Method: The anti-proliferative activity and cytotoxicity of UA in MDA-MB-231 cells were measured by methylene blue assays developed by our lab. Anti-invasion effects were tested by scratch assay. Key proteins regulating cell signaling transduction pathway were detected by Western Blot assay.

Results: UA significantly suppressed proliferation of MDA-MB-231 human breast cancer cells in a dose-dependent manner at the concentrations without cytotoxicity. The EC50 value of anti-proliferative activity was 34.4 µM. UA at concentrations of 20, 30, and 40 µM significantly inhibited cell invasion in a dose-dependent manner. At the concentration of 40 µM, the cell invasion was inhibited by 73.9% at 12h. Additional tests indicated that the anti-invasive activity of UA was partially due to the antagonistic stimulation of EGF (epidermal growth factor), a carcinogenesis promoter. As one of the mechanisms of action, UA repressed expression of STAT3, the transcriptional factor upregulating cancer cell proliferation and invasion.

Significance: We demonstrated that UA inhibited cancer activity through inhibiting both proliferation and invasion of MDA-MB-231 cells. Its downregulation on transcriptional factor STAT3 could be as one of the mechanisms of action. These data shed light on understanding the protective activity of plant foods against breast cancer.

P02-092
Chemopreventive Potential of Select Herbal Teas and Spices on Azoxymethane-Induced Aberrant Crypt Foci in Fisher 344 Male Rats
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Introduction: Colon cancer is the third leading cause of death in U.S. Research suggests that consumption of selected herbal teas and spices may reduce the incidence of chronic diseases such as cancer. The objective of this study was to identify the effect of strawberry leaf, raspberry leaf, hibiscus tea, and cinnamon on azoxymethane (AOM)-induced aberrant crypt foci (ACF) in Fisher 344 male rats.

Method: After an acclimatization period of 1 w, 49 male weanling rats were divided into 16 groups. The control (CON) group was fed AIN-93G diet; 15 treatment groups were administered control diet+strawberry leaf tea (STW), raspberry leaf tea (RAS), hibiscus tea (HIB), cinnamon (CIN), strawberry leaf tea+cinnamon (STW+CIN), raspberry leaf tea+cinnamon, (RAS+CIN), hibiscus tea+cinnamon (HIB+CIN), and strawberry leaf tea+raspberry leaf tea+hibiscus tea+cinnamon in combination (COM) at 2 levels each (tea added at 1 and 2% CIN added at 2.5 and 5%). Rats received 24 mg/kg body weight of AOM dissolved in saline s/c at 7 and 8 w of age. Animals received experimental diets until sacrificed by CO2 asphyxiation at 17 w of age. ACF were enumerated in colon. Hepatic antioxidant enzymes were determined; superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPO), and glutathione (GH).

Results: All treatment groups had a reduction in ACF compared to CON (154). Lowest presence of ACF were observed in rats administered HIB 2%+CIN 5% (13.16) with a 91.43% reduction compared to CON. The number of ACF observed in treatment groups administered teas and cinnamon in combination was lower than those administered teas singly. SOD and CAT activities in rats administered treatment diets were higher than CON (13.63 U/mL, 0.95 µmol/min/ml). Rats administered COM (20.65 U/mL) had highest SOD activity. CAT activity was 51.27% higher in rats administered HIB 2% (1.96 µmol/min/ml). GPO activity ranged from 7.26 (STW 1%-CIN 2.5%) to 9.59 (STW 2%) µmol/min/ml.

Significance: Results from this study suggest that herbal teas and spices may reduce the risk of colon cancer and improve antioxidant status and regular consumption may provide beneficial health effects.

P02-093
Intragastric Gelation of Soy Protein/Alginate and Its Effect on Sucrose Release
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Introduction: Protein digestion is highly influenced by several factors including gastric conditions, protein structure, and the presence of other food components in the gastrointestinal tract. Our previous work has shown that certain dietary fibers can delay the digestion of whey protein due to the formation of intragastric gel; however, the effect of dietary fiber on digestion of soy protein is not fully understood. The goal of our study is to investigate the effect of alginate on in vitro gastric digestion and sucrose release of soy protein isolate (SPI) in model beverages.

Method: Model beverages containing 5% w/v SPI, 0 to 0.20% w/v alginate and 10% w/v sucrose were prepared by heating the mixtures at 85°C for 30 min and pH 6 or 7. Characterizations of beverages included determination of phase separation, particle size analysis and rheological properties measurement. Digestion patterns and sucrose release were determined after 0 to 2 h in-vitro gastric digestion using SDS-PAGE and HPLC analysis, respectively.

Results: Increasing alginate concentration led to increased particle size as well as increased viscosity and shear thinning behavior; however, no phase separation was observed in any of the samples. The effect of pH was more pronounced at high alginate concentration with beverages at pH 6 having broader and larger particle size and significantly higher viscosity (P < 0.05). In the absence of alginate, only SPI beverage at pH 6 could form weak intermolecular gel at pH 7. Forged gel only in the presence of > 0.01% alginate. Formation of intragastric gel led to delayed protein digestion and slower release of sucrose. Higher resistance to digestion and slower sucrose release rate were exhibited at increased alginate concentration and at pH 6. This suggests that electrostatic interaction between SPI and alginate that occurred when the beverage under gastric conditions, could be responsible for the intragastric gelation.

Significance: This study indicated that at certain conditions, soy protein and alginate mixtures could form intragastric gel, which delayed protein digestion and sucrose release from the matrix. These results can potentially lead to formulation of a soy protein beverage having functionality of lowered postprandial glycemic response.

P02-094
Structures of Corn Arabinoxylan Fragments Drive Changes of Human Gut Bacteria in a Competitive Environment
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Introduction: Consumption of dietary fiber can significantly alter the gut microbiota community, which is important to address certain chronic diseases such as obesity and inflammatory bowel disease. A better understanding of the interaction between dietary fiber and the gut bacteria represents a means of improving the microbiota, particularly when dysbiosis exists. However, relatively little is known about whether and how the fiber structures affect the behaviors of gut microbes in competitive environments.

Method: qPCR was used to characterize the abundance of each strain in community. Structures of arabinoxylan substrates were designed using enzymatic method and determined by High Performance Size Exclusion Chromatography (HPSEC), Gas Chromatography (GC) and Gas Chromatography Mass Spectrometry (GC/MS).

Results: In this study, we demonstrate nutritional relationships (e.g. cross-feeding, competition)
between human gut strains (Bacteroides xylanisolvens XB1A, Bacteroides ovatus 3123, Bacteroides cellulosolvens DSM 14838) are influenced by discrete dietary fiber structures, using corn arabinoxylan fragments with subtle structural difference in a multi-strain microbial community. B. xylanisolvens XB1A showed the capacity to support the growth of B. ovatus 3123, which poorly digested the structurally complex fragments alone, apparently due to a crossfeeding mechanism. The support of B. ovatus 3123 by B. xylanisolvens XB1A was notably changed by different arabinoxylan substrates. Similarly, Bacteroides ovatus 3123 and Bacteroides cellulosolvens DSM 14838 showed a fiber structure-dependent ability to compete for different substrates over a two-day incubation. Furthermore, these subtly different arabinoxylan substrates induced dramatically different compositions of the model community (e.g., the abundance of Bacteroides cellulosolvens DSM 14838 is changed from 28% to 79.65% on the relatively complex arabinoxylan structures).

Significance:
The results show that the behavior of gut bacterial strains in a competitive environment is highly fiber structure dependent. This study indicates that the microbiota composition potentially could be changed by specific fiber structures through predictable nutritional interactions.

P02-095
Beta-Carotene Content and Recovery in Sweet Potato Bread S. Feng, NC State, J. Allen, Email: sfeng4@ncsu.edu

Introduction:
Vitamin A deficiency is a major global micronutrient deficiency associated with xerophthalmia, blindness, and weakened immune systems that can lead to premature death. β-Carotene is a bioactive precursor retinoid that can form Vitamin A. The objective of our project was to determine the retention of β-carotene derived from orange sweet potato when sweet potato flour and puree were used as ingredients in the formulation of sweet-potato breads.

Method:
The β-carotene concentration of commercial sweet potato puree, sweet potato flour produced in our lab from fresh Covington sweet potatoes, and three sweet potato bread formulations were measured by hexane extraction and absorption at 450 nm. The three bread formulations baked in a Panasonic SD-YD250 Automatic bread maker were: Bread 1: Sweet Potato Flour Bread, with sweet potato flour substituting for 25% of the wheat flour in the standard bread maker recipe; Bread 2: Sweet Potato Puree Bread, with sweet potato puree substituting for the water and 25% of wheat flour; Bread 3: Gluten Free, High Protein Sweet Potato Flour Bread that used a mixture of ingredients, including 25% sweet potato flour to replace all wheat flour.

Results:
The β-carotene content of the sweet potato flour and sweet potato puree was 382.5 mg/kg (dry basis) and 98.2 mg/kg (WWB, 491 mg/kg DMB) respectively. The β-carotene contents of bread samples were: Bread 1: 69.49 mg/kg, Bread 2: 72.85 mg/kg, and Bread 3: 61.90 mg/kg (CV=5.8%). Dry matter content of the breads was 59.9±6.7%. Previously reported β-carotene content in cooked orange-fleshed sweet potatoes was 67 to 160 mg/kg fw (Truong, 2010), similar to our ingredients. Sweet potato bread made with puree (bread 2) showed a 96% recovery of the β-carotene supplied in the puree.

Significance:
Sweet potato bread from both sweet potato flour and puree yield high levels of β-carotene that may help prevent Vitamin A deficiency in developing countries.

P02-096
Development of a Shelf Stable Oat β-Glucan High Protein Beverage That Meets the Coronary Heart Disease Health Claim E. Vasquez Orejarena, The Ohio State University, V. Alvarez, Ph.D., C. Simons, Ph.D., J. Litchfield, Email: vasquezorejarena.1@osu.edu

Introduction:
Soluble fiber components in foods such as β-glucan have been associated with the reduction of cholesterol and the decrease of cardiovascular disease risk, as well as normalization of blood sugar levels. The objective of this study was to formulate an oat beverage containing at least 0.725 g of oat β-glucan per serving size (8 fl oz), enriched with milk protein isolate (MPI).

Method:
Oat flour (5.3% β-glucan) and isolated oat β-glucan (72.0 %) were hydrated, mixed with all ingredients in a steam kettle (80°C), and homogenized (20MPa). Formulations were adjusted to three levels of total protein (15, 20, and 25 g per serving size) and oat flour (2, 2.75, and 3.5%). Beverages were thermally processed in a still retort (121°C for 17 min). Mixed linkage β-(1→4) and β-(1→3) β-glucan was quantified as glucose after treatments with lichenase and glucosidase (AOAC 995.16) and total protein was assessed by Kjeldahl analysis. Viscosity was measured at a shear rate of 50/s and at temperatures from 10 to 25°C. Samples were sensory evaluated by overall liking measured on a 9-point hedonic scale and Just-About-Right (JAR) scale for viscosity.

Results:
Preliminary sensory testing indicated that formulations with 2% oat and 15 or 25 g of protein were the most preferred. Beverages with viscosities of 70 cp to 234 cp were considered as “just about right” in thickness. Formulations with more than 739 cp were considered too thick, which were the samples with concentration of oat flour higher than 2.75%. Therefore, temperature and concentration of oat flour had a significant effect on beverage viscosity. The finished product had an acceptable mouthfeel and liking.

Significance:
This study demonstrates that by adding oat flour (~2%) and isolated oat β-glucan (~0.7%) as thickening agents, it is possible to formulate a functional dairy beverage that meets the coronary heart disease health claim (21 CFR 101.81). This claim requires the product to contain at least 0.75 g of soluble fiber per RACC.

P02-097
Preliminary Study on the Optimization of the Conditions to Form Tea-Infused Alginate Spheres for Flavor Control Release M. Escrara, Cal Poly Pomona, L. Chuman, R. Martin del Campo, G. Davdav-Pardo, Email: michelle.ecrara@gmail.com

Introduction:
Direct spherification is an ever-growing technique used in food technology. Examples of this technique are widely seen in molecular gastronomy and flavor encapsulation, which are catalysts to better flavor delivery. The objective of this work was to optimize the direct spherification conditions to create tea-infused sodium alginate (SA) spheres extruded in a CaCl2 bath using ionic-gelation. Tests were conducted in the search for a product encompassing a burst-in-mouth tea flavor sensation.

Method:
The method of approach was preparing a sweetened, tea-infused dispersion, with 1% (w/w) of SA refrigerated overnight for full hydration of the hydrocolloid. The SA dispersion was then extruded into a CaCl2 bath to create the direct spherification. Different concentrations and residence time in the CaCl2 bath were tested. The tea-infused spheres were thoroughly rinsed with distilled water to remove any excess of CaCl2. The spheres were further coated with chocolate to prevent the diffusion of the runny filling by creating an edible hydrophobic coating. Acceptance, Just-About-Right, and preference sensory evaluation were performed on spheres for two different filling flavors (peppermint and mango). The spheres were made with the optimal formulation of 1% SA submerged in the 0.006M CaCl2 solution bath for a maximum of 2 minutes.

Results:
The concentration of the CaCl2 bath was directly correlated to sphere firmness and had a greater impact than residence time. It was discovered that the gelation process continued to set even after the spheres were removed from the CaCl2 bath and rinsed thoroughly. The product was found to be susceptible to mold growth within one week of storage at room temperature. There were significant differences among the acceptance of the two treatments (p<0.05) with overall liking values of 3.75±1.73 and 4.98±1.25 out of a balanced 7 point scale for peppermint and mango, respectively.

Significance:
Mold growth revealed the necessary precaution of including additives to increase product longevity and safety, especially when developing similarly flavored spherification products. Direct spherification is a promising technique in the field of Food Science, when mastered, may revolutionize the industry through the controlled release of flavors to create unique flavor experiences.

P02-098
Newly Formulated Rye Bread Product Enriched With Phenolics From Olive Leaf Extracts E. Evcan, Izmir Institute of Technology, K. Doğru, Z. KAYA, S. Yildiz, S. Gulec, Email: ezgihoseri@yahoo.edu.tr

Introduction:
In recent years, consumer demands have been increased towards functional food products which provide additional health benefits beyond basic nutrition. Bread is one of the oldest and staple foods in all civilizations’ diet with its low price, high nutritive value, and ease of use. Rye flour has been used as a valuable ingredient for bread making due to a higher content of fiber compared to wheat flour. The ingredients of the rye bread can be also enriched with the addition of olive leaf extract (OLE), which provides nutritional and sensorial properties for food products. The objective of this study was to investigate the changes in functional and sensorial properties of rye bread enriched with OLE.

Method:
For this purpose, concentrations of 0.75% and 3% (w/v) OLE were added to rye bread to enrich the total phenolic compounds (TPC). Textural and sensorial properties of rye bread formulations baked in a Panasonic SD-YD250 Automatic bread maker were: Bread 1: Sweet Potato Flour Bread, with sweet potato flour substituting for 25% of the wheat flour, which are catalysts to better flavor delivery. The objective of this work was to formulate an oat beverage containing at least 0.75 g of soluble fiber per RACC.
Significance: Our study suggested that phosvitin could be used as a substrate to produce novel ACE inhibitory peptides.

P02-102
Characterization and protein enrichment of high protein rice flour, a co-product of high fructose rice syrup production, as compared to broken rice, the feedstock
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Introduction: Rice is a major staple food grain in the world. Currently, the world rice production is estimated at 470 million tons. Broken rice constitutes approximately 15% of the rice milled. An enzymatic process has been commercialized to produce high fructose rice syrup from broken rice, with high-protein rice flour (HPRF) as a co-product. This co-product contains up to 70% protein and is used mainly as animal feed.

Method: In this study, HPRF of a commercial source was characterized, along with broken rice for comparison, for proximate composition, phosphorus profile, and protein extractability or further enrichment with chemical and physical means. The ultimate objective was to explore value-added utilization of rice products.

Results: Results showed that the enzymatic process led to reduction in starch content from 84.7% in broken rice to 8.3% in HPRF but over 6-fold increase in protein, oil, ash, and phytate P. Aqueous ethanol leaching over a wide range of ethanol concentration only slightly improved protein content in both HPRF and rice samples while protein extractability was less than 3% from HPRF over a wide range of pH, and between 5-68% from rice, depending on medium pH and particle size. Furthermore, particle size separation did not lead to a significant increase in protein content in any fractions from rice flour or rice sample.

Significance: Protein enrichment by the chemical and physical methods was ineffective for HPRF due to total protein denaturation during processing, while only alkaline extraction proved to be relatively effective for broken rice.

P02-103
Structural Modification of Whey Proteins With Phenolic Derivatives Under Neutral and Acidic pH Conditions
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Introduction: Incorporation of radical-scavenging polyphenols into protein structures in alkaline solutions at high temperature has been widely reported to improve antioxidant performance of food proteins. However, interactions of phenolic compounds with proteins in mild pH and room temperature conditions have received much less attention. The objective of this study was to characterize structural changes and in vitro digestibility of whey protein isolate (WPI) induced by Gallic acid (GA) and its derivative – Epigallocatechin gallate (EGCG) at non-alkaline conditions.

Method: WPI solutions at pH 3.0 and 7.0 were incubated with GA/EGCG (20, 120, and 240 μmol/g, protein basis) at 21°C for 2 h. Total sulfhydryl, surface hydrophobicity (So), and thermal transition (Tmax) of WPI were measured. Radical-scavenging capacity during in vitro digestion and selective peptide fragments were analyzed, respectively, with the ABTS+ assay and the Ticline-SDS-PAGE analysis coupled with MALDI-TOF-MS/MS. Binding of phenolics to WPI was evaluated by isothermal titration calorimetry (ITC) and fluorescence quenching (pH 7.0).

Results: Results showed that the enzymatic process led to reduction in starch content from 84.7% in broken rice to 8.3% in HPRF but over 6-fold increase in protein, oil, ash, and phytate P. Aqueous ethanol leaching over a wide range of ethanol concentration only slightly improved protein content in both HPRF and rice samples while protein extractability was less than 3% from HPRF over a wide range of pH, and between 5-68% from rice, depending on medium pH and particle size. Furthermore, particle size separation did not lead to a significant increase in protein content in any fractions from rice flour or rice sample.

Significance: Protein enrichment by the chemical and physical methods was ineffective for HPRF due to total protein denaturation during processing, while only alkaline extraction proved to be relatively effective for broken rice.
functionality in foods, such as tenderness, water holding capacity, emulsifying ability; it also affects the health-promoting properties of food: for example, attaching bioactive compounds (phenolics or polysaccharides) to proteins modifies their digestibility and allergenicity. Cross-linking via laccase-catalyzed oxidation is a potential approach in protein modification. Laccase (EC 1.10.3.2) is capable to generate radicals from phenolic functional groups or tyrosine residues of proteins, which will subsequently oxidize other substrate molecules or couple with each other becoming oligomers or polymers. This study is aimed at the investigation of oxidative cross-linking mechanism by laccase using amino acids (lysine and tyrosine), proteins (patatin and lycosyme) and their corresponding peptides.

**Method:**
Docking study was conducted on ZDOCK 3.0.2 with models of laccase 1GYC, patatin 4PK9, lycosyme 4WL7 from the Protein Data Bank, in which 10 binding results were selected for each protein based on their docking scores. Model peptides were identified from the binding results. Cross-linking of the AAs, peptides and proteins was carried out using fungal laccase from Trametes versicolor or Coriolus hirsutus, with or without mediator (ferulic acid). Product's molecular weight distributions and conversion yields are analyzed by HPSEC. The characterization of reaction products is performed by MALDI-TOF-MS.

**Results:**
The binding affinities of proteins at laccase's active site and the accessibility of their oxidized sites were characterized from the docking study. The models showed that patatin oriented towards the active site with tyrosine 301 residue in the middle of the peptide chain SYMTDOYLST, whereas lysosyme approached the active site with the region where peptide chain AKKQWYQDGW was located. The HPSEC result of tyrosine incubation was similar among those with or without mediator, with a conversion yield of ~82%. The cross-linked product's molecular weight was 20 times that of tyrosine. The experimental results are further correlated with molecular modeling study.

**Significance:**
Protein cross-linking by laccase-catalyzed oxidation offers a promising ecofriendly choice to protein modification. However, its mechanism is still unclear, and limited studies have characterized structurally the products. The combination of experimental results and computational analysis can help better elucidate the oxidation mechanisms and promote protein modifications by laccase.

**P02-105**
The Effect of Salt Reduction on Dough Mixing Properties and White Pita Bread Sensory Characteristics
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**Introduction:**
The relationship between salt/sodium intake and chronic diseases is well established. Bread is the main staple in the Middle East and was shown to be a significant contributor to salt intake. Salt fulfills important functional and sensory properties in bread and decreasing its level could significantly impact the overall dough and bread qualities. The objectives of this work were to assess the effect of salt reduction on the mixing properties of white pita bread dough and the sensory characteristics of the bread.

**Method:**
Three treatments, NaCl, agglomerated NaCl, and partial substitution of NaCl with 30% KCl, were used at 5 different salt levels (0.3, 0.6, 0.9, 1.2, and 1.5% wt/wt in flour) to develop 15 versions of white pita bread. Farinograph measurements were conducted to determine the mixing properties of dough. Descriptive analysis (DA) was carried out with trained panelists (n=12). Moreover, an acceptability test was conducted with bread consumers (n=72). A Just-About-Right (JAR) scale for saltiness was included. Sensory analyses were conducted using the Compusense at-hand® sensory evaluation software.

**Results:**
Farinograph results showed that decreasing salt levels does not significantly impact mixing properties of dough except between the 1.5% and 0.3% levels (p<0.05). DA showed that samples were significantly different for 8 out of 16 attributes (p<0.05). Acceptability of bread was not significantly dependent on salt content; however, ratings on the JAR scale showed that the optimal salt level in bread was 0.9% NaCl. ME pointed out that 0.68% agglomerated NaCl and 1.13% NaCl-KCl are needed to achieve an equivalent saltiness to 0.9% NaCl.

**Significance:**
The above results suggest that lowering the salt content to 0.6% in white pita bread is feasible without any significant effect on quality and taste.

**P02-106**
Consumer Attitudes and Preferences for Organic Milk
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**Introduction:**
The market share for organic milk has increased steadily over the last decade. It is imperative to understand consumer value of organic designation, as well as other key attributes in fluid milk. The purpose of this study was to identify the attributes that influence consumers to purchase and consume organic milk.

**Method:**
An Adaptive Choice Based Conjoint (ACBC) survey was designed for attributes of fluid milk. The survey also included Kano, importance, and emotions questions for fluid milk, and consumer purchase and attitudes for organic foods. Maximum Difference scaling (MaxDiff) was used to rank the importance of single attributes in fluid milk that affected purchase and to rank issues associated with organic milk. Results were analyzed by univariate and multivariate statistics.

**Results:**
A total of 1,163 fluid milk consumers completed the survey. Of the organic consumers (N=970), 54.2% reported purchase of organic dairy products on a regular basis, which ranked third behind vegetables (77.3%) and fruits (71.8%). The ideal conventional fluid milk was 2% milkfat, conventionally pasteurized, and contained no additives or label claims. The ideal organic milk was 2% milkfat and conventionally pasteurized, but also contained the label claims “Rbst-free” and “DHA added.” Based on utility and importance scores in the ACBC, price was a more motivating factor of purchase for conventional consumers than organic consumers (p<0.05). MaxDiff analysis of organic consumers showed that the belief “organic milk is healthier” was the most important motivator for purchase of organic milk (p<0.05). MaxDiff analysis of all fluid milk consumers confirmed milkfat content as the most important attribute, followed by flavor/taste, package size, and price. Overall (N=1163), milk designation as “organic” was ranked eighth of 14 attributes. Conventional milk consumers (N=193) ranked milkfat as the most important attribute influencing purchase, followed by taste, price, and package size. Organic designation ranked fourteenth of 14 attributes in importance for these consumers. For regular consumers of organic milk (N=526), the most important attributes were milkfat, flavor/taste, and “organic” followed by package size, and price.

**Significance:**
Better insight into the motivating factors of purchase will enable fluid milk manufacturers to better meet consumer desires.

**P02-107**
Comparison of Methods for Characterizing Consumer Perception of Brewed Black Coffee
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**Introduction:**
The challenges of traditional preference mapping and descriptive analysis (DA) are that they are a time and labor intensive practice, requiring hours of DA training, as well requiring the ability to perform a traditional consumer test with large numbers of consumers. The objective of this study was to compare traditional external preference mapping with projective mapping with check all that apply (PMCATA) for consumer perception of brewed black coffee.

**Method:**
Eleven ground retail coffees were selected based on roast and market share. Untrained black coffee consumers (n=22) were asked to choose one type of coffee in duplicate by mapping them on a 2 dimensional plane based on their similarities and selecting attributes (PMCATA) from a provided list. Liking was also scored on a 9-point hedonic scale. A trained descriptive sensory panel (n=10 panelists each with >100 h of training) was brought to perform consumer acceptance testing with 150 black coffee consumers. Data from PMCATA was analyzed using multiple factor analysis, and traditional preference mapping was conducted by partial least squares regression analysis.

**Results:**
Both methods revealed similar basic groupings of coffees: dark roast coffees and light roast coffees. The two consumer groups from PMCATA were distinguished by their preferences for light and dark roast coffee attributes (light roast: sweet and sour taste; dark roast: spicy, woody and bitter taste). DA revealed more differences among the coffees than PMCATA (p<0.05). Strength of roast was a defining factor in consumer liking by either method, but traditional preference mapping revealed greater differentiation of consumers (three distinct clusters) with more specific drivers of liking. Cluster 1 consumers preferred sweet aromatic and intense overall flavor, Cluster 2 consumers preferred sweet aromatic and beany flavors with low bitter taste, and Cluster 3 consumers preferred smoky and spicy flavors with bitter taste.

**Significance:**
There are many circumstances where product developers may desire to rapidly characterize a large number of prototypes or retail products. These results suggest that even with sensorially complex products (such as coffee), actionable data can be obtained with less expensive, untraditional methods.

**P02-108**
The Use of Immersive Technologies to Modulate the Contextual Constellations of Visual, Auditory, and Olfactory Stimuli Important in Shaping Hedonic Responses
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**Introduction:**
To explore how contextual streams of information are processed and prioritized in the
brain, we used immersive technologies to manipulate the congruency of visual, auditory and olfactory cues and assessed the impact on the preference and liking for cold brewed coffee.

Method: Each consumer (n=50) was exposed to six randomized and counterbalanced scenarios—two control conditions, a visually incongruent condition, an auditory incongruent condition, and an all-incongruent condition. The control condition simulated a virtual environment complete with the sights, sounds and smells (i.e. cinnamon roll) commonly experienced in a coffeeshouse. Laundry detergent, a laboratory setting and construction noise represented the individual incongruent aroma, visual and auditory streams, respectively. For the incongruent scenarios, the incongruent stream was delivered while the other two streams were consistent with a coffeeshouse. In each condition, panelists first ranked the three coffees from least to most preferred and then rated them using the 9-point hedonic scale. After evaluating all the samples, panelists completed a recall questionnaire designed to assess their attention to the previously presented contextual cues. Repeated measures ANOVA was used to assess the impact of treatment condition on liking scores.

Results: Results showed that liking for the different coffees did not differ significantly between conditions. However, in reorganizing the data to determine whether the contextual condition significantly altered liking for subjects’ least or most preferred coffees—whichever coffee that might have been—we found liking to be significantly lowered for all coffees in the all-incongruent condition compared to the control condition. Exposure to completely incongruent sensory streams was more impactful than exposure to any individual incongruent stream alone, perhaps because the simultaneous delivery of these incongruent streams maximized their saliency. In context recall, only 26% of panelists recognized the two aromas whereas 96% of panelists were able to identify the visual cues and 82% were able to identify the audio cues, suggesting olfactory information has a lesser priority than visual or auditory information in the simulated environments.

Significance: Understanding how the saliency of contextual information influences consumer behavior and attention can inform sensory testing methodologies and marketing strategies in the industry.

Food Perception and Acceptability Vary With Respect to Manner of Eating

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Introduction: Recent studies have shown that contextual elements such as cutlery and tableware to some extent affect flavor perception of food and drinks. In this study, two experiments were designed to determine whether sensory perception and liking of food, the speed and amount of food consumed, and the degree of satiety vary with respect to the manner of eating the food, i.e., either by using hands only or by using cutlery.

Method: Pizza was chosen as the stimulus since cultural differences have been reported in the way pizza is eaten. In Experiment 1, 100 participants were asked to rate sensory aspects of a pizza sample after eating two pieces of pizza, either using hands only or using cutlery, on two different days. In Experiment 2, 68 participants were asked to eat pizza ad libitum either using hands only or using cutlery on two different days in a natural setting, and their hunger/satiation, eating time, amount of pizza eaten, and acceptability were assessed. For statistical analysis, two-way repeated measures analysis of variance (RM-ANOVA) were used.

Results: The overall aromatic intensity of the pizza sample was rated significantly higher when it was eaten using cutlery compared to when eaten using hands only (P = 0.005). Overall, participants exhibited slower eating rates and higher acceptability when pizza was eaten using cutlery rather than using hands only (for all, P < 0.05). In conclusion, this study demonstrates that sensory perception and acceptability of pizza can be affected by the manner of eating: using cutlery versus hands only.

Significance: These results contribute to the understanding of how contextual elements can affect consumer sensory perception. In addition, these findings are relevant to product development and restaurants since different dishes can be served in different ways (i.e., with the presence or absence of cutlery) aiming to enhance consumers’ eating experience.

Consumer Acceptability of a Sweet Potato (Ipomoea Batatas (L.) Lam.) Ginger (Zingiber Officinale) Crisp Prototype Rich in Dietary Chemopreventative Compounds and Natural Sugars in a Whole Food Matrix

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Introduction: Colorectal cancer (CRC) is the third leading cause of morbidity and second leading cause for mortality by cancer in the United States. Development of CRC is affected by poor dietary habits, which may be preventable by plant-based diets. Phytochemicals within fruits and vegetables such as ginger and sweet potato have demonstrated chemopreventive potential capable of preventing or suppressing cancer development by reorganizing certain defense mechanisms within the body. Additionally, current trends in product innovation involve development of natural food products containing no added sugars, which aims to ameliorate health risks associated with high intake of refined sugars in the diet.

Method: The aim of this study was to evaluate consumer acceptability of a yellow-fleshed, sweet potato ginger crisp prototype. Preference and acceptability of the prototype was compared to a commercial product using various tests, namely Hedonics, Food Action Rating Scale (FACT), and Paired-Comparison. Thirty-two male and female subjects (Mean age of 22.8 years) were recruited at California State University, Long Beach.

Results: Consumer acceptability utilizing a 9-point Hedonic Scale (1 = “Dislike Extremely”, 9 = “Like Extremely”) was significantly (P < 0.05) higher for the commercial product compared to prototype respectively on appearance (7.56, ± 0.277 vs. 6.63, ± 0.310); flavor (7.81, ± 0.213 vs. 5.00, ± 0.399); aroma (7.94, ± 0.205 vs. 6.84, ± 0.407); texture (7.59, ± 0.257 vs. 3.66, ± 0.375); and overall acceptability (7.65, ± 0.225 vs. 4.90, ± 0.383). Frequency of consumption using the FACT scale was significantly (P < 0.001) higher for the commercial product (6.625, ± 0.257) compared to prototype (3.813, ± 0.328). Preference for the commercial product was higher in appearance (84%), color (81%), flavor (88%), aroma (53%), texture (94%), and overall preference (91%) using paired-comparison tests. Although the commercial product was rated significantly higher on most measures, the prototype was “Liked Moderately” on appearance, color, and aroma.

Significance: Further experimental research may be needed to improve the overall quality of the prototype and attributes. Synergistic benefits in relation to the chemopreventative compounds in sweet potatoes and the presence of natural sugars may be a strategic marketing tool to improve its overall acceptability.
P02-113
Post-Harvest Blue LED Light Treatment Increases Acceptability of Strawberry Fruit
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Introduction: The food industry relies heavily on ELISA-based methods for the detection of peanut residues in food matrices. Although commercial peanut ELISA kits perform quite well with a number of food matrices, most of these kits do not perform quite as well with heat processed foods, residual sunflower or safflower oil, and emulsions as inhibitors of AGEs formation. However, more natural dietary products from peanut derived products and protect the consumer against the long term deleterious effects of aflatoxins.

Method: peanut proteins were extracted from light roast peanut flour and the low molecular weight proteins were concentrated using ammonium sulfate precipitation at 30% saturation followed by 45% saturation of the resulting supernatant. Ara h 2 was purified from the resulting sample using hydrophobic interaction chromatography followed by further purification of the Ara h 2 rich fractions using anion exchange chromatography. Polyclonal antibodies raised in rabbits against purified Ara h 2 proteins were used to develop a competitive inhibition ELISA. Rabbit serum containing anti-Ara h 2 antibodies diluted 1:1500 were used to inhibit a series of Ara h 2 standards ranging from 0 to 100 µg/mL. The inhibitor and serum mixture was transferred to an ELISA plate coated with 0.05 µg/mL of Ara h 2. Goat anti-rabbit IgG labeled with alkaline phosphatase together with an appropriate substrate was used for detection. Absorbance measured at 405 nm was applied to generate a standard curve using a nonlinear regression function.

Results: The developed ELISA was highly sensitive with a detection range of 50-300 ng/mL of Ara h 2. The limit of detection and IC50 were 3.2 ± 0.1ng/mL and 117 ± 15 ng/mL of Ara h 2 respectively. The high sensitivity of the developed ELISA to a heat stable protein, we believe that this ELISA will have sufficient sensitivity to detect peanut in heat processed foods.

Significance: Overall this leads to the conclusion that the blue light treatment increased important volatiles to the degree where they were distinguishable from the control.

P02-114
Development of a Sensitive and Ara H 2 Specific Competitive ELISA for the Detection of Peanut
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Introduction: The objective of the research was to increase the consumer acceptability of peanut fruit through the manipulation of volatile content by the use of specific wavelengths of light applied post-harvest.

Method: Two strawberry varieties were treated, “Strawberry Festival” and “Florida Radiance,” as they represent the majority of strawberries grown in the Florida market. The fruit were treated and tested during three harvests in 2013. Individual fruits were kept in isolated treatment rooms with regulated atmospheric conditions, 4 ± 1.5°C and above 90% relative humidity, the treatment group receiving a 24-hour treatment of 100 µmol m-2 s-1 blue LED light while the control was kept in the dark. Following treatment samples were analyzed for flavor volatiles, sugars, acids, firmness, and for sensory differences. For study one, treatment and control fruit for both Festival and Radiance were rated for Overall Liking and Texture Liking as well as Sweetness Intensity, Soumness Intensity, and Overall Strawberry Flavor Liking on the global sensory intensity scales (GISIS) and the sensory general labeled magnitude scale (glLMS) respectively.

Results: A significant difference was found among the treated and control group of the Festival fruit for the overall liking rating, indicating the panelists preferred the treated Festival fruit. Following that a triangle test was employed in study two on the treatment and control groups for the Festival fruit. A significant difference was found between the two groups allerging the treated fruit were higher in many flavor volatiles including those known to contribute to sweetness in strawberries. Four volatiles were found to have significant differences among all four harvests, and of those, butanoic acid, octyl ester, is the only one that consistently showed higher concentrations in the treated versus control fruit. The remaining three volatiles, pентanoic acid, ethyl ester, acetic acid, hexyl ester; and methyl isovalerate, were up-regulated in the treated versus control fruit for all three Festival harvests, but not the Radiance.

Significance: Overall this leads to the conclusion that the blue light treatment increased important volatiles to the degree where they were distinguishable from the control.

P02-115
The Inhibitory Effect of Amino Acids on the Formation of 2-Amino-1-Methyl-6-Phenylimidazo[4,5-B]Pyridine (PhIP) and 2-Amino-3-Methylimidazo[4,5-F]Quinoline (IQ) in a Maillard Reaction Model System
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Introduction: Mutagenic and carcinogenic heterocyclic amines (HCAs) are formed via the Maillard reaction in foods that have been cooked at high temperature. Food additives that minimize the HCAs have been widely investigated, however, there has not been much research on addition of amino acids and their ability to inhibit HCAs. The objectives of this study were to determine if amino acids inhibited PhIP and IQ formation in Maillard reaction models and their effect on browning color development.

Method: Model systems were prepared using glucose (Glc), creatinine (Cre), and phenylalanine (Phe) in water:diethylene glycol (10:90, v/v). Seven amino acids were individually added into model system at different concentrations to get a final molar ratios of Glc-Phe-Creatminos as 0.5:1:1:0 (Control), 0.5:1:0.1:1.25, 0.5:1:0.25, 0.5:1:1.5:0.5, 0.5:1:1, and 0.5:1:1:2, and heated at 180°C for 1 hour. PhIP and IQ were measured by high-performance liquid chromatography (HPLC), and phenylaceteldehyde was quantitated using gas chromatography mass spectrometry (GC-MS).

Results: All amino acids had a significant effect (p < 0.05) on the formation of HCAs compared to the control. At the highest molar ratio, tryptophan, lysoleucine, and proline showed the most pronounced inhibitory effects on PhIP formation with 100%, 100%, and 90% reduction respectively, along with a considerate (~77%) reduction on phenylaceteldehyde levels. Leucine and arginine were effective PhIP inhibitors with 87% and 76% reduction, respectively, but phenylalanine and glycine only reduced PhIP by 26% and 19%, respectively. The inhibitor effects of amino acids on IQ generation according to order in leucine < proline < phenylalanine < glycine < arginine < lysoleucine < tryptophan. Browning was significantly affected by the amino acids, except phenylalanine and glycine.

Significance: These results indicated that some amino acids can be used as inhibitors to control the PhIP and IQ formation in chemical model systems. The inhibitory abilities may positively relate to new phenylaceteldehyde-amino acid adduct formation.

P02-116
Preliminary Assessment of the Aflatoxin Content in Peanut and Peanut-Derived Products in Haiti
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Introduction: This study aimed to evaluate the aflatoxin content of raw peanuts harvested on a satellite island of Haiti, La Gonâve, and locally processed peanut butter sold in supermarkets of the country’s largest metropolitan area, Port-au-Prince.

Method: In La Gonâve, a total of 24 samples of raw peanuts (12 shelled and 12 unshelled) was collected directly from farmers’ fields in different communal sections. At surveyed supermarkets, four (4) local brands of peanut butter were selected for analysis. As a control, an imported brand of peanut butter was chosen with aflatoxin contents below 20 ppb, the action threshold recommended by the United States Food and Drug Administration (FDA). The analyses were carried out following the “Reveal Q+” method, an immuno-chromatographic assay based on a competitive immunological method.

Results: Among the unshelled peanut samples, 45% showed aflatoxin levels above 150 ppb. With respect to shelled peanuts, 69% had aflatoxin content (21.6 to more than 150 ppb) above the FDA required action level. All analyzed local peanut butter samples revealed aflatoxin levels higher than 150 ppb. In response, training is recommended for ground workers on agricultural practices to reduce aflatoxin contamination in the soil. Furthermore, promoting appropriate drying and storage practices will reduce post-harvest contamination. Finally, to ensure the safety of their products, local peanut butter processors should receive support to adopt a Hazard Analysis and Critical Control Point (HACCP) System.

Significance: This study calls for all actors on the Haitian Food Industry (scientists, processors, and regulatory agencies) to take necessary actions to reduce aflatoxin level in peanut and peanut derived products and protect the consumer against the long term deleterious effects of aflatoxins.

P02-117
Influence of Phenolic Acids on Advanced Glycation Endproducts Formation in a Model System
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Introduction: Advanced glycation end products (AGEs), created through the Maillard reaction, are a group of heterogeneous compounds with pathogenic significance in chronic diseases such as diabetes. A variety of synthetic products such as aminoguanidine have been evaluated as inhibitors of AGES formation. However, more natural dietary products from...
plants were proposed to be promising inhibitors as they are less toxic. A number of previous reports have shown that antioxidants, such as phenolic compounds from cereal products, can inhibit AGES formation. In this study, the inhibitory effect of selected phenolic acids on the formation of AGES was evaluated in a model system. Method: Bovine serum albumin (1mg/μL) and glucose (100 mM) were incubated with 1 mM of the phenolic acid compounds: vanillic (VA), chlorogenic (CHA), genistein (GE), and ferulic acids (FA), in 100 mM phosphate buffer (pH 7.4) at 37°C for 7 days, followed by detection of AGE content as N-carboxymethyllysine (CML) by reversed-phase HPLC with fluorescence detection. The degree of glycation (DG) of the systems was determined with the 2,4,6-trinitrobenzenesulfonic acid (TNBS) method, and radical scavenging activity of selected phenolic acids was evaluated by 2,2-diphenylpicrylhydrazyl (DPPH) scavenging activity assay. Analyses of variance (ANOVA) were performed on the data, and all analyses were conducted in the GLM procedure by using SAS version 9.1 (SAS Inst. Inc., Cary, NC, USA). Results: There were significant differences (P<0.05) in CML concentration between the control system (4.6±1µg/100mL) and the treatment groups of GE (2.47±0.100mL) and CHA (2.86±0.120mL), GE (44.9±% inhibition) and CHA (30.4±% inhibition) exhibited higher properties as free radical scavenger in the DPPH assay. No significant differences (P>0.05) of DG were observed between the control and treatment systems. Significance: The results suggest that the inhibition mechanism of phenolic acids on AGES formation may due to their capacity to scavenge free radicals in the later stages of the Maillard reactions. The two phenolic acids, GE and CHA, effectively reduced AGE formation in this model system/conditions, which may be a potentially useful method for inhibiting AGES.

P02-118
The Rheological Behavior of Eggs Pasteurized Using Radio Frequency Energy
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Introduction: Conventional hot water thermal pasteurization of shell eggs can cause a reduction in egg white functionality. A recently patented radio frequency (RF) method was used to pasteurize eggs in less than half the time of the conventional thermal method; however, a comparison of the rheological behavior of eggs pasteurized by thermal and RF has yet to be performed. The objective of this research was to compare the viscoelastic and flow behavior of fresh eggs to eggs pasteurized using the conventional hot water thermal process and the new RF process. Method: RF eggs were exposed to 40.68 MHz for 5.0 minutes, followed by immersion in a 56.7°C water bath for 1.5 minutes. Thermally treated eggs were immersed at 56.7°C for 60 min. Both treatments have been shown to reduce Salmonella by 5 log. The apparent viscosity was measured by an Anton Paar rotational rheometer as a function of shear rate. For the selected shearing rate, viscosity was measured in relation to shearing rate. Significance: These results indicate that the RF pasteurization method results in less denaturation compared to the conventional thermal method. Results: Both thermally and RF pasteurized egg white samples exhibited shear-thinning behavior. For all eggs, the time–dependence of viscosity decreased rapidly. The shear-thinning behavior was fitted well using the power law model (with a satisfactory correlation of R² > 0.95). Corresponding changes were observed with increasing consistency behavior (in value) and decreasing flow behavior index (n value) showing pseudoplastic behavior. Raw egg white showed shear thinning behavior, with viscosity decreasing from 420 Pas at 0.1 s⁻¹ to 0.05 Pas at 500 s⁻¹. Both RF and thermally pasteurized eggs followed very similar trends but thermally pasteurized eggs had higher viscosity than RF eggs due to denaturation. RF treated egg white showed little, no visible denaturation. The elastic modulus (G') and complex viscosity (η*) of RF egg white samples were lower than those of the thermally treated egg and closer to the raw egg values.

P02-119
Variability of Ethanol in Commercial Kombucha Products
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Introduction: The estimation of ethanol in beverages is one of the oldest practices in food quality control. However, the suitability of traditional alcohol-by-volume (ABV) methods for kombucha has been called into question by industry and labs due to observed differences in values obtained by different methods. Gas chromatography has evolved as a more specific and sensitive method, however GC can be costly and may not sufficiently correct for sources of error such as improper sample handling and storage, analyte loss through evaporation, insufficient partitioning, and matrix interferences from solids and dissolved gases. These issues are exacerbated by ‘live’ kombucha ongoing production of ethanol while on the shelf, and the legal limit of 0.5% alcohol to remain a non-alcoholic beverage. The objective of this study was to evaluate the variability of ethanol content in commercial kombucha products at established contract laboratories, in advance of AOAC single-label validation of a gas chromatography method. Method: Commercial kombucha samples were purchased, stored and transported overnight in unopened original packaging, with ice packs to multiple contract analytical labs in the US. Laboratories were selected based on experience with common alcohol-by-volume (ABV) testing and kombucha matrix, and participation in the AOAC kombucha working group (WG). Each sample was tested in duplicate by separate GC with headspace FID (1) and GC-MS (2) instruments and referencing methods commonly used for food and nutritional products (AOAC 983.13). At another lab, a GC-MS headspace method (3) modified from EPA wastewater methods was used. Significance: The ethanol content in commercial kombucha samples can vary widely among labs using different methods modified from compendia methods. This data supports the need for the development and validation of methods specific to kombucha, and more analysis needs to be performed. Results: The mean values from methods (1), (2) and (3) were 0.719%, 0.723%, and 1.05%, respectively, with a range of 0.209% to 1.59%. The mean difference between same-sample results from GC-FID and GC-MS methods was <4%, while the mean difference between lab on GC-MS methods was 45%.

P03-001
Heavy Metals in Korean Gim (Sea Veggie) for American Consumers
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Introduction: Heavy metal contamination is a concern in Korean gim (sea veggie), especially with its increasing popularity in the US as a healthful food source. California Proposition 65 regulates the presence of heavy metals in food products by requiring all commercial producers to list chemicals that are known to cause cancer, birth defects, or reproductive harm. The Safe Harbor Limits used by Proposition 65 include the No Significant Risk Level (NSRL) and the Maximum Allowable Dose Level (MADD). The objective of this study is to measure chemicals linked to California Proposition 65 in Korean gim from collected samples sold in the US and Korea. Method: Twelve seasoned, dried sea veggie products from the U.S. and seventeen from Korea were randomly collected and evaluated for heavy metal content. The total mercury (Hg) content was determined by the combustion gold amalgamation method (Korean Food Code, 2015), using a mercury analyzer (Model SP-3A, Nippon Instrument Co, Tokyo, Japan). Extraction and analysis of the other heavy metals [total arsenic (As), cadmium (Cd) and lead (Pb)] was carried out according to the method of the Korean Food Code (2015), using an inductively coupled plasma mass spectrometer (ICP/MS). Significance: Heavy metals associated with the consumption of sea vegetables are considered harmless in a recommended serving of 3 g. However, the heavy metal content should be regularly monitored to ensure food safety and protect consumers from potential health risks. Results: For arsenic, cadmium, lead, and mercury, U.S. samples showed values of 48.9±9.97, 2.16±0.567, 0.023±0.024, and 0.001±0.003 μg per 3 g serving, respectively. The arsenic, cadmium, lead, and mercury content in Korean samples were 20.67±5.7 6.1, 1.87±0.600, 0.510±0.195, 0.020±0.011 μg per 3 g serving, respectively. Inorganic arsenic, the more toxic form, made up a small portion of the total arsenic content in these samples. The inorganic arsenic of one representative U.S. sample was tested and contained only 0.135 μg per 3 g serving, well below the NSRL (10 μg/day). All samples were below the MADD of cadmium (4.1 μg/day), the NSRL of lead (15 μg/day), and the proposed MADD of mercury (0.3 μg/day).

P03-002
Relationships Among Penetration, Tensile, and Torsion at the Fracture of Surimi Gels Under Image Analysis
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Various mechanical tests have been used to characterize the textural properties of surimi gels at fracture. However, the relationship among tests, particularly regarding added ingredients, has not been reported. An enhanced understanding of the relationship among the various methods would enable prediction of fracture strength and the deformable nature of surimi gels. Our objectives were to (1) characterize the relationships among penetration, tensile and torsion with or without egg white, whey protein and potato starch, respectively and (2) analyze the different relationships caused by ingredients using the digital image correlation method. Method: A total of two hundred fifty (250) batches of various surimi with/without ingredients at different moisture contents were appropriately prepared. Three fracture gel tests (penetration, tensile, and torsion) were conducted to determine textural properties of...
cooked gels denoting hardness and deformability. A digital camera recorded the strain distribution during the path of each test to estimate local strain values. Based on the difference in strain distribution (penetration vs. tensile vs. torsion), local strain values concentrated during fracture were compared and estimated textural properties were obtained to minimize the effect of local strain distribution at fracture.

Significance:
Image analysis was an effective tool to estimate the characteristics of surimi gels, with and without added ingredients, upon fracture from penetration, tensile, and torsion.

Results:
The relationships of textural properties related to the hardness and deformation of surimi gel without any ingredient (SG) showed linear functions (R2 > 0.90 and 0.85, respectively). However, R2 of tensile strain and shear strain of surimi gel made with egg white (SG-EW) and whey protein (SG-WP) were significantly lower than that of SG. Local strain values concentrated in surimi gels regardless of ingredient addition were estimated by image analysis. Local strain values concentrated in SG-EW and SG-WP were significantly higher than SG (P < 0.05). To minimize the effect of local strain concentrated at fracture, tensile strain and shear strain were estimated. Based on tensile strain and shear strain, the estimated textural properties of SG-EW and SG-WP were significantly higher than the actual values, but no significant difference was found for SG (P<0.05).

P03-003
Functional Properties of Proteins Isolated From Green Crab by Isoelectric Solubilization/Precipitation
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Introduction:
Growing populations of invasive green crabs (Carcinus maenas) have had detrimental effects on marine habitat, molluscan aquaculture, and commercially important fisheries. The primary objective of this project is to create value added products from the currently unprofitable green crabs, which are too small for traditional processing methods. The present study was designed to evaluate functional properties of green crab proteins isolated by isoelectric solubilization/precipitation (ISP) under acid and alkaline conditions.

Method:
Soft tissue mince obtained from deboned green crab was diluted 1:10 (w/v) with cold water and homogenized for 1 min. Samples were solubilized at pH 2 (PP2) and pH 10 (PP10) for 30 min. Supernatant pH was readjusted to 5.5 after centrifugation. The samples were centrifuged again to precipitate proteins which were then freeze-dried. All treatments were processed in triplicate.

Significance:
Our results suggest that the ISP method has potential application to obtain proteins from green crabs. We can also conclude that the functional properties of the green crab protein isolates depend on pH during the solubilization stage. As food ingredients, the green crab protein isolate solubilized at pH 10 could be added to protein based food products which require higher solubility at neutral pH whereas the pH 2 isolate could be applied to protein gel-based products.

Results:
Color differences between the two isolates were measured using a colorimeter. L+, a+ and b+ values were significantly higher for PP2 than PP10. To determine the potential use of the protein isolates as functional food additives, solubility, gelation, foaming activity/stability, emulsifying activity/stability, and proximate composition were evaluated. Both PP2 and PP10 exhibited the lowest solubility at pH 5. PP2 showed the highest solubility at pH 11 (86%) whereas PP10 exhibited highest solubility at pH 3 (66%). At pH 7 and pH 8, solubility of PP10 was significantly (p<0.05) higher, 13% and 41%, compared to solubility of PP2, 3% and 6%, respectively. For gel formation, PP10 required a higher concentration (21%) than PP2 (12%). In the case of foaming activity, low values were observed for both PP2 (17%) and PP10 (21%).

P03-004
Shell Life Evaluation of Fresh Red Seaweeds, Palmaira Palmata (Dulse) and Gracilaria Tikvahiae Under Refrigeration
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Introduction:
Because of their growing popularity among consumers, in part due to their health benefits, seaweeds have attracted the attention of farmers, academics and the food industry. Americans enjoy many species of red seaweeds and fresh Dulse and Gracilaria have already made their way into various innovative recipes in upscale restaurants. However, since they have been traditionally consumed dried, quality changes during storage of fresh seaweeds is poorly investigated. The objective of this study was to evaluate quality loss and shelf life of freshly harvested red seaweeds; (Dulse and Gracilaria) at two refrigeration temperatures (35°F and 45°F).

Method:
Seaweeds were washed and bagged in triplicate, and microbial (aerobic plate counts), physicochemical (instrumental color and texture, soluble protein, and drip-loss) and sensory properties were assessed for up to two weeks. An experienced 12-member panel rated sensory attributes (color, texture, aroma, and overall quality) using a 15 cm line scale with opposite descriptors on either side of the scale, where 0 was complete loss/degradation and 15 was the best score for the attribute.

Significance:
These results provide foundational information to efficiently process, distribute and market fresh red seaweeds for niche food service and retail markets and contribute to the growing demand for minimally processed, fresh produce.

Results:
Sensory scores for color (9.03), texture (9.15) and overall quality (9.48), dropped significantly in Dulse samples at 35F on Day 9 compared to Day 1 scores (~12.8). Panelists considered 35F Dulse to be acceptable even on Day 11 whereas 45F samples had an unpleasant aroma on Day 7. Sensory results and lower instrumental force values indicate significant (p<0.0001) quality loss occurred by Day 7 at 45°F. For Gracilaria at 35°F, increased drip-loss and lower sensory texture and overall quality scores indicated significant quality loss by Day 8. At 45°F, although the overall quality scores were significant (p<0.0001) lower by Day 5, sensory aroma and L* values did not drop significantly until Day 8. Higher storage temperature significantly reduced shelf life of Dulse whereas for Gracilaria most results were not affected by temperature. For both species, quality loss could not be attributed to microbial growth.

P03-005
Mass Balance for Isoelectric Solubilization/Precipitation of Krill, Menhaden, Carp, and Chicken
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Introduction:
Isoelectric solubilization/precipitation (ISP) has been applied to various aquatic and terrestrial resources. Krill is underutilized. Menhaden is used by reduction fisheries and not for direct human consumption. In US waters, carp is an environmental nuisance species with rapid growth but minimal requirements, replacing indigenous aquatic life. Large volume of chicken-by-products presents an opportunity to isolate protein and lipid for human consumption instead of rendering. Although ISP efficiently isolates protein and lipid, depending on input material, ISP may produce different yields and quality of the isolates.

The overall objective was to determine mass balance for ISP applied to practically meaningful and representative sources. Specific objectives were to determine (1) crude protein composition, (2) total lipid and its classes, (3) moisture and ash in fractions isolated with ISP from krill, menhaden, carp, and chicken. Furthermore, (4) recovery yields and (5) mass balance were calculated.

Method:
Protein, lipid, and insolubles were isolated separately from krill, menhaden, carp, and chicken using ISP. Isolated protein, lipid, and insolubles were analyzed for crude protein and its composition, total lipid and its classes, moisture, and ash by micro-Kjeldahl and SDS-PAGE, Soxhlet and TLC, oven, and muffle furnace, respectively. Then, recovery yields and mass balance were calculated. Experiments were statistically analyzed.

Significance:
This study demonstrates that lipid in ISP input material affects composition and yields of ISP isolates.

Results:
Depending on input materials, the isolated protein contained 85-90% moisture. When compared to the input material, the isolated protein was concentrated, containing on dry basis 72-77% crude protein for krill and menhaden; while carp and chicken had 86-89%. The lower protein content in krill and menhaden was because lipid did not separate during ISP and was retained with the isolated protein. The isolated protein from menhaden contained approximately twice as much lipid as carp and chicken; while krill protein isolate had about five times more. Based on TLC, the protein isolated from krill and menhaden contained phospholipids (PLs). PLs form emulsions, particularly when protein is present. Although we did not present this information, long-chain polysaturated fatty-acids found in krill and menhaden are beneficial, especially when esterified in PLs.

P03-006
Effect of Corn-Cowpea Weaning Blend on Viability of Lactobacillus Plantarum NCIMB 8826 Under Gastrointestinal Tract Conditions
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Introduction:
Cereal-legume blends are a traditional food for infants in Sub-Saharan Africa. This region suffers from distress/death in young children due to gastro-intestinal disorders. Fortifying traditional cereal-legume weaning mixes with probiotic bacteria, a novel and practical concept, may improve infant gastrointestinal health. This study investigated the effect of corn-cowpea weaning blends on the viability of Lactobacillus plantarum NCIMB 8826 (LP) under simulated gastrointestinal tract (GIT) conditions.

Method:
Three maize based formulations that meet infant nutritional requirements (Maize-Cowpea, 70:15:10:5 ratio) were developed. Ten grams of each formula were separately mixed with 90 g of water, autoclaved and centrifuged to remove the supernatants. LP (1010 CFU/g) were added to the supernatants and kept at 37°C for 16 h to immobilize the cells. The immobilized cells in the supernatants were evaluated for viability and GI tolerance with simulated gastric fluid (SGF) at pH 3 and
also at bile (oxgall) conditions. The cells were grown in MRS broth (free cell) and free cells were also used as a control. Triplicate experiments were conducted and the data was statistically analyzed (α = 0.05).

Significance: This study demonstrated that maize-cowpea weaning food supernatants could be used to immobilize \textit{L. plantarum} and that immobilized \textit{L. plantarum} could tolerate gastric conditions presenting the potential for use in a probiotic delivery system of infants.

Results: LP viability in all supernatants was lower (109 CFU/g) regardless of the blend than the free cells (1010 CFU/g). The gastric tolerance test produced one log reduction of the immobilized cells in the supernatant for all formulations. Cell reduction in the supernatants at gastric fluid condition (pH 3) was similar to that in MRS broth. In general, at least 106 CFU/g should reach colon for improved gut health. Our study indicated that immobilized cells in the supernatant tolerated the gastric condition well, regardless of formulation. Both immobilized cells and free cells had one log reduction in the bile test. Free cells did not tolerate long-term storage well. Immobilized cells had adequate viability under the test conditions and have the potential to remain viable during long term (non-refrigerated) storage.

P03-007

\textbf{Engineering Lactococcus Lactis to Overexpress Genes Encoding the Bisin Lantibiotic From Bifidobacteria Longum DJ010A}

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Introduction: Bisin is a broad spectrum lantibiotic produced by \textit{Bifidobacterium longum} DJ010A. However, production of lantibiotic is very low in vitro and no production occurs in broth cultures. The bisin gene cluster was predicted to involve the lanADM genes for production and immunity, with lan2R2 encoding the two-component signal transduction regulatory system and lanR1 originally proposed to encode a putative repressor. To further investigate this, and to enable large scale production of bisin, \textit{Lactococcus lactis} was engineered to express the production and immunity genes.

Method: Synthetic lanADM genes that were codon optimized for \textit{Lactococcus lactis}, were designed and synthesized. These were cloned into a dual plasmid nisin expression system for \textit{L. lactis}.

Significance: Further investigating the correct media conditions to enable active bisin to be produced will be of benefit to the food industry given bisin has the potential to be used as a natural antimicrobial that can protect against both gram positive and gram negative bacteria.

Results: The expression system functioned successfully, but no detectable bisin bioactivity was obtained. Liquid Chromatography Mass Spectrometry (LC-MS) was used to detect the presence of LanA, LanD, LanM, LanL, and LanF, confirming all genes were expressed. This suggested that some essential components were missing for bisin production. As lanR1 was the only gene in the bisin gene cluster with no confirmed function, it was reexamined using Uniprot bioinformatics software. The results indicated that LanR1 was unlikely to be a repressor, but more likely to interact with LanD and therefore may be needed for production of active bisin. Therefore, a codon-optimized lanR1 was synthesized and cloned into the expression cassette in \textit{L. lactis}. The newly constructed strain exhibited a slow growth rate, but no antimicrobial activity was detected. To evaluate if something else in \textit{B. longum} DJ010A was needed for bisin production the entire lanAR1DMLT cassette was amplified using high-fidelity PCR and cloned into an expression vector, PDOHR-W6 under the control of a 165 RNA gene promoter. This plasmid was introduced into \textit{B. longum} DJ010A via conjugation. However, no bioactivity was obtained, suggesting some component from the medium environment was needed for production of an active bisin lantibiotic.  

P03-008

\textbf{Fermentation Process Effects in the Antioxidant Capacity and Chemical Characteristics of Cocoa Beans (Theobroma Cacao L.) Produced in Two Colombian Regions (Alto Sinú, Córdoba and Montes de María, Bolívar)}

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Introduction: Cocoa (\textit{Theobroma cacao L.}) is not only the neo-tropical food with the highest international market penetration, but it is recognized for being an important source of antioxidants due to its high content of phenolic compounds, mostly flavonoids and procyanidins. The main goal of this research was to evaluate the current state of the process and variables in the traditional cocoa's fermentation applied in two Colombian's regions (Alto Sinú, Córdoba and Montes de María, Bolívar).

Method: A chemical characterization of the fruit was made and the effects of the fermentation process in pH, acidity, reducing sugars, total phenols, and antioxidant capacity by using three typical methods (3-ethyl-benzothiazoline-6-sulfonic acid-ABTS, 2,2-diphenyl-1-picrylhydrazyl- DPPH, and ferric reducing antioxidant power-FRAP) were evaluated. A completely randomized experimental design with repeated measures in the time of process was applied. Clones ICS-39 and ICS-96 were selected in Alto Sinú and Montes de María, respectively, due to their high production and tradition.

Significance: This research has significant impact in the cocoa industry due to the lack of data about this product in the studied regions, which have high market penetration worldwide.

Results: The cocoa production in Alto Sinú is more technified, it has higher hectares grown per producer (2,8 Ha) and higher yield per harvest (830 Kg/Ha/year) than Montes de María (250 Kg/Ha/year). The ICS-95 had the highest values of crude protein (20,7%), ash (4,8%), fat (36,9%), fiber (14,8%), and mucilage (60%); on the other hand, ICS-39 had the highest values of reducing sugars (0,7 mg glucose/g cocoa) and acidity (1,8 % lactic acid). During the fermentation process, pH, acidity, and reducing sugars had a typical fermentation profile without significant differences (p<0,05) between the studied regions. Total phenols and antioxidant capacity (ABTS and DPPH) did not have significant differences (p<0,05) neither between the days of the process nor the studied regions. However, antioxidant capacity determined with FRAP had significant differences among the fermentation days and the regions, reaching up to 13,4 mg of ascorbic acid / g cocoa in Alto Sinú and 5,0 mg of ascorbic acid / g cocoa in Montes de María after the six days of the bioprocess.

P03-009

\textbf{Stress Response Related to HSP Production in Lactic Acid Bacteria With Probiotic Potential}

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Introduction: Bacterial survival mechanisms are generally referred as the stress response, which involves synthesizing a set of proteins to facilitate their adaptation and survival. Particularly, the bacterial heat shock response is characterized by the elevated expression of a number of chaperone complexes, the called heat shock proteins (Hsp). The thermal resistance of lactic bacteria, opens the possibility that they may face a second stress condition, allowing them a better adaptation to survive other stress conditions that probiotics suffer during its passage through the gastrointestinal tract. The objective of this work was to establish the presence of Hsp complexes in lactic acid bacteria when submitted to different stressing conditions and correlate the HSP family associated with that response.

Method: Stationary-phase cells of lactic acid bacteria of 6 to 7 h in MRS broth were harvested by centrifugation and washed twice with potassium phosphate buffer. Cell lysis was performed with a sonifier on ice, into samples of each bacteria submitted to (a) acid stress, (b) thermal stress, (c) combination of acid and thermal stress, and (d) non-stress condition. The cytosolic fraction was obtained by centrifugation and protein concentration in each sample was adjusted prior to SDS-PAGE.

Significance: Results in this study demonstrate that certain lactic acid bacteria may acquire stress resistance to acid and thermal treatment conditions, thus allowing them to survive both food processing conditions and gastrointestinal transit if they may employ as probiotic microorganisms.

Results: HSP 60 complex was overexpressed in \textit{E. faecium} when submitted into acid and thermal stress. For some \textit{P. pentosaceus} strains an overexpression of HSP 70 (20,7%), 66 (25,7%) and HSP 60 complexes was observed with acid stress condition. Small HSP complexes (shps) were observed in the three stress conditions assayed for all lactic acid bacteria. It has been showed that some of the lactic acid bacteria have a better stress response to one of the conditions analyzed, acid or thermal stress. This characteristic will probably allow them to respond to other stressing environmental factors that may afford during food processing.

P03-010

\textbf{Enhanced Antioxidant Effects of Korean Ginseng Marc After Fermentation by Lactobacillus Plantarum Isolated From Kimchi S. Eom, G. Jung, J. Hang, J. Jung, K. Kim, H. Paik, Email: insomnia.hamnail.net}

Introduction: Ginseng marc, a by-product obtained from ginseng extraction, contains various bioactive compounds. Fermentation processing using lactic acid bacteria enhances the extract's functionality, such as by imparting antioxidative, antiinflammatory, and anti-aging effects. This study's aim was to enhance the antioxidant effect of ginseng marc extract by fermentation with \textit{Lactobacillus plantarum} KCCM 11613.

Method: Ginseng marc was extracted with 70% ethanol at 60°C and concentrated using a rotary evaporator. The \textit{L. plantarum} strain was inoculated into 1% (w/v) ginseng marc extract and incubated at 37°C for 24 h. During fermentation, viable cell number was measured by the pour-plated method with MRS agar. Total phenolic content was detected using the Folin-Ciocalteu assay. Gallic acid was used as a standard. Antioxidative activity was measured by DPPH radical scavenging, β-carotene bleaching, and ferric thiocyanate (FTC) assay.

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Significance:
This study is the first report on the fermentation of ginseng marc extract using lactic acid bacteria from kimchi, and the results suggest that fermented ginseng marc could be used as a natural antioxidant.

Results:
Cell number increased to approximately 10^8 CFU/mL and pH decreased to 4.2 after 24 h of fermentation. Total phenolic content increased to 41.7±1.7 mg/g solid. The antioxidant effect did not change significantly (p>0.05) in the DPPH radical scavenging assay, but the β-carotene bleaching and FTC assay results indicated increases in the antioxidant effect to 67.3±1.5% and 77.0±0.9%, respectively.

P03-011
Physical and Thermal Properties of Rice Starch Modified by Acetylation and Extrusion Process for Its Use in the Elaboration of Edible Biodegradable Films
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Introduction:
The use of plastic materials for packaging food has been increasing. However, such materials are usually made of petroleum which degradation takes thousands of years producing large amounts of garbage. Therefore, the aim of this project is to create a film based on starch and mucilage of chia and nopal, in order to use it as packaging for food. Starch consists of two polymers with a linear region amylose and a branched region amylopectin. It is a raw material widely used in the food industry due its biodegradability, but low cost which granular structure can be altered in the presence of a plasticizer by the application of thermo-mechanical treatment. Starch modification provides storage stability, strength, and flexibility because of its hydrophilic character, physical and thermal properties. Rice starch was isolated (IRS) and subsequently modified (MRS) by the addition of acetic anhydride by the extrusion process.

Method:
Rice starch was isolated and modified by acetylation and extrusion process at 60, 80, and 100°C temperatures, as well as characterized by its physical (moisture content, color, WAI, WSI) and thermal (TGA, DSC) properties.

Significance:
The modification of IRS provides a raw material able to create biodegradable films of lower cost for food packaging.

Results:
Moisture content of MRS was 13.44% showing an increased compared to IRS 7.83%. Due to thermo-mechanical treatment that was submitted by the extrusion process; significant change was observed in color in IRS (L* = 94.737, a* = -0.047, b* = 2.097, IW = 93.286) compared with MRS (L* = 13.44, a* = 0.14, b* = 5.0, IW = 84.0); an increase in WAI ratio was observed in MRS (3.49%) compared to IRS (2.348%) as well as a decrease in WSI in MRS (0.07%) compared with IRS (2.198%). A decrease in gelatinization temperature was observed in MRS (40°C) compared to IRS (60°C) this represent a change in molecular structure, effect by the extrusion process; A thermogravimetric analysis (TGA) showed a lower mass loss in MRS (53.31%) compared to IRS (55.3%) due to the chemical modification that decreases the amount of hydroxyl groups susceptible to degradation.

P03-012
Cellulose Nanofibers Produced From Banana Peel By Chemical and Enzymatic Treatments: Characterization and In Vitro Cytotoxicity Assessment
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Introduction:
Cellulose has potential to be used in a variety of technological and environmental friendly applications. One of these possibilities is the development of biodegradable film composites. Cellulose nanofibers (CNFs) have been explored as an alternative to reinforce biopolymeric matrices, since they have potential to improve thermal stability, mechanical and barrier properties.

This study investigated the use of different treatments for the production of CNFs from banana peel (Musa paradisiaca) in order to apply them as a reinforcing agent in composite films.

Method:
CNFs were produced by chemical (NC) (acid hydrolysis with H2SO4) and enzymatic (NE) (hydrolysis with xylanase) treatments. Also, the insoluble residue from NE was treated with catalytic oxidation with 2,2,6,6-tetramethylpiperidine-1-oxyl (TEMPO) (NE- CO), tert-butanol (NE-Tb) or 2-Diethylaminoethyl chloride hydrochloride (NE-DEAE). Transmission electron microscopy (TEM) and dynamic light scattering (DLS) were used to assess CNFs morphology, diameter and surface charge (ζ-potential). Once these CNFs will be applied in biodegradable films, CNFs biocompatibility at different concentrations (50-5000 µg/mL) was evaluated via cell viability measurements (MTT assay) using Caco-2 cells. Data were analyzed (α=0.01) using ANOVA and Tukey's post hoc means comparison test.

Significance:
The different treatments isolated CNFs efficiently from banana by-products, which are very promising as reinforcing agent in biopolymeric matrices. Also, the toxicological assessment of CNFs shows the innovative character and quality of this scientific research.

Results:
TEM analysis showed that the treatments were effective for the isolation of banana fibers at nanometer scale, and suggested that amorphous fractions were removed. CNFs had an average diameter of 18.8 nm (NC), 3.7 nm (NE), 7.5 nm (NE-Tb), and 26.9 nm (NE-DEAE). NE-CO treatment was aggressive and degraded the fibers. NE-Tb treated samples showed CNFs to be better distributed and dispersed, once NE-Tb inhibited CNF aggregation. CNFs suspensions exhibited negative (ζ) potential in water: -36.6 mV (NC), -29.1 mV (NE), -29.4 mV (NE-Tb) and -53.0 mV (NE-DEAE). The surface charge of CNFs produced with NE treatment increased considerably after the additional treatments (i.e. NE-Tb, NE-DEAE), which prevent the formation of CNF aggregates, thereby yielding a more stable colloidal suspension.

In vitro studies showed that CNFs produced were not cytotoxic at concentrations less than 2000 µg/mL.

P03-013
Resistant Starch Content of Taro (Colocasia Esculenta L. Schott) Flour Drying at Different Conditions
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Introduction:
Taro (Colocasia esculenta) is a kind of starch-rich corms and consumed in many tropical countries due to its high nutritional value. Resistant starch (RS) is an important starch portion in human diet due to its availability for fermentation in the large bowel. RS content of the food can be increased by process conditions. The aim of this study was to investigate the effect of different drying conditions on the resistant starch content of taro flour.

Method:
Raw taro corms were obtained from the Anamur region of Mersin in Turkey and dried at different temperature (40, 50, and 60°C) and air flow rate (0.5, 1.25, and 2 m/s) in drying oven (Milkol, Turkey). RS content of taro flour was determined according to AOAC (2002) method by using the Megazyme resistant starch assay kit. The results were analyzed by two-way analysis of variance using JMP 5.0.1.

Significance:
Increasing the RS content of food by some process have been investigated in recent years. The drying process which has been widely applied in many foods is one of them. This study shows that drying conditions have been considered in terms of RS content of Taro flour. Moreover, taro flour could be used in many food applications as a functional ingredient/product thanks to having RS content.

Results:
RS content of taro flours varied between 33.1 and 51.4 g / 100 g flour. Generally both of drying temperature and air flow rate significantly affected RS content (p<0.05). The highest RS content was found at 50°C and 2 m/s as 51.4 g / 100 g flour. Increasing of air flow rate at 50°C led to an increase of RS content. At constant flow rate, drying temperature of 60°C caused significant reduction of RS content of taro flour (p<0.05). Taro flour also contained higher level RS content between 33.1 and 51.4 g / 100 g flour when compared to other tropical flours, such as unripe banana flour (12.5 g/100 g solids) and edible canna flour (18.6 g/100 g solids).

P03-014
Mechanical Properties and Water Status of Traditional and Whole Grain Cooked Pasta
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Introduction:
An increased fiber intake is advisable in the Western diet as it has multiple beneficial effects on human health. Pasta, being a staple food, may be a vehicle to increase fiber intake maintaining familiar dietary habits. However, little has been published on the effect of these new formulations on physical properties of cooked pasta. This study aims to characterize mechanical properties and water status of traditional and whole grain pasta at different cooking times.

Method:
Traditional (STD) and whole grain (W) pastas (penne rigate shaped) were characterized for water status (DSC frozen water; TGA moisture content [MC, g water / 100 g product] and evaporating profile), and mechanical parameters (hardness, Texture Analysis; DMA G’ and G’, 25°C) at different cooking times (optimal cooking time (OCT): 11 min (STD) and 9 min (W), OCT+3 min (undercooked) and OCT+3 min (overcooked).

Significance:
The high fiber content of W significantly increased water availability in the pasta matrix making the material softer and less elastic. Pasta properties can be modulated with variable cooking times.
Results: STD had higher carbohydrates (75 vs 70%), lower proteins (12.5 vs 14.3%), fibers (3.6 vs 10.7%), and lipids (1.8 vs 2.7%) than W. MC of STD and W were comparable at OCT (42%) and OCT-3 (49%), while overcooked W absorbed more water than STD (56 vs 52%). Water was more prone to freeze in W (higher frozen water) than in STD (48 vs 42% g frozen water/100 g water at OCT) suggesting a decreased solid-liquid-water interaction in the presence of fiber. The water evaporation profile (bimodal pattern, 75% evaporating at 45–48°C and 25% at 103–111°C) was comparable in STD and W.

Hardness was significantly affected by formulation, with STD harder than W at all cooking times, and overcooked STD having a comparable hardness to undercooked W (7.62±0.30 and 7.57±0.30 N). The ability to store energy (G, 25 Hz) decreased with increasing cooking time in both samples and it was significantly higher in OCT-3 STD (0.13 MPa) and lower in OCT-3 W (0.03 MPa), while STD OCT was comparable to OCT-3 W (0.07 MPa) and OCT-3 STD to OCT W (0.05 MPa).

P03-015
Reclamation and Reuse of Waste Streams from Clean-in-Place Operations of Dairy Processing
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Introduction: Cleaning is a critical part of dairy processing since milk tends to foul easily and heavily. However, the high consumption of water, chemicals and energy during cleaning create economic and ecologic challenges for the dairy industry. Reuse of Clean-in-Place (CIP) waste streams can reduce the cleaning agents consumption and improve the sustainability of the process. The objectives of this study were: (1) to establish the extent of cleaning solution reuse before effectiveness is lost, and (2) to evaluate the application of membrane technology for reclamation of waste streams from CIP operations.

Method: Two concentrations (0.05% and 0.5% by weight of NaOH) of a commercial cleaning agent were re-used for seven days while cleaning pipe sections in a pilot-scale system. Deposits of 20% non-fat-dry-milk were applied to pipe sections using heat to fix. After each cleaning sequence, the protein content of the residual film on the interior pipe surface was analyzed to evaluate the cleanliness of the pipe section. In addition, electrical conductivity, active alkaline concentrations of the cleaning solution were measured before and after each cleaning step. Microbial populations of the cleaning solution were measured after cleaning step. Five different types of membrane were selected to reclaim the CIP waste stream.

Significance: These results confirm the feasibility of re-using the detergent solution of CIP operations. The reusing limit of the detergent and proper membrane modules to reclaim the detergent are determined. These findings provide potential solutions for dairy plants to improve their processing sustainability, reduce detergent consumption while maintaining the cleaning effectiveness.

Results: The results suggested the effectiveness of cleaning solution decreased each time of using and during the storage. The limits of electrical conductivity and active alkaline value were 0.64 mS/cm and 0.0029 mol/L, respectively. After the cleaning solution reaches those values, protein residue starts to be detected on the pipe surface, which suggests it lost its effectiveness and cannot be reused. 0.05% cleaning solution can be reused for 6 days (1 time per day). 0.5% cleaning solution was always effective during seven days of reusing. The membrane system separated the milk residue and microorganisms from the cleaning agents successfully.

P03-016
Fine Grinding or Freeze-Drying Milk Protein Concentrate Improves Select Functional Properties and Performance in Model High-Protein Nutrition Bars
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Introduction: When they are used in nutritional bars, high-protein milk protein concentrates (MPCs; ≥ 80%) are known to increase crumbliness and susceptibility to hardening. Internal moisture migration between constituents and the protein source/type are scrutinized for their role in texture change during storage. High-protein MPCs have impaired wettability, poor dispersibility, good water binding, and relatively poor hydration characteristics (e.g., solubility). These functionalities, which stem from the powder's surface properties, likely influence moisture migration within high-protein nutrition (HPN) bars (≥ 20% protein) and textural instability.

Method: MPC85 was jet-milled or was rehydrated and freeze-dried to alter the powder's characteristics (e.g., solubility). These functionalities, which stem from the powder's wettability, poor dispersibility, good water binding, and relatively poor rehydration characteristics are scrutinized.

Significance: These functionalities, which stem from the powder's wettability, poor dispersibility, good water binding, and relatively poor rehydration characteristics are scrutinized.
Significance:
Knowledge of the temporal properties of non-nutritive sweeteners and the methods by which to measure them is important in order to understand how addition into product formulation will affect the overall sensory properties of the food product.

Results:
Protein concentration and vanilla flavor had no impact on perceived sweet taste intensity (p>0.05). The three temporal methods provided complimentary results. Results from TI demonstrated that beverages sweetened with fructose or sucrose were characterized by initial intense sweetness that quickly faded. Monk fruit and stevia were slower in sweet onset and characterized by bitter and metallic aftertastes and lingering sweetness. Sucralose displayed a delayed sweetness onset and lingering metallic taste and sweetness after expectation. By TDS and TCA/TA, sucrose and fructose beverages were characterized by dominant sweetness. Stevia and monk fruit beverages were characterized by initial dominant sweet taste, then by bitter and metallic. Sucralose beverage was characterized by predominant and lingering sweet taste then metallic.

P03-019
Use of Microteaching Principles to Improve Graduate Student Presentation Skills in a Large Introductory Food Science and Human Nutrition Course
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Introduction:
Research shows that students struggle to develop higher order thinking skills and effective study strategies during the transition from high school to university level learning. Thus, in addition to teaching students subject matter content, effective instructors also need to assist students in learning how to learn that content. One very helpful, but often under-utilized tool to enhance students’ learning skills is metacognition, which is the students’ ability to think about their thinking. An effective assignment that assists students in thinking about their exam performance is the exam wrapper. The objective of this study was to evaluate the impact of exam wrappers on students’ perception of their study habits, exam performance, and utilization of this learning tool in future classes.

Method:
Exam wrappers are short, reflective writing activities that ask students to review their performance and the instructor’s feedback on an exam with a focus on adapting their future learning and study practices. Often three main questions are posed: (1) how did you prepare for the exam?, (2) what kind of errors did you make on the exam?, and (3) what could you do differently on the next one?. Three exam wrapper assignments were offered as extra credit (4 points each), one after each of the three first-hour exams in a large introductory Food Science and Human Nutrition course.

Significance:
In summary, this study shows that the exam wrapper process is an effective post-exam reflection tool for improving students’ self-reported study habits. In addition, once students are exposed to the benefits of metacognition through the exam wrapper process, use of metacognition becomes a resource in their life-long learning toolbox.

Results:
Based on Likert scale responses, 72% of students either strongly agreed or agreed that the exam wrappers helped them improve their study habits and only 2% disagreed, whereas only 52% of the students either strongly agreed or agreed that the exam wrappers helped them improve their exam scores and 7% disagreed. However, when asked if they would use the exam wrapper process (post-exam reflection) for future classes the majority of the students (71%) strongly agreed or agreed and only 6% disagreed.

P03-020
Use of Microteaching Principles to Improve Graduate Student Presentation Skills in Teaching and Research
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Introduction:
Strong presentation skills are necessary for students to bring to their careers in the food industry. However, meaningful presentation feedback is often scarce. One technique used to improve presentation delivery is microteaching, which is typically used in a teaching context. The principles of microteaching involve preparation of a lecture, teaching while being recorded, observing the recording while receiving feedback from a mentor, re-planning the lecture, re-delivering the lecture, and re-observing the video. A critical aspect of microteaching is recording the presentation for the listener to view and receive feedback. The objective of this study was to utilize microteaching principles to improve graduate student presentation skills for a teaching and research presentation.

Method:
Graduate students at the University of California, Davis from the Biological Systems Engineering and Food Science and Technology Graduate Programs participated in microteaching modules for teaching (n = 3) and research (n = 8) presentations. For both modules, the presentation was planned with the mentor and delivered while being recorded. Presentations were evaluated on organization, accuracy, message, language, delivery, use of time, questions, and presence. Presentations were evaluated either by undergraduate students (teaching presentations) or peers (research presentations). After reviewing their video and receiving feedback, students re-planned and re-delivered presentations while being recorded and evaluated.

Significance:
It is crucial for the next generation of food science professionals to have excellent presentation skills. As such, widespread implementation of educational methods that aid in professional development of graduate students is necessary. By utilizing techniques such as microteaching, graduate students can improve presentation skills and bring these skills to the food industry.

Results:
All students showed improvement in their re-delivered (second) presentation. In teaching presentations, most areas of evaluation scored 4 or greater (maximum score of 5) at the end of the module (average score 4.5/5). Evaluations by undergraduate students were higher for graduate students presenting a teaching lecture who had participated in the microteaching module compared to a control graduate student (4.5 vs. 4.25, respectively). From watching their own recordings, all students identified areas for improvement, including gestures, distracting hand movements, use of filler words (e.g. um, like), and talking to the board.

P03-021
Examining the Impact of Teachers’ Fidelity of Implementation Scores on Students’ Food Safety Knowledge Gains
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Introduction:
The CDC estimates roughly 1 in 6 Americans contract a foodborne illness every year, many of which could be prevented by proper food handling by consumers. Adolescence is the stage at which consumers begin to form lifelong food safety habits. By arming adolescents with proper food handling knowledge, the number of foodborne illnesses reported each year could dramatically drop over the next generation.

The effectiveness of food safety education interventions that rely on train-the-trainer delivery methods may be compromised when trainers deviate from the designer’s original intent. Fidelity of implementation (FOI) is the degree to which an intervention is implemented in accordance with the designer’s intent. While a number of mechanisms may be put in place ensure high degrees of FOI, deviations are inevitable for a wide-range of reasons, such as limited instructional resources and meeting the needs of learners.

The purpose of this study was to investigate FOI for an established food safety educational intervention to determine: (1) the manners in which trainers most frequently modified the intervention and (2) what percentage of variability in student learning gains was described by teachers’ FOI.

Method:
FOI scores were collected from n=27 middle school teachers through the use of a structured observation form as they implemented the food safety educational intervention. Prior to intervention, students in these teachers’ classes completed a pre-test containing 40 food safety knowledge items. A regression analysis was conducted to examine the relationship between FOI and changes in students’ food safety knowledge.

Significance:
These findings provide guidance for food safety educators and trainers in identifying curricular deviations which enhance students’ food safety education knowledge and deviations which are detrimental.

Results:
Results indicate that teachers most frequently modify structural procedural elements of lesson such as having handouts and other materials ready for use or displaying definitions of unknown words on the board. Structural procedural deviations accounted for 1.1% of the variance in knowledge change (R2=.12, Adj R2=.01, F(1,32)=4.68, p<0.05), instructional pedagogical deviations accounted for 2.5% of the variance (R2=.17, Adj R2=.02, F(1,32)=9.29, p<0.05), and instructional engagement deviations accounted for 1.8% of variance (R2=.15, Adj R2=.018, F(1,32)=7.084, p<0.05).

P03-022
Conductivity (μS) Measurement of Individual Food Ingredients and Food Coating Batter Mix in Aqueous Suspensions
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Introduction:
Salt measures salt content in solutions by measuring the solution’s conductance and is reported in percent salt. This is accurate for salt and water solutions [brine]. However, if one wanted to test or develop a blend of several dry ingredients plus sodium chloride [salt] the conductance value may not be solely the contribution of salt. Therefore, knowledge of all ingredient conductance would be beneficial to accurately quantify the salt contribution and the other ionic constituents.

Method:
The conductivity (μS) measurement is based on the batter mix dissolved in distilled water, whereby the ions present could be measured. We divided the work into three phases: (1) evaluate individual ingredients in solution to better understand a food coating batter mix formula in a solution; (2) evaluate a commercial batter mix; and (3) investigate the conductivity measurement of a total mix to assist with understanding the order of predominance of ingredients. We identified the conductivity of each of the
single ingredients in 1%, 2%, 5%, and 10% solutions. Conductivity was treated as an ingredient attribute. Its proportional contribution was based on the ingredient percent present in 100 units of sample. A simple spreadsheet was used to rank order the values.

**Significance:**
A conductivity meter is a precise instrument for measuring the ionic content of individual ingredients in solution. The results correlate with the published data. A skilled developing scientist can use the conductivity value to predict the approximate dry mix formula for a product. The results also contribute to product development time. The conductivity meter may be used by a QC technician to monitor the quality of complex mixes containing ionic ingredients.

**Results:**
The majority of the ingredients used in a batter formulation contains ions and as a result contribute to conductivity. Sodium chloride [salt] is not the singular contributor of conductivity. Wheat flour contributes a significant amount of conductivity. When two or more ingredients were present in the dry mix, conductivity was the sum of the ions contributed by each ingredient. The addition of more than one ingredient in to a dry mix increased the conductivity by the proportionate amount on the pure ingredient.

**P03-023**
**Drying of Murta (Ugni Molinae Turcz) Berries: Effects on Bioactive Components, Functional Properties, Structural Characteristics, and Microstructure**
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**Introduction:**
Murta berries, native to southern Chile, are usually dehydrated for longer shelf-life and for use as an ingredient in many recipes. Although the effects of drying temperatures on the bioactivity of the berries have been quantified, changes caused by the drying process have not been investigated.

**Method:**
In this study the effects of five different drying methods, namely convective drying (CD), Vacuum drying (VD), freeze-drying (FD), infrared radiation drying (IR), and sun drying (SD), were evaluated using various control parameters. Total flavonoids (TF) in the free and bound forms were determined using an absorbance method with rutin hydrate as standard, while total anthocyanin content was determined by pH differential method. Contents of the four tocopherols were determined by HPLC using a fluorescence detector at 290 nm excitation and 330 nm emission. Amino acids, except cysteine and tyrosine, were determined by HPLC equipped with a UV detector. Fatty acids composition was determined by conversion to fatty acid methyl esters injected in a gas chromatograph and detected by a flame ionization detector. As functional properties rehydration ratio (RR) and water holding capacity (WHC) were determined. Structural characteristics like hardness, springiness, gumminess, and chewiness were analyzed using a texture analyzer. Microstructure was observed using cryo-scanning electron microscopy.

**Significance:**
The results obtained could be helpful in deciding the best drying method for the desired quality of the dried product.

**Results:**
The drying methods were found to have significantly different effects on the various quantified control parameters. In general, the freeze-drying process caused the least damage to the bioactive components. TF in the free form were reduced, while TF in the bound form showed a slight increase. More than 50% loss of free TF occurred during IRD, while freeze-drying did not cause any significant change in both free and bound TF. RR and WHC of the freeze-dried samples were highest and significantly different compared with the other drying methods. Hardness was reduced by freeze-drying, while it was increased by the other drying methods. The microstructure of the freeze-dried samples showed similarity with that of the fresh berries, while noticeable cell wall damage occurred during the other drying processes.

**P03-024**
**Effects of Quercetin and Rutin on the Oxidative Stability in Oil-in-Water Emulsions Containing Iron Under Riboflavin Photosensitization**
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**Introduction:**
Phenolic compounds are present in plant and plant-derived foods like tea and wine. The antioxidant properties of phenolic compounds have been investigated, which improves the oxidative stability of foods containing lipids as well as their beneficial effects on human health. The antioxidative capabilities of quercetin and rutin have been reported in ferrous induced lipid oxidation system and food matrix including oil-in-water (O/W) emulsion and in vitro assay. However, studies on the antioxidant or prooxidant properties of quercetin and rutin have not been reported in O/W emulsions under RF photosensitization.

The objective of this study was to determine the antioxidant or prooxidant effects of quercetin and rutin on the oxidative stability of RF photosensitized O/W emulsions in the presence or absence of added FeC2.

**Method:**
The effects of 0.1, 0.5, and 1.0 mM quercetin and rutin were tested in iron catalyzed oil-in-water (O/W) emulsion systems under visible light irradiation or in the dark condition. In addition, the antioxidative/prooxidative properties of quercetin and rutin were evaluated in O/W emulsion at room temperature for 48 h under riboflavin photosensitization. Headspace oxygen depletion, conjugated dienoic acid assays, and lipid hydroperoxides were analyzed in samples. Data of headspace oxygen content, conjugated dienes, and lipid hydroperoxides were analyzed statistically by ANOVA and Duncan’s multiple range test using SPSS software program (SPSS Inc., Chicago, IL, USA). A p value <0.05 was considered significant.

**Significance:**
Aglycone (quercetin) had better antioxidant properties than corresponding glycosides (rutin). The antioxidative or prooxidative properties of phenolic compounds like quercetin and rutin vary depending on the concentration and environmental condition. The results of this study can help to improve the oxidative stability of emulsion typed foods containing plant extracts.

**Results:**
Quercetin had higher metal chelating ability than rutin in iron catalyzed O/W emulsion. Generally, 0.1 mM of quercetin and rutin had prooxidant properties while 0.5 and 1.0 mM of quercetin and rutin had antioxidant abilities in O/W emulsion under RF photosensitization. Depending on the testing methods, different antioxidant properties were observed.

**P03-025**
**Preliminary Study of Quinoa (Chenopodium Quinoa Willd) Starch to Obtain β-Cyclodextrins**
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**Introduction:**
Quinoa is a cereal crop grown in South America. Its starch has only 11% amylose. Therefore, the high amylopectin occurrence of this crop makes it a good alternative to waxy corn starch, which is used to synthesize cyclodextrins (CD) in the industry. CDs are produced from starch by the cyclization reaction of cyclodextrin glucosyl transferase (CGTase). The most common available CDs are composed of 6, 7, and 8 glucose units named α-, β-, and γ-cyclodextrins, respectively. They are used in food, pharmaceutical, drug delivery, and chemical industries, as well as in agriculture and environmental engineering. Therefore, the objective of this work was to use quinoa starch to synthesize CDs, using CGTase previously produced by Bacillus megaterium.

**Method:**
Quinoa starch was obtained by agitation of seed flour using 0.1 M acetate buffer (pH 6.5, 0.01 M HCl). The resultant slurry was sieved through a series of sieves, until a 400 mesh flour was obtained. Starch and CGTase were added with continuous stirring to sodium phosphate buffer (20 mM; pH 6.0) and incubated at 70°C. After a 24 h reaction, the sample was centrifuged at 4,300 g by Centrikon H-401B. Afterwards, the supernatant was analyzed by HPLC using a column Bio-Rad Aminex® Carbohydrate HPX-20C. This column was eluted with distilled water at 85°C. The flow rate was 0.6 ml min. Cyclodextrins were recorded by a refractive index detector.

**Significance:**
Therefore, quinoa starch may be an alternative to produce CDs to use them in the food and pharmaceutical industries.

**Results:**
The optimum reaction temperature was 70°C and the amount of enzyme used was 22 U/g starch. Under these conditions with 10% of starch, β-CD (6.7±0.2 mg/ g) was preferably produced. The content of CDs, yielded in the final product after centrifugation, was 22.8 %, 53%, and 24.2% of α, β, and γ, respectively. Residual starch was 38.4%. Under similar conditions, 54.5% β-CD was obtained using waxy corn starch.

**P03-026**
**Antimicrobial Eugenol Nanoemulsion Prepared With Natural Emulsifiers and Evaluation of Nano Spray Drying Technology to Enhance Redispersibility**
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**Introduction:**
As an essential oil, eugenol has been well documented due to its wide spectrum of biological functions. However, the poor water solubility and stability as well as high volatility were the major challenges when applying eugenol as a bioactive compound. Nanotechnology, particularly nanoemulsion, is the most studied technology to overcome the above challenges to expand its application in food industry. One major objective was to develop eugenol oil nanoemulsions using natural food grade emulsifiers, including gum arabic and lecithin. The specific aims included: (1) to optimize formulation and fabrication method; (2) to characterize physicochemical properties; (3) to obtain nanoemulsion powders using a nano spray drying technique; (4) to explore antimicrobial activities of nanoemulsions.

**Method:**
Nanoemulsions were prepared by homogenization using food grade emulsifiers, lecithin and lecitin, and their mixtures. Particle size, polydispersal index, and zeta potential were characterized. The molecular interactions were studied by Fourier transform infrared spectroscopy. The effects of drying technologies, nano spray drying, and freeze drying on the morphology and redispersibility of the nanoemulsion powders were explored. The antimicrobial activity of nanoemulsion against Listeria monocytogenes and Salmonella Enteritidis was evaluated.
**P03-027**

**Influence of Food Matrix and Storage Temperature on Vitamin Stability**

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**Introduction:**

NASA will require foods that maintain vitamins throughout prolonged storage (3-5 years) for possible travel to Mars. Nutrient loss is hazardous since astronaut functioning is imperative for mission completion and return. Our objectives were to: test the stability of lipid- and carbohydrate- encapsulated vitamins in food systems that (a) by (a) lipid content and (b) powdered vs. compressed state; determine vitamin losses after different storage intervals/temperatures; determine vitamin liability and influence of matrix/encapsulant; and determine influences of storage time and temperature on sensory quality.

**Method:**

Vitamins A, B1, B9, C, and E were encapsulated in high-melting-point lipid for fortification of relatively low fat products, and encapsulated in starch for fortification of relatively high fat products, at twice the Space Flight Requirement (SFR). Products (chocolate drink mixes and compressed blueberry granola bars, each at high and low fat contents) were stored at 70°F for one year and at 100°F for 6 months and 1 year. Vitamin levels and organoleptic quality were determined.

**Significance:**

Results demonstrated maintenance of vitamin levels at above the SFR for one year 70°F storage, and indicated strategies for protection of select vitamins by matrix design.

**Results:**

On average, vitamin loss followed the sequence, A > B9 > C > B1 > E (35-3% range), with high fat products having slightly less loss, and no significant difference due to compressed vs. dispersed product state. Water soluble vitamins on average were better protected in high fat systems. Losses after 6 months at 100°F were slightly higher than, but not significantly different from, losses after 1 year at 70°F but lower than those after 1 year at 100°F. B9 was less stable in low fat matrices; Vitamin A was the most susceptible to high temperature storage. Samples stored at 70°F maintained sensory acceptability.

**P03-028**

**Microbial and Quality Changes of Fresh-Cut Romaine Lettuce Treated With Nanoencapsulated Cinnamon Bark Extract:**

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**Introduction:**

In order to improve CBE delivery to spoilage microorganisms while monitoring their effect on microbial and total aerobic counts, respectively versus the control while maintaining the overall quality attributes of the fresh-cut produce. These antimicrobial nanoparticles were effective at the concentrations tested and show potential as a non-thermal treatment of fresh-cut produce by reducing microbial growth while maintaining the overall quality attributes of the fresh-cut produce.

**Results:**

By 10 days of storage, the most effective antimicrobial concentration was 1600 µg/mL of the chitosan-PNIPAAm encapsulated CBE, with a 1 and 2 log10 CFU/g reduction (p<0.05) on psychrotrophic and total aerobic counts, respectively; versus the control and free CBE treatments. Afterwards, no significant difference among treatments was observed. Up to the 10th day of storage, no significant changes in color parameters could be observed for all treatments. Total chlorophyll and carotenoid contents decreased more significantly for the control and free CBE treatments, while for the chitosan-PNIPAAm treatments the reduction was slower. Sensory analysis showed that the differences in consumer’s acceptance among the control and the treated samples were not significantly different for most quality attributes throughout day 10. Overall, the chitosan-PNIPAAm nanoparticles with entrapped CBE showed to be effective inhibitors of spoilage microorganism growth, and extended the shelf-life of fresh-cut romaine lettuce up to 10 days.

**P03-029**

**Measurement of Oxygen Diffusion in Model Foods**

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**Introduction:**

Food quality degradation often occurs or accelerates in the presence of oxygen. Presence/absence of oxygen in headspace of packaged food may also influence microbial growth. Knowledge of oxygen diffusivity (D (O_2)) in food matrices is, therefore, necessary to predict shelf life, microbe growth in food, and selection of suitable packaging materials. D (O_2) data are available for aqueous foods such as fruit juices, and oils, but scarce for solid, viscous, and fibrous foods.

**Method:**

In this study, a non-invasive method was developed to determine D (O_2) in the model foods using Oxydol luminescence sensor. A transparent diffusion cell with 12 cm diameter and 2.5 cm height was designed. The volume of cell was 8 ounces, similar to a commonly used polymeric tray. At first, oxygen was leaked at the side and bottom of the cell, and then filled with 1, 2, and 3% (w/v) agar gel as model food. After deoxygenation, local oxygen concentrations in gels were measured non-invasively at 4, 12, and 22°C. Effective oxygen diffusivities in gel (D (O_2)g) and water (D (O_2)w) were obtained after fitting the experimental data to analytical solution and finite difference approximation (FDM) of Fick's second law.

**Significance:**

The method developed can be used to study oxygen diffusion in food matrices. It would help in explaining diffusion dependent phenomenon at wide range temperatures for packaged food trays.

**Results:**

D (O_2)w were estimated to be 2.20×10^-10 m^2/s at 22°C and 1.24×10^-9 m^2/s at 22, 12, and 4°C, respectively. D (O_2)g values were reduced by 90-75% compared to D (O_2)w. Decreasing temperature from 22 to 4°C reduced the D (O_2)w and D (O_2)g values by 55-60%. D (O_2)w values obtained from analytical solution were 5-10% higher than those from FDM. A combined model was used to explain the decreased D (O_2)g with increasing gel concentration.

**P03-030**

**The Use of Stearic Acid and Palm Fat for the Production of Lipid Microparticles Containing Ginger Oleoresin**

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**Introduction:**

The spray chilling technique employs lipids as carriers for the formation of solid particles, and can be considered as an interesting alternative to conventional methods to form solid particles, such as spray drying. Particles obtained by this technique can be used into fat-based foods, powdered foods, or bakery products. Ginger oleoresin (GO), a dark golden brown viscous oil with flavorful properties, once carried into solid lipid microparticles, can have improved properties such as handling and pungent and volatile compounds retention, due to the protection provided by the lipid carrier from environmental factors such as light, heat, and oxygen. The aim of this work was to verify the particles properties in relation to addition of palm fat (PF) in the GO and stearic acid(SA) system.

**Method:**

The spray chilling technique was used to obtain solid lipid microparticles (SLM) loaded with GO (10%w/w). A lipid in solid state at room temperature (stearic acid 90;85,75%w/w) and a semisolid fat (palm fat 5;15%w/w) were used as carriers. The selection of these materials was based on their miscibility in GO. Microparticles behavior was verified in relation to GO compound retention by chromatography gas (GC-FID) and HPLC and physical properties by DSC, X-ray diffraction, particle size and surface morphology.

**Significance:**

This research enables the production of SLM to use in fat-based foods as controlled release of GO.

**Results:**

The use of SA as a structural lipid carrier made possible the formation of SLM at room temperature, ensuring the structural stability of the particles due to high melting point (>65°C). The mean diameter of particles with SA, PF and GO showed no significant differences when compared to the particles with the SA and GO only. The addition of PF showed less crystalline particles, analyzed by X-ray diffraction, which resulted in volatile retention of GO compounds lower than 84%. The retention of pungent compounds was not influenced by the addition of PF and showed values above 97%, for all formulations.
The surface morphology of particles was spherical and wrinkled for all treatments. Results showed that the combination of lipid carriers and the spray chilling technique presented promising results for SLM loaded ginger oleoresin.

**P03-031**

**Modeling of Mass Transfer During Osmotic Dehydration of Cherry Tomato With Sorbitol and Maltitol Solutions**

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**Introduction:**
Osmotic dehydration (OD) is used as a pre-treatment to remove the water from fruit prior to drying, freezing and freeze-drying. It is used to improve the nutritional, sensorial, and functional properties of food, and reduce post-harvest losses. There are two-way mass transfers during OD: (1) water transfers from fruit to solution, and (2) solute transfers from solution to fruit. Mass transfer kinetics during OD is a key to control and/or improve the product quality, which depends upon several process variables such as composition and the concentration of osmotic solution, immersion time, and the nature of fruit. The objective of this research was to develop a mathematical model for predicting the mass transfer during OD of cherry tomatoes with sorbitol and maltitol solutions.

**Method:**
Samples were immersed into 65°Brix sucrose, sorbitol and maltitol solutions at 30°C and a sample to solution ratio of 2:3. They were soaked until water and solid contents were almost constant (0 to 72 hours). Osmotic process kinetics were studied by analyzing water loss (WL), solids gain (SG), and weight reduction (WR). The model was developed based on mass transfer kinetics.

**Significance:**
The modeling approach integrated with relevant experimentation is potentially for design, optimization, and/or the control of process conditions. Also, the improvement of quality of osmosed products is applicable.

**Results:**
Different types of osmotic solutions and immersion time influenced content of WL, SG, and WR (p<0.05). WL, SG, and WR were higher in the first six hours due to the greater concentration gradient between the osmotic solutions and samples in the beginning of the OD process. The sample treated with maltitol showed a higher increase of WL when compared with the sample treated with sorbitol and sucrose (p<0.05). Whereas, the sample treated with sorbitol showed a higher increase of SG when compared with the sample treated with sucrose and maltitol (p<0.05). Henderson-Pabis, Magee, Newton, Page, Peleg, and Penetration's models were used to predict the equilibrium conditions, which were shown to be appropriate for WL, SG, and WR. It could not only be appropriately applied for process control, but also for simulating the real time of OD.

**P03-032**

**Influence of Carrier Agents on the Physical Properties and Morphology of Spray Dried Microparticles of Jussara (Euterpe Edulis Martius) Extract**

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**Introduction:**
Jussara (Euterpe edulis Martius) is a tropical of the Brazilian coast and its consumption can provide several benefits to health. This fruit is a rich natural source of anthocyanins, flavonoids, and phenolic and fatty acids. Anthocyanins are sensitive pigments and can easily degrade when exposed to light, oxygen and pH > 7. This work aimed to extract these compounds from Jussara pulp and to stabilize them using carrier agents by employing a spray drying process.

**Method:**
Extraction of anthocyanins was performed in an orbital shaker using ethanol and water (adjusted with citric acid pH 3.0) as a solvent. Maltodextrin with different dextrose equivalent values (10, 20 and 30 DE), gum Arabic, and maltodextrin (10 DE) with gum Arabic (25:75; 50:50 and 75:25) were evaluated as carrier agents in the drying process. Microparticles were analyzed in relation to moisture content, water activity, hygroscopicity, glass transition temperature, particle size distribution, anthocyanins retention, identification and quantification of individual anthocyanins, and microstructure.

**Significance:**
An extraction process of anthocyanins associated with spray drying technique was shown to be a good alternative to promote the stabilization of these pigments, resulting in particles which can be used in food or pharmaceutical products.

**Results:**
The spray drying process produced microparticles with high anthocyanins retention, above 88%. Individual anthocyanins profiles observed in the chromatograms (cyanidin 3-rutinoside and cyanidin 3-glucoside) were similar to the microparticles and Jussara extract. Particle mean diameter presented typical characteristic of spray dried powders. Glass transition temperature of the particles was influenced by the moisture content and molecular weight of the carrier agents. All the samples presented glass transition temperature above 75°C, except those of maltodextrin 30 DE. Maltodextrin 30 DE produced microparticles with higher hygroscopicity and the lowest glass transition temperature. The ones produced with maltodextrin 10, 20, and 30 DE showed smoother spherical surface than particles constituted with gum Arabic, which presented irregular and rough surface. The increasing hydrolysis degree of maltodextrin provided a higher amount of smooth shaped particles. Anthocyanins presented a natural ability to fluoresce, generating sufficient contrast in the confocal microscopy analysis, where we could see a homogeneous pigment distribution in the whole particle structure, which may indicate a possible encapsulation of anthocyanins.

**P03-033**

**Fabrication of S/O/W Emulsions to Encapsulate Lactase for Retained Enzymatic Activity During Dehydration, Heating, and Storage**

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**Introduction:**
To supply milk products to lactose-intolerant consumers, lactase is hydrolyzed by lactase to produce lactose-free milk, but the adopted processes change quality parameters such as turbidity, viscosity, and flavors. Alternatively, lactase can theoretically be encapsulated to remain inactive in milk until being released after ingestion to hydrolyze lactose in vivo. The objective of the present work was to study solid/oil/water (S/O/W) emulsions as encapsulation systems to fabricate delivery systems of lactase.

**Method:**
Spray-dried lactase powders were prepared from four types of lactase products. To encapsulate lactase, spray-dried powder was suspended at 20% w/v in an oil phase with 90% w/v anhydrous milk fat and 10% w/v Span® 80 at 40°C, while aqueous solutions with 5% w/v whey protein isolate or sodium caseinate and 1% w/v lecithin were prepared at neutral pH. The S/O suspension was emulsified into the aqueous protein solution at volume ratios of 1:6 and 1:8 to prepare S/O/W emulsions that were determined for hydrodynamic diameter and zeta potential. The S/O/W emulsions were treated with and without dissolving 5% v/v skim milk powder were spray-dried. The residual activity and heat stability of lactase in spray-dried powder were determined after hydration in water. Hydrolysis of lactase in full-fat milk hydrated with spray-dried powder was evaluated during storage at 4°C for up to three weeks.

**Significance:**
The present findings suggest S/O/W emulsions are potential delivery systems to incorporate lactase in milk.

**Results:**
The highest efficiency of encapsulating lactase in S/O/W emulsions was about 76%, and the corresponding emulsion had a hydrodynamic diameter of 357.3 nm and a zeta potential of -17.03 mV. Incorporation of skim milk powder in emulsions reduced free lactase from 41% to about 25% after spray drying. About 54% and 98% of activity was lost after heating free lactase at 60 and 72°C for 30 min, while more than 50% of activity was retained for the encapsulated lactase. The hydrolysis of lactase in full-fat milk after 3-week storage reduced from about 80% for free lactase to <20% for encapsulated lactase.

**P03-034**

**Development of Healthy Crispy Carrot Snacks Using Sequential Infrared Dry-Blanching and Hot Air-Drying Methods**

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**Introduction:**
Carrots are rich in β-carotene and fiber, which are beneficial to human health, and low in fat. There is limited availability of ready-to-eat snack foods rich in these nutritious ingredients. Freeze dried carrots can be used to produce crispy and crunchy ready-to-eat snack foods; however, the method has low processing and energy efficiencies. The objective of this research was to develop a crispy carrot product using the sequential infrared (IR) dry-blanching and hot air-drying (SIRDHAD) method and optimize the drying conditions.

**Method:**
a single layer of carrot slices of 1.0mm thickness was dried using electric IR emitters at the product temperatures of 60, 65, and 70°C to a target moisture content of about 8%. The results showed that the carrot slices dried at 70°C had a 10% and 20% greater drying rate and 17% and 23% shorter drying time than the samples dried at 65 and 60°C, respectively. Therefore, the carrot slices were dried at 70°C using IR and the drying was completed. The IR drying was done to remove about 40%, 50%, and 60% of moisture in the carrots and the pre-dehydrated carrot slices were dried by hot air to a final moisture content of 3%.

**Significance:**
The research results revealed that the SIRDHAD method could be applied to produce high quality healthy and crispy carrot snacks with improved processing and energy efficiencies.

**Results:**
The drying rate and quality characteristics of carrots, including color, crispness, and shrinkage ratio, were evaluated and compared with that of hot air drying. The results showed that the SIRDHAD dried carrots had more desirable red color and crispness than that of hot air dried ones. The SIRDHAD method also showed significant reduction of the drying time, indicating a great energy saving potential.
**P03-035**

**Determination of the Temperature Dependence of Heat Transfer Coefficient in the Natural Convection of Non-Newtonian Liquid Prepared With the Extraction of Opuntia Humifusa**

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**Introduction:**
Natural convection is an essential physical phenomenon often found in the thermal processing of liquid food. Determination of heat transfer coefficient (HTC) for the natural convection is important in designing a thermal process or conducting a numerical simulation. *Opuntia Humifusa* (OH), a cactus species, contains several important nutritional components, such as complex polysaccharides. The complex polysaccharides are the major component influencing the non-Newtonian flow behavior of OH extract (OHE). Because of the high temperature dependence of viscosity of OHE, the HTC of OHE in natural convection varies during the unsteady state thermal process. Although there have been many studies on the thermal processing or the numerical simulation of liquid food, there is no clear method to determine the HTC of non-Newtonian fluid under the unsteady state thermal process.

The objectives of this study were to (1) determine the activation energy of OHE, (2) develop a group of dimensionless number to represent the non-Newtonian flow behavior of the OHE in a natural convection, and (3) analyze the heat transfer phenomena of the OHE in a thermal process in a cylindrical can geometry using a finite volume method.

**Method:**
The concentration of OHE was adjusted to 1.5% and 3% using the distilled water and freeze-dried stem extract of the OH. Numerical simulations were performed using ANSYS Fluent. Dimensionless numbers to estimated HTC were calculated during the unsteady state heat transfer. The temperature dependence of HTC was embedded with the ANSYS Fluent using a user-defined function (UDF).

**Significance:**
This study clearly demonstrated that the HTC of natural convection of a non-Newtonian fluid varies with temperature and it has to be associated with the heat transfer model.

**Results:**
The powder law model suitably described the flow behavior of OHE at varied concentration. The activation energy was between 9385.68 and 9522.86 J/mol, depending on the concentration. The HTC estimated using a group of dimensionless numbers showed a linear dependence on the temperature during the unsteady state heat transfer. The unusual linear increase of the temperature of OHE during the thermal process was well described with the heat transfer model associated with the HTC function.

**P03-036**

**Spray Drying of Pomegranate Juice Using Maltodextrin/Cyclodextrin Blends as the Wall Material**

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**Introduction:**
Microencapsulation can pack sensitive nutrients into a coating material to preserve them, mask flavors, or to aid in delivery. The objective of this study was to evaluate the effectiveness of adding cyclodextrin with maltodextrin in spray dried pomegranate juice, and observing the effect drying temperature has on the blends.

**Method:**
Different ratios of maltodextrin-cyclodextrin (20:0, 19:1, and 17:3 % w/v) were mixed with pomegranate juice and spray-dried to examine the effect on astringency and physical properties. The drying was carried out in a laboratory spray dryer (Pulvis GB 22 model) at inlet air temperatures (120, 140 and 160°C), and air pressure (0.45). Parameters evaluated were water activity, % water content, color, pH, soluble solids (Brix), and methyl cellulose-precipitable tannin assay (MCPTA) in reconstituted powders.

**Significance:**
The results show that spray drying fruit juice with a combination of dextrins affects the physical properties and the astringency. These results may extend to spray drying of other natural products.

**Results:**
The greatest concentration of cyclodextrins (17.3 %w/v) caused a slight, but significant increase in pH and Brix over the other formulations. Water activity and percent water content were least in the samples dried at 160°C, although maltodextrin only sample retained the least water and had the least water activity, while samples with cyclodextrin held more water when dried at 160 and 140°C. Drying at 120°C, the 19:1 ratio held the least water and had the lower water activity. Increased cyclodextrin (17.3 %w/v) resulted in higher hue angle. The 120°C drying temperature, also increased hue angle. The 3% cyclodextrin and the 120°C resulted in more yellowish hue angle, while the malto-dextrin dried samples at 160°C had more a red hue angle. The chroma values were greatest for the samples dried at 120°C, meaning they were the most vivid. Meanwhile, the 140 and 160°C dried samples with the 17.3 blends were less vivid. The MCPTA indicated that 120°C drying caused greater astringency than 140 and 160°C drying.

The blending of cyclodextrins to maltodextrins for spray drying slightly increased the water activity, decreased astringency assay at the 1% cyclodextrin concentration, and slightly affected color.

**P03-037**

**Multilayer Emulsions of Chia Oil Stabilized by Whey Protein/Pectin Microencapsulated by a Spray Dryer**

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**Introduction:**
Chia seed oil has a high content of α-linolenic acid (60%) and linoleic acid (30%). Use of this oil in different products is limited due to its liquid state, and the presence of insaturation is a trigger for oxidation. In this context, the aim of this work was to produce microparticles of chia oil by spray drying emulsions stabilized by whey protein concentrate (whey protein concentrate = oil) was produced by homogenization in a rotor-stator (12,000rpm/1 min) followed by 3 passes at 250 bar in a high-pressure homogenizer. 2- Pectin was added into the primary emulsion and homogenized in a rotor-stator (12,000 rpm/1 min) followed by 1 pass at 250 bar in a high-pressure homogenizer. 3- wall materials (maltodextrin 10 DE or modified starch Hi-Cap® 100) were added into the emulsion formed in the second step, in pure form, and the final emulsion was homogenized in a rotor-stator (16,000 rpm/4 min). The final emulsion was composed of 0.5% (w/w) of whey protein concentrate, 0.5% (w/w) of pectin, 6.0% (w/w) of Chia and 23.0% (w/w) of wall materials. For comparison, emulsions stabilized by whey protein concentrate without the addition of pectin were prepared. They were characterized in relation to stability, droplet size, C-potential and optical microscopy. For the microparticles, moisture content, water activity, particle size, microstructure, and oxidative stability were measured by the Rancimat method.

**Significance:**
Emulsions prepared by electrostatic layer-by-layer deposition technique associated to spray drying process are efficient to improve chia oil oxidative stability, enabling use of chia oil particles in food products.

**Results:**
Single layer and layer-by-layer emulsions showed droplet mean diameters ranging from 0.80 to 1.31 μm and D-potential varied from -6.87 to -27.43 mV. Particles mean diameter varied from 7.92 to 8.59 μm. The microparticles produced with modified starch showed smoother spherical surface than particles constituted with maltodextrin 10 DE, which presented wrinkled surface. All microparticles exhibited higher oxidative stability than chia oil in pure form.

**P03-038**

**Spray-Dried Microencapsulation of Orange Essential Oil Using Modified Rice Starch as Wall Material**

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**Introduction:**
Microencapsulation provides protection of flavors against oxidation, temperature and volatilization, allowing the release of the microcapsule content in controlled rates under specific conditions. However, commercial wall materials required for microencapsulation are expensive. Therefore, the aim of this study was to create a wall material that provides the same protection as commercial ones but at lower cost. The use of rice starch is proposed due to its low costs, high accessibility and its ability to form spherical aggregates. In the present project microcapsules of orange essential oil were obtained through spray-dried technology, using modified rice starch (MRS) along with native rice starch (NRS) and maltodextrin (MDX) as wall materials.

**Method:**
Rice starch was isolated and later modified with acetic anhydride by an extrusion process. The characterization of rice starch was performed by evaluating its physical and thermal properties. Emulsions at 30% ratio of solids and 15% of orange essential oil were prepared, homogenized and spray dried at inlet and outlet temperatures of 180 ± 5°C and 85 ± 10°C respectively and microencapsulation efficiency was evaluated.

**Significance:**
The modified rice starch is an alternative for obtaining high efficiency microcapsules at lower cost.

**Results:**
The effect of modification in the MRS provided a greater functionality decreasing viscosity (0.0289 Pa.s) and increasing water solubility index (14.89%) compared to NRS (231 Pa.s: 1.64%). As well, the gelatinization enthalpy (ΔHº) was lower 3.83 ± 0.04 Jg⁻¹ compared to NRS (ΔHº = 4.51 ± 0.24 Jg⁻¹). A lower ΔHº indicates a loss in crystallinity of the starch due to thermomechanical treatment. A thermovigravimetric analysis (TGA) showed a lower mass loss in MRS (39%) compared to NRS (48%) due to the chemical modification which decreases the amount of hydroxyl groups susceptible to degradation.

Concerning to the microcapsules obtained, the results showed a microencapsulation efficiency (%E) of 99.9% (MRS-MDX 50:50), 85.30% (NRS-MDX 50:50), 83.78% (MRS 100%), 65.61% (MDX 100%), 60.65% (NRS 100%) and 53.97% (NRS-MRS 50:50), indicating that MRS creates a resistant wall material with high encapsulation efficiency. However, this is achieved in conjunction with another encapsulating material (maltodextrin) showing the presence of a synergistic interaction between the two materials.
Introduction:
Peroxidase (PO) is a group of enzymes that widely present in fruits and vegetables and usually cause reduction in flavor, color, and storage stability of foods by catalyzing oxidative reactions. The objective of this research was to investigate the effect of pulsed light (PL) treatments on the activity and conformation of a typical peroxidase, horseradish peroxidase (HRP).

Method:
HRP were treated under different intensities (100, 300 and 500 J/pulse) and pulse numbers (1 to 10) of PL and the residual activity of enzyme after treatments was measured. The surface topography, secondary, and tertiary structures of HRP were determined using atomic force microscope (AFM), Raman spectroscopy, and fluorescence spectroscopy, respectively.

Significance:
Pulsed light could be a potential promising technology to fix the browning problem in fresh fruit juice industry.

Results:
The results showed that an increase in either intensity or treatment number (pulses) caused a rapid decrease in the activity of HRP. A complete inactivation of HRP was achieved in 10 pulses at an intensity of 500 J/pulse. AFM analysis showed that as the treatment duration increased, the HRP protein aggregated and surface roughness decreased. Results from Raman spectra showed that the PL irradiation significantly changed the content of secondary structure of HRP. It was found that the β-sheet was decreased by 14.05% while β-turn and random coil were increased by 6.20% and 6.51%, respectively. Fluorescence spectroscopy analysis exhibited that PL treatment destroyed the tertiary structures such as hydrophobic interaction of protein molecules and led to the unfolding of the molecules. The above results revealed that the PL treatment could be used to effectively inactivate the peroxidase in foods by destroying the active center of the enzyme containing the secondary and tertiary structures of protein.

P30-040
Essential Oils as Natural Fungicides to Avoid Pesticide Application in Garlic Crops
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Introduction:
In many countries, garlic (Allium sativum L.) is widely cultivated and use as a flavoring condiment in foods. The white rot caused by Sclerotium cepivorum (Berk) is the most important disease, with losses up to 100%. Chemical control is the most common way for white rot management. The objective of this study was to evaluate essential oils (EOs) as potential fungicides against S. cepivorum in order to avoid the use of synthetic pesticides commonly applied to garlic crops and improve its quality.

Method:
Five EOs extracted from different aromatic plants grown in Argentina were studied: Tagetes minuta L. (Su), Tagetes filifolia L. (An), Origanum vulgare L. spp. Vulgare (OCom), Origanum vulgare L. spp. Majoricorum (OMen), and Laurus nobilis L. (Ba). The chemical composition of EOs was analyzed by GC-MS. Anti-fungal activity of EOs was evaluated and minimum fungicide concentrations (MFC) were determined. A phytotoxicity assay was carried out to identify EO with potential negative effect on garlic.

Significance:
The studied EOs had no negative effect on garlic plants. In conclusion, An and Su could be used as fungicide to control white rot in garlic crops.

Results:
The main components were: anethole (63.80%), estragole (23.81%) and spathulenol (3.20%) in OCom; verbenone (28.31%), cis-tagetone (18.73%) and trans-β-ocimene (13.40%) in Su EO; 1,8 cineole (42.43%), linalool (15.19%) and Terpinene 4-acetate (8.91%) in Ba EO; o-cineole (14.25%), 4ol-terpenein (12.48%) and thymol (10.86%) and in OCom; thymol (27.51%), terpinyl acetate (21.89%) and γ-terpinene (13.92%) in OMen. OMen, with thymol as major compound had the best antifungal activity with a MFC in 300 ppm. OCom was also effective with a higher MFC (800 ppm). However, both essential oils inhibited completely the plant growth and had strong phytotoxic effects. Su had a MIC in 700 ppm but also showed phytotoxic effects on garlic plants. An and Ba showed both moderate antifungal activity with the same MFC (600 ppm) but no phytotoxic effects.

P03-042
Comparative Transcriptome Analysis Between Listeria Monocytogenes WaxX12 and Delta sig8 Mutant Revealed by RNA-Seq
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Introduction:
Listeriosis in humans and animals is caused by Listeria monocytogenes, which exist in various environments. The general environmental stress response, controlled by the alternative sigma factor, σ8, has an important role for bacterial survival.

Method:
To elucidate the σ8-regulated genes and their expression level directly, we compared the transcriptome of L. monocytogenes WaxX12 and its delta sig8 mutant by RNA-Seq technology.

Significance:
Our findings provide the basis for future research on novel development at a molecular level in L. monocytogenes under different environments.

Results:
The results showed the assembly formed into 3,048 unigenes referring to EGD-e genome in WaxX12. GO analysis indicated these unigenes across 45 categories within the three ontologies, “molecular function,” “cellular component,” and “biological processes.” Furthermore, the genes and enzymes involved in the biosynthesis were predicted according to the sequencing and annotation results. The Fructose and mannose metabolism was the most significant difference (p<0.05) changed in metabolic pathways from KEGG. Comparative transcript analysis displayed 123 positive and 17 negative genes under control of σ8. We used quantitative real-time PCR verifying the expression profiles of 7 different genes, and confirmed the reliability of all the 140 regulated genes.
Significance:
This study quantified the effect of salt and sugar on the D values of S. Enteritidis in liquid egg products and provides references for selecting heating treatments for liquid egg white and egg yolk containing salt or sugar.

Results:
In liquid egg white, mean D50, D51, D52, and D53 values of S. Enteritidis were 8.9, 4.3, 3.5, and 1.5 min, respectively. In liquid yolk, the mean D55, D58, D60, and D62 values were 9.7, 5.3, 3.1, and 0.8 min, respectively. The z values of S. Enteritidis in liquid egg white and yolk were 4.2 and 6.8°C, respectively. A model describing the D values as a function of solute concentration and heating temperature was developed. The model showed that salt or sugar increased the D values of S. Enteritidis. Salt increased the D values more than sugar in liquid egg yolk, while sugar increased the D values more than salt in liquid egg white.

P03-045
Identification of β-Glycosidase Activity of Lactobacillus Buchneri URN-0103 and Its Potential in Conversion of Ginsenoside Rb1 from Panax Ginseng
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Introduction:
Lactic acid bacteria (LAB) exhibiting extracellular β-glucosidase activity are present in fermented plant foods. A certain LAB strain possessing β-glucosidase activity may have a potential in conversion of ginsenoside Rb1 from Panax ginseng. The objectives of this study were to isolate the LAB strain having β-glucosidase activity from fermentation products of Korean plant foods, and examine the hydrolytic activity of the identified β-glucosidase on conversion of saponin (Korean ginsenoside) to other functional ginsenoside metabolites.
Method:
All LAB strains were extracted from the experimental fermented Panax ginseng. TLC and reverse-phase HPLC equipped with Prontoil 120-5 C18 ACE-PS column (4.6x250 mm) were used to isolate the specific strain showing positive β-glucosidase activity in the Esculin Iron Agar test. The isolated LAB strains were identified by the 16S rDNA analysis.
Results:
Of the 61 types of LAB exerting positive β-glucosidase activity in the Esculin Iron Agar test, only one LAB (URN-0103) was found to exhibit high hydrolytic activity on ginsenoside Rb1. The URN-0103 strain was identified as Lactobacillus buchneri (99% homology for Lactobacillus buchneri NIRRL 30929). The URN0103 reacted with ginsenoside Rb1 at 35°C and pH 5.0 during 14 days, and β-glucosidase activity of this LAB strain showed the distinct ability of converting ginsenoside Rb1 to minor ginsenosides Rd and Rg3. The URN0103 had higher enzymatic activities of leucine arylamidase, valine arylamidase, α-galactosidase, β-galactosidase, and β-glucosidase than other strains exhibited.
Significance:
It was concluded that the β-glucosidase activity of Lactobacillus buchneri URN0103 isolated from Korean fermented plant foods can effectively convert ginsenoside Rb1 into Rd and Rg3. The converted ginsenoside could be used in food and cosmetic industries for the manufacture of yogurts, beverage products, cosmetics and other health products.

P03-046
Isolation and Partial Characterization of Two Bacteriophages φMV-1 and φMV-4 of Histamine-Producing Morganella Morganii
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Introduction:
Scombroid or histamine poisoning is one of the most common seafood-borne diseases in fish. Morganella morganii is considered as one of the important histamine producer, and the main responsible for histamine accumulation during storage of seafood products. Bacteriophage (phage)-based application has much recent interest in an alternative agent for controlling or reducing food-borne pathogens in food. In this study, we described the isolation and preliminary characterization of phages φMV-1 and φMV-4 active against M. morganii.
Method:
Phages infecting M. morganii were isolated from various river waters using M. morganii (NRRLB 30929). The URN0103 reacted with ginsenoside Rb1 at 35°C and pH 5.0 during 14 days, and β-glucosidase activity of this LAB strain showed the distinct ability of converting ginsenoside Rb1 to minor ginsenosides Rd and Rg3. The URN0103 had higher enzymatic activities of leucine arylamidase, valine arylamidase, α-galactosidase, β-galactosidase, and β-glucosidase than other strains exhibited.
Results:
Phages infecting M. morganii were isolated from various river waters using M. morganii (NRRLB 30929). The URN0103 reacted with ginsenoside Rb1 at 35°C and pH 5.0 during 14 days, and β-glucosidase activity of this LAB strain showed the distinct ability of converting ginsenoside Rb1 to minor ginsenosides Rd and Rg3. The URN0103 had higher enzymatic activities of leucine arylamidase, valine arylamidase, α-galactosidase, β-galactosidase, and β-glucosidase than other strains exhibited.
Significance:
This study quantified the effect of salt and sugar on the D values of S. Enteritidis in liquid egg products and provides references for selecting heating treatments for liquid egg white and egg yolk containing salt or sugar.

Results:
In liquid egg white, mean D50, D51, D52, and D53 values of S. Enteritidis were 8.9, 4.3, 3.5, and 1.5 min, respectively. In liquid yolk, the mean D55, D58, D60, and D62 values were 9.7, 5.3, 3.1, and 0.8 min, respectively. The z values of S. Enteritidis in liquid egg white and yolk were 4.2 and 6.8°C, respectively. A model describing the D values as a function of solute concentration and heating temperature was developed. The model showed that salt or sugar increased the D values of S. Enteritidis. Salt increased the D values more than sugar in liquid egg yolk, while sugar increased the D values more than salt in liquid egg white.
Introduction: The antifungal activity of mustard essential oil (MEO) has been demonstrated, particularly when MEO was tested by direct contact. However, there is scarce information on the antimicrobial effect of vapors generated by MEO especially when tested using short exposure times. In this study, the inhibitory effect of MEO applied in vapor phase using short or long exposure times was evaluated in vivo against Aspergillus niger on inoculated tomatoes (Solanum lycopersicum L.).

Method: MEO minimum inhibitory concentration (MIC) was determined by inoculating tomatoes with 5 µL of A. niger suspension at four points around the stem and placed into hermetic containers with a filter paper impregnated with selected concentrations (0.00, 0.01, 0.15, 1.1, 1.0, 6.16, or 9.24 µL/Lair) of MEO. Inoculated fruits were incubated for 10 days at 26°C and observed daily for mold growth. MIC was defined as the minimal tested concentration that inhibited mold growth. To evaluate short exposure times of MEO, tomatoes were inoculated and placed into hermetic containers with a filter paper impregnated with MIC, double MIC, triple MIC, ¼ MIC, ½ MIC, or ¾ MIC and exposed for 30, 45 min, 1, 2, 4, or 24 h. After tested exposure time, tomatoes were then placed in empty sealed containers, incubated for 10 days at 26°C, and observed daily for mold growth.

Results: After 10 days of incubation, MIC was 3.08 µL/Lair while results for short exposure times demonstrated that it is possible to inhibit A. niger growth on tomatoes when exposing the fruits to the MIC for 30 min. Other treatments that had similarly effective antifungal effect were ¼ MIC (2.31 µL/Lair) and ½ MIC (1.54 µL/Lair) for 24 and 1 h, respectively. In vivo results prove the effectiveness of vapors of mustard essential oil against A. niger.

Significance: The tested essential oil contains highly volatile organic compounds with strong inhibitory effects, so mustard essential oil could be considered a good alternative to traditional synthetic antimicrobials. Further studies regarding its sensory compatibility with selected foods could lead to the development of new and distinct products.
compounds related to irradiation off-odor. Triacetyl β-cyclodextrin (TACD) is a derivative of β-cyclodextrin (β-CD), which has a large hydrophobic pocket inside the structure, and thus can be used as a functional packaging ingredient to trap off-odor volatiles with the enhanced compatibility for polyolefins such as low-density polyethylene (LDPE). The objective of this study was to determine the effect of TACD-impregnated LDPE matrix film and fibers in trapping volatile sulfur compounds using model systems.

Method:
The LDPE film and fibers using β-CD or TACD were produced by cast-film extrusion and electrospinning methods (with cyclohexane/dimethylformamide solvent mixture), respectively. Different amounts of packaging film (0.1 and 0.5 g) or fibers (0.05 and 0.1 g) containing either 5% β-CD or TACD were weighed into a 43.7 ml sample vial and added with a 4.37 µl (100 ppm) of DMDS, DMS or CDS. Five microlitres of the headspace were injected into a GC-MS after 24 h of storage at room temperature and the amount of sulfur compounds remaining in the headspace was compared with the control without LDPE film or fibers.

Significance:
In conclusion, TACD-impregnated LDPE film or fibers have potential to reduce sulfur compounds and minimize irradiation-induced off-odor from irradiated meat.

Results:
Between the TACD and β-CD (powders, film, and fiber forms), TACD performed better than β-CD in trapping sulfur compounds. Among the three sulfur compounds tested, DMDS had the highest affinity to TACD and β-CD. When 0.05g of TACD powder was used, 82.7% of DMDS, 20.9% of DMS, and 19.4% of CDS were removed after 24 h of storage. With the 0.1g of TACD film, 38.5, 15.3 and 17.1% of DMDS, DMS and CDS, respectively, were trapped. With the 0.1g of TACD fibers, 44.9, 12.0, and 20.7% of DMDS, DMS, and CDS, respectively, were chelated. This indicated that the film performed better than the powder, but the trapping efficiency of the fibers was better than the film form.

P03-054
Antimicrobial Activity of Skate Skin Gelatin Films Incorporated With Thyme Essential Oil and Application in Chicken Tenderloin Packaging

K. Song, Chungnam National Univ., K. Lee, J. Lee, H. Yang, Email: kbsong@cnu.ac.kr

Introduction:
There is increasing interest in finding new eco-friendly and biodegradable film base materials. Skate (Raja kenojei) is a popular fish in South Korea because of its unique taste and flavor; a large amount of by-products consisting of skin and bone are generated during its processing. In particular, skate skin contains high amounts of collagen. Fish gelatin obtained from the hydrolysis of collagen has good film-forming abilities and therefore it can be used as a new film base material. The purpose of the present study was to examine the feasibility of preparing a skate skin gelatin (SSG) film from skate skin to develop the antimicrobial SSG film incorporated with thyme essential oil (TEO), and apply it to the packaging of chicken tenderloin.

Method:
Gelatin was extracted from skate skin and the SSG film was prepared. In addition, TEO was incorporated in the SSG film as an antimicrobial agent for the preparation of an antimicrobial film. The mechanical properties and antimicrobial activities of the SSG film containing TEO were determined.

Significance:
These results suggest that the SSG film with added TEO has potential to act as active food packaging to extend the shelf life of chicken tenderloin.

Results:
The tensile strength (TS) and water vapor permeability (WVP) of the film decreased by 16.16 MPa and 0.33 x 10^-9 g/m²s/Pa, respectively, whereas elongation at break (E) increased by 120.73% with the addition of TEO. As the concentration of TEO in the SSG film increased, the Hunter b value increased from 4.26 to 11.69, indicating that the color of the SSG film became more yellow. In addition, the SSG film containing TEO showed increased antimicrobial activity against Listeria monocytogenes and Escherichia coli O157:H7 as TEO concentration increased. The packaging of chicken tenderloin with the TEO-containing SSG film inhibited the growth of L. monocytogenes and E. coli O157:H7 compared to the control during storage. After 10 days, the chicken tenderloin wrapped with the SSG film containing TEO showed a decrease in the populations of L. monocytogenes and E. coli O157:H7 by 2.18 and 2.51 log CFU/g, respectively, compared to that observed for the control.

P03-055
Improving Stability of Lycopene in Oil-in-Water Emulsions with Polyphenol Coated Active Packaging Materials
M. Roman, Kraft Heinz, E. Decker, J. Goddard, Email: maxine.roman@gmail.com

Introduction:
Natural colors, such as lycopene, are susceptible to metal-promoted oxidative degradation that results in color loss causing a decrease in product quality and shelf life. Synthetic food additives, such as ethylenediaminetetraacetic acid (EDTA) and butylated hydroxytoluene (BHT), are effective to minimize color loss, but are not desirable to consumers who prefer ‘clear-label’ products. The aim of this study was to develop a polyphenol coated active packaging material and demonstrate its ability to inhibit lycopene degradation in oil-in-water emulsions.

Method:
Polyphenol coatings were applied to the surface of chitosan-grafted polypropylene by laccase assisted oxidative polymerization of catechol and catechin. Coated materials were assessed for iron chelating capacity, radical scavenging capacity, and inhibition of lycopene degradation.

Significance:
This study suggests that polyphenol polymer coatings can be used to prepare antioxidant active packaging materials to minimize natural color degradation in food and consumer products.

Results:
The polyphenol coated packaging material exhibited metal chelating (32.3 ± 3.3 nmol Fe3+ cm-2, pH 4.0) and free radical scavenging (3.51 ± 0.77 nmol Trolox eq. cm-2, ORAC) capacity. Polyphenol coated active packaging materials inhibited lycopene degradation in oil-in-water emulsions at pH 4.0.
Colorimeter exhibited that the surface appearance of the control had a lighter color (L*-values: Control: 38.69; Treatment 2: 35.14) and lower red to green value (A*-values: Control: 18.37; Treatment 2: 31.23), whereas the blue to yellow value (B*-values: Control: 27.7; Treatment 2: 23.82) was higher than the 100% Treatment. Additionally, the Universal Penetrometer was used and values showed that the control (431) was firmer than the two treatments (444).

Significance: The significance of this research was finding a gluten-free alternative to the production of the traditional Welsh cake that adds nutritional value. In conclusion, this product development study demonstrated that almond flour can be used as a suitable replacement for all-purpose flour in the production of Welsh cakes.

Results: Overall, the results showed that Treatment 2 was preferred by panelists almost universally in all areas except for color, however difference in color was not enough to affect the overall likability of the product.

P03-059
Antimicrobial Properties of Black Seed Oil in Various Bioplastic Trays
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Introduction: Spoilage and pathogens are two leading concerns in food services. Spoilage accounts for an estimated total retail value of $165.6 billion per year in the US with meat, poultry, and fish accounting for 41%. The CDC reported that in 2013, over 19,000 cases of food borne infection were identified, 4,200 leading to hospitalization and 80 resulting in death. Black seed (Nigella sativa) has shown potential antimicrobial properties. However, its flavor can be undesirable for consumers. Therefore, black seed should be incorporated into storage containers to deliver its antimicrobial activity. The research’s objective was to determine the impact of black seed oil (BSO) on the growth properties of spoilage and food-borne pathogens when incorporated into bioplastic trays.

Method: Corn, rice, and potato starches were used to make bioplastic trays. Rapid ViscoAnalysis (RVA) was performed on each starch to identify its thermal breakdown. The bioplastic trays were made using 90g starch, 180ml water, 6ml glacial acetic acid, 9ml glycerol, and 300 ppm BSO in the test samples. The components were sterilized under agitation until reaching 62°C. The trays were deposted in a bed and dried. Samples of beef, chicken, and shrimp were incubated and isolated with Escherichia coli K12, Staphylococcus epidermidis, or Pseudomonas putida respectively. Each protein was placed onto a bioplastic tray, covered, and refrigerated at 5°C for 5 days before measuring total bacterial load through ATP swabs and plate culture.

Significance: This information is aimed at reducing food waste from spoilage and pathogens. Additionally, the use of bioplastic trays can reduce overall environmental impact. The anticipated cost increase of the antimicrobial bioplastic storage trays can be justified by the increased safety and extended shelf life of costly, highly perishable products for food service and retail outlets.

Results: When comparing RVA values, the potato starch showed the quickest peak time but had the highest thermal breakdown. The corn starch had the slowest peak time and least thermal breakdown. The BSO was degraded in the microwave heating on the rice bioplastic substrate. The rice-based bioplastic showed a reduction in E. coli, while the potato-based bioplastic showed a reduction in Staphylococcus. No difference was determined in the corn-based bioplastic.

P03-060
Effects of Fermentation With Lactobacillus Acidophilus on Volatile Compounds in Garnet Sweet Potato
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Introduction: Sweet potatoes are rich in nutrients such as Vitamin A, Vitamin B5, B6, thiamin, niacin, riboflavin, and carotenoids. They serve as an important daily food supply in many countries. Current cooking methods such as boiling, frying, baking or roasting can provide special flavor for sweet potatoes; however, there is negative correlation between thermal processing and loss of nutrients. Fermentation is a desirable method for improving both bioavailability of nutrients and flavor of sweet potatoes. This study was performed to evaluate effects of fermentation with Lactobacillus acidophilus on volatile compounds in garnet sweet potato.

Method: Garnet sweet potato was ground, further inoculated with 10% Lactobacillus acidophilus, and incubated at 37°C for 24 h. A solid-phase microextraction (SPME) needle containing polydimethylsiloxane (PDMS) fiber was exposed to the sweet potato mash headspace to perform the volatile extraction for 30 min. Then, the fiber was injected into a gas chromatography–mass spectrometer (GC-MS) for volatile analysis. Two independent experiments were performed. All data were statistically analyzed.

Results: Compared with fresh sweet potato, the number of volatile compounds in fermented sweet potato significantly increased from 7 to 26. Those compounds could be clustered as alcohols, aldehydes, terpenes, furans, ketones and esters. Benzaldehyde and benzeneacetaldehyde were found in both fresh and fermented sweet potatoes. In the fermented sample, β-cadinen was identified as the most abundant compound which was accounted for 41.7% of the total volatiles, followed by cypere ne and nerol (8.0% and 6.7%, respectively). Other terpenes including 1,4,7-cycloundecatriene-1,5,9-tetramethyl-2,2,2, α-guaiaene, isolide, rotundene, germacrene D, and germacrenes B were in a range of 0.9 to 3.3%. Linalool, phenethyl alcohol, 7-epi-eudesmol were the three primary alcohols in fermented sweet potato with 80.1, 1.04, and 0.30%, respectively.

Significance: This study reported that the fermented sweet potato contained a large amount of terpenes, which have been reported to contribute to antioxidant, anti-inflammatory and anti-anxiety functions, cell regulation, and cancer prevention. Therefore, fermentation with the probiotic Lactobacillus acidophilus will not only enhance the flavor of sweet potato, but also may provide health promoting functions.

P03-061
Using Elderberry (Sambucus Nigra) Fruit for Making an Alternative Beverage
W. Tangham, McNesse State University, B. Swati, F. LeMieux, S. Srironggutikorn, Email: wttangham@mcsneeds.edu

Introduction: Elderberry (Sambucus nigra) is an alternative to more common fruit beverage choices. Elderberry holds unique phytochemical properties that are thought to be antioxidant, anti–cancerigenic, immune-stimulating, antibacterial, anti-allergic, and antiviral. The objective of this study was to evaluate specific attributes of six elderberry preparations. These include elderberry mixtures of 1%, 3%, and 5% from both commercial and fresh preparations, as well as 100% alcoholic and fermented samples. The evaluators were panelists from McNesse State University.

Method: Panelists were trained in evaluating consumer acceptance and purchase intent. Additionally, the beverage products were assayed for certain physicochemical characteristics and undesirable microorganisms. Using a 9-point hedonic scale, 115 participants evaluated the elderberry beverages for consumer product acceptance and purchase intent. Additionally, the beverage products were assayed for certain physicochemical characteristics and undesirable microorganisms. Using a 9-point hedonic scale, 115 participants evaluated the elderberry beverages for consumer product acceptance and purchase intent. Additionally, the beverage products were assayed for certain physicochemical characteristics and undesirable microorganisms. Using a 9-point hedonic scale, 115 participants evaluated the elderberry beverages for consumer product acceptance and purchase intent.

Results: The best improvement of total phenolics (14.96%) and antioxidant capacity (9.14%) was found in Treatment 2 with controls occurred at 100% power and 2 minutes of sonication. Lower power density treatments had an opposite effect; 30% power treatment for 30 seconds resulted in a 15.57% decrease in total phenolics and 100% power for 30 seconds showed a 2.14% increase (3.46%) in antioxidant capacity. PAL activity was not affected by these treatments. The best enhancement of total phenolics (21.49%) was with two exposures to 100% power for 30 seconds, with a one week interval between treatments. The optimal recovery time was 72 hours.

Significance: This research demonstrates the potential application of minimal plant stress, such as sonication, to the enhancement of secondary metabolite production in hydroponic lettuce. This optimization could ultimately be tailored to optimization of quality of leafy green production in urban gardening and vertical farming scenarios.

P03-062
Using Elderberry (Sambucus Nigra) Fruit for Making an Alternative Beverage
W. Tangham, McNesse State University, B. Swati, F. LeMieux, S. Srironggutikorn, Email: wttangham@mcsneeds.edu

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Significance: This research demonstrates the potential application of minimal plant stress, such as sonication, to the enhancement of secondary metabolite production in hydroponic lettuce. This optimization could ultimately be tailored to optimization of quality of leafy green production in urban gardening and vertical farming scenarios.
Results:
Overall liking scores from the hedonic analysis indicated that 1% fresh elderberry concentration was the most desirable at 6.83 and the 5% fresh concentration was least desirable at 5.95. From the acceptability and purchase intent questionnaires, the 1% fresh concentration again scored the highest at 92.0% and 65.0%, respectively. Concerning the physiochemical characteristics, “Brix for the commercial elderberry beverage ranged from 12.6 to 14.60 in the 1% and 5% concentrations, respectively. For the fresh, “Brix ranged from 12.53 to 14.0 in the 1% and 5% concentrations, respectively. Moisture content, L* values, pH and TBARS values were nominal throughout 28 days of storage. With respect to aerobic plate counts, E. coli, yeast/mold and Listeria counts, the 1% fresh elderberry concentration exceeded safety levels within the 28 days of storage. Additionally, safety levels of Salmonella were maintained throughout this period.

Significance:
Our preliminary finding suggest that elderberry as a beverage exhibits a viable potential product.

P03-062
Effect of pH and Temperature on Peroxidase and Polyphenoloxidase Activities of Coffee Skin-Pulp Byproduct
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Introduction:
There is a trend towards efficient utilization and value-addition of agro-industrial residues such as coffee by-products. Coffee skin-pulp is rich in anthocyanins and it is not yet exploited. The red color is rapidly lost resulting in browning, which may be caused by anthocyanin stability loss or degradation. Peroxidase (POD) and polyphenol oxidase (PPO) are usually related to browning and discoloration of several fruits. This study aimed to evaluate pH and temperature influence on peroxidase and polyphenoloxidase activities in coffee skin-pulp.

Method:
POD and PPO crude extracts were prepared. The effect of different pH and temperature on enzyme activity was evaluated. Guaiacol and chlorogenic acid were POD and PPO substrates respectively. A response surface methodology using a rotatable central composite design for each enzyme was applied with two independent variables: pH (2.5 - 9.5) and temperature (4-70°C). Additionally, POD and PPO activities on cyanidin-3-rutinoside and cyanidin were assessed using HPLC by measuring substrates reduction percentage after one hour of reaction under optimum enzymatic conditions previously identified.

Results:
A second-degree equation for independent and response variables was computed for both enzymes. A contour plot of the quadratic response surface model showed a maximum surface with a maximum activity in the center contour for POD and a surface shaped like a saddle for PPO, which means that the estimated surface did not have a unique maximum. Both enzymes showed maximal activity between 23°C and 37°C and pH 5.0 to 6.5. POD activity remained high between pH 4.25 and 7 in combination with temperatures between 17°C and 70°C. POD activity was very low at pH below 4.5 and above 7.5 independently of temperature and above 55°C independently of pH. POD activity decreased at pH below 4 or above 8 at temperatures below 30°C and pH above 8 at temperatures above 40°C. Both enzymes presented high activity on cyanidin-3-rutinoside and cyanidin, although it was higher for the anthocyanidin.

Significance:
Identifying optimal pH and temperature of coffee skin-pulp deterioration enzymes offers opportunities to develop products with a very attractive red color and high antioxidant activity.

P03-065
Antifungal Activity of SPI-Based Films Enriched With Essential Oils and Postharvest Application of Coatings on Quality of Persian Lime (Citrus latifolia Tanaka)
M. Calderon-Santoyo, Instituto Tecnológico de Guadalajara, J. Ragazzo-Sánchez, D. Konuk, L. Razetti, Email: montserratcalder@gmail.com

Introduction:
There is a new tendency in food technology preservation to develop organic materials as a promising cash crop, most especially among small producers. However, its high perishability presents challenges to marketing fresh edamame.

Method:
Perishability presents challenges to marketing fresh edamame. One alternative is the use of vacuum impregnation.

Significance:
This new knowledge will be useful when combining vacuum impregnation with non-thermal decontamination treatments such as irradiation as a means to increase the phenol level of blueberries while ensuring their safety.

P03-067
Role of Steam Blanching and Vacuum Packaging on the Physical and Microbiological Quality of Fresh Vegetable Soybean (Edamame) During Storage
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Introduction:
The large-seeded green vegetable soybean, edamame, is considered to be a superfood due to its many health benefits, and it has been gaining popularity among farmers as a promising cash crop, most especially among small producers. However, its high perishability presents challenges to marketing fresh edamame.

Method:
This study therefore investigated the use of the combination of steam blanching, vacuum packaging and cold storage for prolonging the physical and microbiological quality of edamame. The data obtained from samples of each treatment were subjected to analysis of variance and Duncan’s multiple range test (SAS Institute, Cary, NC) to determine if significant difference (P ≤ 0.05) existed between mean values of treatments.

Results:
Steam blanching for 30 sec at 90°C significantly increased the green color intensity of whole pod edamame by 35.5% and shelled bean edamame by 28.3%. At the same time, the hardness of whole pods did not significantly change but the hardness of beans significantly decreased by 16.3%. The green color intensity of whole pods subjected to the treatment combination was significantly higher than that of the control sample.
at the end of a 30-day cold (4°C) storage. Steam blanching whole pods significantly reduced the total counts of aerobic mesophiles (>5.1 log CFU/g), yeasts and molds (>4.3 log CFU/g), and psychrophilic (>4.0 log CFU/g), and no significant increase in overall microbial counts was observed during 4°C refrigeration for <9 days. Residual total aerobic mesophile and psychrophilic counts (<2.0 and <1.0 log CFU/g, respectively) on treated product stored at room temperature (22°C) increased to >7.2 log CFU/G within 3 days. The current study demonstrated that cold storage at 4°C effectively prevented the proliferation of microorganisms on treated product, but it also showed that microbial counts can rebound on treated product at 22°C.

Significance:
The combination of methods used in this study is environmentally friendly and easily adaptable to a small farm setting, giving it a great deal of potential to benefit small farmers who wish to increase profits by marketing their fresh edamame as an alternative crop.

P03-068

Effect of Processing Methods on Proanthocyanidin From Purple and Blue Corn
E. Gonzalez de Mejia, University of Illinois, C. Chen, Q. Li, P. Somavat, V. Singh, Email: edemejia@illinois.edu

Introduction:
Proanthocyanidins (PACs), also known as condensed tannins, are oligomeric and polymeric flavonoids containing catechin, epicatechin and other gallic acid esters. Because of the high degree of polymerization and galloylation, proanthocyanidins have been shown to have numerous bioactivities, such as anti-inflammatory, anti-bacterial, anti-viral, and anti-carcinogenic. The objective was to compare the concentration and type of PACs in different coproducts from commonly used corn processing methods, dry milling and wet milling.

Method:
PACs were extracted from ground corn coproducts using 1% methanolic HCl, collected after filtration and measured by the vanillin assay. Analyses were conducted in at least three independent replicates and statistical differences determined by Tukey (p < 0.05).

Results:
For wet milling, steeping water contained the highest amount of PAC (1703 ± 4.4 g catechin equivalent/kg dry corn, dc) followed by gluten slurry (313 ± 1.8 g catechin equivalent/kg dc) (p < 0.05). Other wet milling coproducts, including fiber, germ, and starch had very low PAC concentration (1.6 ± 0.2, 0.7 ± 0.1, and 0.4 ± 0.1 g catechin equivalent/kg dc, respectively). For dry milling, pericarp contained the highest concentration of PAC (435 ± 2.1 g catechin equivalent/kg dc), followed by small grits (24.3 ± 1.0 g catechin equivalent/kg dc), and large grits (10.5 ± 0.3 g catechin equivalent/kg dc). Germ and starch contained only 0.7 ± 0.1 and 0.4 ± 0.1 g catechin equivalent/kg dc, respectively. Therefore, the highest concentration of PACs in wet milling and dry milling are steeping water and pericarp, respectively. Total amount of PACs recovered from wet milling was 2043 ± 6.2 g catechin equivalent/kg dc, in comparison to the total PACs from dry milling coproducts (910.0 ± 8.5 g catechin equivalent/kg dc). Steeping water in wet milling contributed the most of the total PACs. PAC profile in coproducts had similar degree of polymerization. PACs from purple corn processing coproducts were also compared to blue corn. In conclusion, for the first time, this study reports the different amounts and composition of PACs from color corn coproducts from dry milling and wet milling. The results of reference sample analysis showed the lowest detection limits with real-time PCR is also a well-established method for this purpose. A total of 15 reference samples containing known percentages (0.1-99.9%) of pork and beef were analyzed in duplicate using real-time PCR and ELISA. Thirty commercial products, including deli meats, sausages, pet treats, and canned meats, were also tested in duplicate to assess the performance of each method with processed products.

Results:
The results of reference sample analysis showed the lowest detection limits with real-time PCR, which detected pork at 0.10% (w/w) and beef at 0.50% (w/w) in the mixture. ELISA detected pork at a level of 10.0% (w/w) and beef at 1.00% (w/w) in the reference water extract (PAW) and purple corn pure water extract (PW), passed through a resin, had total monomeric anthocyanin concentrations 56.2±1.3, 190±3.3, and 48.7±3.0 mg cyanidin 3-O-glucoside, C3G, equivalent/g extract, respectively (p<0.05). PW produced a 95.7% decrease in initial velocity at a concentration of 10 mg/ml and had the highest inhibitory effect on JAK3 with an IC50 = 0.17 mg/ml. PAW was the second most effective with a 91.9% decrease at 10 mg/ml and IC50 = 0.22 mg/ml (p<0.05). RAW (10 mg/ml) had an 80.4% decrease in the reaction with an IC50 = 0.87 mg/ml. Pure C3G at a concentration of 1 mg/mL resulted in a 71.6% inhibition and IC50 = 0.61 mg/ml. Computational docking predicted the placement and binding affinity of C3G in the binding pocket of JAK3 with a free energy equal to -4.71 kcal/mol and a Ki of 351 μM. Interactions between cyanidin-3-glucoside, peonidin-3-glucoside, and pelargonidin-3-glucoside in the color corn extracts could account for their increased effectiveness in inhibiting JAK3.

Significance:
The ability of anthocyanins to inhibit JAK3 has positive implication for human health, potentially in the decrease of inflammation.

P03-070

Three-Phase Partitioning of the Milk-Cloting Proteases From Solanum Elaeagnifolium Berry
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Introduction:
Proteases are the most commercialized enzymes used in several biotechnological applications. Proteases from Solanum elaeagnifolium berry have been considered as good renewable substrates for commercial application in artificial Asadero cheese-making process. However, studies on enzymatic extract preparation and evaluation of its properties is required. A three-phase partitioning (TPP) technique for the partial purification of its proteases was evaluated.

Method:
Factors such as pH, NH4SO4 concentration and type of solvent (iso- and tert-butanol) on the yield and purification factor were evaluated by the determination of protein content and proteolytic (PA) and milk-clotting activity (MCA). SDS-PAGE analysis was used to monitor the protein purification.

Results:
Results indicated that proteases from S. elaeagnifolium berry were preferentially partitioned in the interfacial precipitate phase and that all factors affected the yield and purification factor. A significant (p<0.05) increase in the purification factor for specific PA and MCA (2.3 and 2.4 folds, respectively) was obtained in comparison with NH4SO4 precipitation protocol. The PA and MCA activity recovery yielded values higher that 80%, with the highest values when using 60% NH4SO4 and tert-butanol as solvent (yields over 95%). No effect of pH and NH4SO4 concentration was observed using isoamylol as solvent. However, both factors (pH and NH4SO4 concentration) had a significant effect (p<0.05) in the yield and purification factor when tert-butanol was used as solvent. SDS-PAGE analysis showed a similar protein pattern for all treatments, but different from the berry crude extract used as the control sample.

Significance:
The high protease yield obtained from S. elaeagnifolium berry by TPP (higher than 80%) indicated that this method represent an attractive option in pre-purification procedures to obtain enzymatic preparations for cheese-making or other biotechnological processes.

P03-071

Comparison of DNA and Protein-Based Methods for Species Detection in Ground Meat Products
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Introduction:
Mislabeling of ground meat products can occur when meat species are mixed together or purposefully substituted for cheaper alternatives. This practice can lead to unfair economic gain, infringe on religious practices, and create potential health risks. To detect the optimal method for species identification within ground meat products, both methods were directly compared based on sensitivity, repeatability, cost, time, and ease of use.

Method:
Two commonly used methods for species detection within ground meat products are real-time polymerase chain reaction (PCR), a DNA based method, and enzyme-linked immunosorbent assay (ELISA), a protein based method. While ELISA is used by the USDA, real-time PCR is also a well-established method for this purpose. A total of 15 reference samples containing known percentages (0.1-99.9%) of pork and beef were analyzed in duplicate using real-time PCR and ELISA. Thirty commercial products, including deli meats, sausages, pet treats, and canned meats, were also tested in duplicate to assess the performance of each method with processed products.

Results:
Comparison of the DNA and protein-based methods showed the lowest detection limits with real-time PCR, which detected pork at 0.10% (w/w) and beef at 0.50% (w/w) in the mixture. ELISA detected pork at a level of 10.0% (w/w) and beef at 1.00% (w/w) in the reference
the same order. Sensory evaluation showed that consumers were able to differentiate
respectively; while protein oxidation values were 2.3 and 1.2 nM carbonyl/mg protein in
conditions the TBARS were 0.292 and 0.209 mg MDA/kg in control and treated samples,
the microflora was affected by the time of storage and the packaging system, but not
test with “sure” an “unsure” options to answer.
sensory evaluation was made in grilled meat, with 80 consumers by a modified “A not A
(DNPH reactive carbonyls) oxidation were evaluated during 10 days of storage at 4°C
Microcapsules made of collagen-pectin (4:1), containing 3.3% avocado-peel extract
evaluate its effect on the shelf-life.
preparatives may affect the meat sensory properties. In this investigation, a mixture of
instance, nisin can be degraded by meat proteases; or some antioxidants are sensitive
Meat is susceptible to decomposition by microbial growth and oxidation, accordingly
significantly greater than that of nonoxidized samples, which was more apparent with the GO/Glucose/FeSO4 system than with the H2O2/
Sulfhydryl (SH) group decreases in sulfhydryl, coincided with protein solubility loss. Firmer gels were produced
from 1 mg/mL glucose in the presence of 80, 160, or 320 µg/mL GO and 10 µM
Pepper, the spores were inoculated in clarified apple juice. Apple juice
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P03-076
Treatment of Fresh Produce Water Effluents by Non-Thermal Technologies
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Introduction: Washing is the traditional technique to reduce dust, soil, and also bacteria load. In most of the conventional processing chains this step requires a high volume of water, mostly because of the use of several washing tanks. Therefore, one big challenge for the food industry is to minimize the use of water by recycling the water effluents. However, in order to avoid any possible cross-contamination, a disinfection step has to be carried out. Non-thermal technologies (e.g., ultrasonic and UV-C light) have been proposed as alternatives for this purpose.

Method: Lettuce wash water was recirculated (3 L/min) for 30 minutes in a closed system which consisted of an ultrasound device (26 kHz, 90 µm, 41.85 W/L) and an UV-C light system (9.1 mW/cm²). Disinfection processes of (i) US, (ii) UV-C light, and (iii) US combined with UV-C light were applied, and aliquots were collected at different time intervals to analyze the microbial load and the optical density at wavelengths of 540 nm and 680 nm. Moreover, the chemical oxygen demand (COD) was also determined.

Results: Initial bacteria population (7.04 log CFU/mL) was reduced by 1.60 and 3.09 log CFU/mL by ultrasound and UV-C light, respectively. The combination of both technologies enhanced the disinfection process resulting to a reduction of 3.38 log CFU/mL. The highest level of color reduction and decrease on the suspended particles was achieved by the combination of US+UV-C light followed by the US process and the UV-C light. COD levels were reduced after all disinfection processes, while the combination of US and UV-C light resulted in the lowest value of COD.

Significance: The combination of US and UV-C was the most efficient process tested. The washing water treated by this combined technology achieved the best results in terms of bacteria inactivation, COD, color reduction, and presence of organic matter. These results have shown that the combined effect of US and UV-C light may be a promising disinfection technology for fresh cut wash water effluents. Further research regarding set-ups configurations and physicochemical analysis of the treated wash water should be carried out.

P03-077
Impact of Cold Atmospheric Pressure Plasma Treatment on Quality and Safety of Mealworm (Tenebrio Molitor) Flour
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Introduction: Sustainable food production is not only related to environmentally friendly production methods but also to food availability. Hence, alternative sustainable protein sources, as edible insects, are expected to enter the food and feed market as replacers for otherwise intensive animal-derived proteins. Research is required for developing microbiologically safe rearing, harvest and post-harvest processing technologies and protein recovery procedures in order to produce safe and high-quality insect-based products.

Method: Cold atmospheric pressure plasma (CAPP) is a promising technology for the gentle surface decontamination of agricultural products. The impact of semi-direct CAPP treatment (di-electric barrier discharge, 3.0 kHz, 8.8 KV, in air, up to 15 min) on microbial safety, techno-functional and protein properties of mealworm flour was investigated via plate count, the Lowry protein assay, tryptophan fluorescence analysis, and SDS-PAGE. Further, the plasma induced effect on water and fat-binding capacities of the flour was studied.

Results: The initial total microbial load of 7.5 log cfu/g was reduced to 6.4, 5.8, 5.3, 5.2, 5.0, and 4.2 CFU/g by exposure to CAPP for 1, 2.5, 5, 7.5, 10, and 15 min. A slight mass loss (dry matter content of the flour 0.84 g/g) was induced by the CAPP treatment. Protein solubility (pH 4) linearly decreased to 54 % with prolonging exposure to CAPP. Often reported plasma-related pH shift in the protein extracts did not occur. SDS-PAGE demonstrated changes in protein composition that were dependent on the CAPP exposure time and on the pH of the solvent. Recorded tryptophan fluorescence spectra of the protein extracts supplied first evidence of plasma-induced changes in the protein structure. The compositional and structural protein modification is presumably responsible for the detected effects on water and fat binding properties of the mealworm flour as the application of CAPP induced a linear decrease in water binding capacity from 0.8 g/g to 0.6 g/g. In accordance with the potential plasma-induced hydrophobization of the proteins fat binding capacity linearly increased from 0.6 g/g to 0.65 g/g.

Significance: With respect to quality and safety aspects, the results of this study clearly underline the potential of CAPP in the post-harvest processing of insect flours.

P03-078
Modifying Soybean Oil Chemistry Using High Voltage Atmospheric Cold Plasma (HVACP) Treatment With Hydrogen and Nitrogen Gas
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Introduction: Soybean oil is the main vegetable oil in the U.S. with a production of 8.5 million metric tons (2015). Food products comprise 70% of the soybean oil market. High Voltage Atmospheric Cold Plasma (HVACP) has been investigated as a novel technology with the ability to modify the chemical structure of soybean oil. The goal of this study is to evaluate the effect of highly energized plasma species from hydrogen and nitrogen on soybean oil chemistry.

Method: Soybean oil (5 g) was exposed to direct HVACP treatment in a sealed chamber filled with gases at four different ratios: 100%N2, 5%H2-95%N2, 50%H2-50%N2, and 100%H2. Treatments were performed at times of 0, 0.5, 1, and 1.5h, in triplicate. The effect of HVACP treatment was evaluated by measuring iodine value, fatty acid composition, and nitrogen content. Optical emission spectroscopy was used to identify the radicals involved in the reactions.

Results: Two sample fractions were analyzed, a liquid (96%) and a solid sample (4%) that are formed by the movement of oil between the electrodes during treatment. Results showed a decrease in iodine value over time for all gas blends, reaching an N of 122-123 in the liquid fraction, and 90-100 for the solid fraction. The fatty acid composition was significantly different from the untreated soybean oil in both fractions, with a significant increase in saturated fatty acid and a decrease in polyunsaturated fatty acids. Trans-fatty acids were not detected in either fraction. Nitrogen content was measured using the Dumas method in the liquid fractions of 100%N and 95%N were 218±62 and 242±62 ppm, in the gas blend of 50% was 114±76ppm. The untreated soybean oil and 100%H sample indicate a nitrogen content of 55 and 85±62 ppm, respectively. Results suggest that HVACP has the capacity to modify the chemical structure of soybean oil by hydrogenation and nitration.

Significance: Hydrogenation is utilized in the food industry to produce partially hydrogenated oils, and nitration is a well-studied reaction in pharmacy, agriculture, and combustion. HVACP has the potential to generate high energy reactive gas species which can catalyze chemical reactions without requiring additional heat, high pressure, or metal catalyst.

P03-079
Folate Stability and Protein Profile of Egg Yolk Granules as the Effect of High Hydrostatic Pressure Treatment
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Introduction: The established role of folate in the prevention of neural tube defects (NTD) has attracted major interest in recent years. For the prevention of NTD, a daily additional intake of 400 µg of folate for women at age of pregnancy is recommended. One of the main approaches to increase folate status, which does not have the health concerns associated with food fortification, is to increase consumption of foods naturally rich in folate. Egg yolks naturally contain folate (~ 4.6 µg/g dry basis) in the form of 5-methyltetrahydrofolate (5-MTHF) with high absorption efficiency and, therefore, high bioavailability. In this case, we designed a process to fractionate hen egg yolk readily transposable to an industrial scale.

Method: Fractionation of hen egg yolk to separate granules. For HHP treatment, 1/w/w granule solutions were transferred to 11 polyethylene terephthalate bottles. The HHP treatments were performed at 600MPa/5 min in a discontinuous hydrostatic pressurization unit Hiperbaric 135 with water as the pressure transmission medium. The HHP-treated granule samples were centrifuged (10000g; 45min; 4°C) to separate the granule from supernatant. Folate was analyzed by an HPLC method: Microstructure Determination by Confocal Laser Scanning Microscopy (CLSM).

Results: The fractionation technique allowed the concentration of 5-MTHF (21µg/g dry basis) in the non-soluble granule fraction of yolk. Consequently, the folate rich granule fractions were solubilized in water (1%) and pre-treated by HHP to improve granule breakdown and increase their folate content. The granule solutions were processed at 600 MPa for 5 min in an industrial-scale HHP unit followed by centrifugation. The micrographs of CLSM revealed that granule particles were disintegrated after HHP treatment. Moreover, an approximately 6-fold higher concentration of folate (230.25µg/g dry sample) was detected in the corresponding plasma fraction from HHP treated granule compared to the non-treated sample (40.25µg/g dry sample). The results indicate stability of folate under harsh condition of HHP (600MPa/5min). However, further research is required to evaluate the full commercial potential of HHP treatment of granule through optimization of pressurization conditions.

Significance: Fractionation of egg yolk followed by high hydrostatic pressure treatment of hen egg yolk granule fraction may have potential for commercial application, since it is concentrated with natural vitamin folate (5-MTHF).
Development of Curcumin-Pea Protein Nanocomplexes Using the Microfluidization Process

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Introduction: Curcumin, a natural plant phenolic compound, has a great potential to be used as a potent coloring, antioxidant and anticancer agent in food products. However, its poor water solubility limits these applications. Nanolization of curcumin may provide a solution to the problem. It was found that an aqueous nanosuspension containing only curcumin nanoparticles has low stability even at a low concentration of the solute. Therefore, the objective of this study was to increase curcumin concentration in nanosuspensions by developing curcumin-pea protein nanocomplexes using the microfluidization process.

Method: Aqueous suspensions of curcumin-pea protein nanocomplexes were prepared by anti-solvent precipitation method followed by the microfluidization process. The nanocomplexes were then collected by centrifugation and freeze-dried. Particle size distribution, loading efficiency of curcumin, morphology, physiochemical structure, and thermal stability of the nanocomplexes were analyzed using particle size analyzer, FT-IR, UV absorption, DSC, and NMR.

Results: The results showed that the particle size distribution of curcumin-pea protein nanocomplexes in water was between 180 to 220 nm and the resulting aqueous nanosuspension was stable at a curcumin concentration up to 289.7mg/L. Moreover, FT-IR and UV-vis absorption spectra suggested that curcumin was bound to pea protein without altering the conformation of the protein and DSC analysis confirmed that curcumin formed an amorphous structure within the pea protein matrix. Furthermore, the loading efficiency of curcumin was 5.6% indicated by 1H NMR analysis. Lastly, the degradation rate of curcumin in curcumin-pea protein nanocomplexes was substantially lower than that of the control when subjected to an elevated temperature of 90°C.

Significance: Suspensions of curcumin-pea protein nanocomplexes developed in this study were stable at a relatively high concentration of curcumin. This will significantly facilitate the development of functional foods using curcumin.

Bioactivity of Rice Bran Derived Pentapeptide and Its Sensory Evaluation and Storage Stability in Orange Juice

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Introduction: One of the top five leading causes of death in the United States is cancer. Food derived bioactive peptides can serve as economical and natural alternatives to current cancer prevention and therapeutic strategies. A pentapeptide prepared from rice bran demonstrated growth inhibition on human colon, breast, liver, and lung cancer cell lines. The objective of this study was to determine the growth inhibition of human prostate cancer cells and cell viability, and sensory acceptability studies of orange juice containing this pentapeptide.

Method: Anti-proliferation activity of the pentapeptide on human prostate cancer cell line (PC-3) was determined to evaluate its anti-cancer activity. Samples of spray dried orange juice powder containing the pentapeptide (240, 460, and 620 µg/mL in reconstituted juice) were evaluated for stability at a 2 month interval over a six month storage period and sensory analysis using a triangle test to identify noticeable differences in the juices with and without pentapeptide and a 9-point hedonic scale to rate the overall liking, as well as the color, mouth-feel, and flavor. Data were analyzed using a statistical model for the significant changes (based on p-values of 0.05).

Results: The pentapeptide inhibited human prostate cancer cell growth by 45% at 460 µg/mL concentration. The pentapeptide was incorporated in spray dried orange juice powder and stored up to 6 months before it was reconstituted in water to make 226 mL (8 fl. oz) per serving to monitor shelf life stability. The study showed a 10% loss of the pentapeptide in the reconstituted orange juice beverage over 6 months under refrigeration, and 30% loss at ambient temperature storage. Sensory analysis showed an overall liking for the product by the panelists based on color, flavor, and mouthfeel, but a slight bitter note was reported. Bitterness masking agents solved the bitter note problem.

Significance: The pentapeptide has the potential to serve as a functional ingredient in nutraceutical beverages under refrigeration.

Development of Heart Health Sterol-Enriched Functional Instant Tea

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Introduction: Tea, one of the most popular beverages consumed worldwide, is ranked as the second non-alcoholic drink after water. Plant-based sterols have been extensively used in functional foods to regulate cholesterol levels by lowering low-density lipoprotein cholesterol (LDL-C) level. Along with the increase in the number of functional foods with their distinguishing feature of potentially preventing the risks of chronic diseases, the market share for functional foods has also grown steadily during the last 10 years. The objective of the study was to develop sterol-enriched functional instant tea and to study its health effects.

Method: Black tea extract obtained from tea has been fortified with plant sterol and processed into instant form by use of appropriate techniques. After that, a placebo-controlled, randomized, double-blind, and human intervention trial was conducted to investigate the effects of the consumption of functional tea, formulated as an iced-tea beverage.

Results: Some 125 volunteers consumed 500 mL (~2 g sterol/d) of the functional tea drink at two servings per day for 4 weeks, and their LDL-C levels decreased by ~9% compared to the control group. In addition, significant decreases in the levels of apolipoprotein B, total cholesterol/high-density lipoprotein cholesterol (TC/HDL-C), and LDL-C/HDL-C were also observed. Other anti-atherogenic effects, including increased anti-oxidant status, adipokines, and endothelial function, improving the lipid and lipoprotein profile, may be attributed to the combined effects of sterol and tea.

Significance: As a result, enrichment of iced tea with plant sterol would provide a considerable contribution to public health.

Psychochemical Properties and Antioxidant Activity of the Leafy Vegetables Cnidoscolus aconitifolius and Crotalaria longirostrata

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Introduction: Cnidoscolus aconitifolius and Crotalaria longirostrata are leafy vegetables native from Mexico and Central America, where they are consumed in traditional dishes. Leafy vegetables constitute a major part of any balanced diet and are good sources of nutrients and psychochemical compounds. Some of the most important psychochemicals found in leafy vegetables are Vitamin C, phenolics and flavonoids. They provide antioxidant activity, which is highly associated with a reduced risk for the development of chronic diseases and cancer. There is lack of information about the psychochemical composition and antioxidant activity of Cnidoscolus aconitifolius and Crotalaria longirostrata. Consequently, the objective of this research was to evaluate the Vitamin C (reduced, oxidized, and total), phenolic (free, bound, and total) and flavonoid concentrations and antioxidant activity of these leafy vegetables.

Method: Cnidoscolus aconitifolius were obtained as stem cuttings from Mass Spectrum Botanics, and three accessions of Crotalaria longirostrata were acquired as seeds from the USDA National Plant Germplasm System. They were grown in synthetic soil in an environmental growth chamber for 10 and 5 weeks, respectively. Vitamin C and flavonoids were measured by colorimetric assays, phenolics were determined using the Folin-Ciocalteu method, and antioxidant activity was performed using the ORAC method. Results are expressed on a fresh weight basis (FW).

Results: Cnidoscolus aconitifolius and Crotalaria longirostrata (average of three accessions) had total Vitamin C concentrations of 2.60 and 1.54 mg ascorbic acid (AA)/g FW, respectively. These concentrations are higher than in kale, mustard greens, collard greens or spinach, the loading efficiency of curcumin was 5.6% indicated by 1H NMR analysis. Lastly, the degradation rate of curcumin in curcumin-pea protein nanocomplexes was substantially lower than that of the control when subjected to an elevated temperature of 90°C.

Significance: These new data about the functional composition of Cnidoscolus aconitifolius and Crotalaria longirostrata suggest that the consumption of these leafy vegetables should be promoted.

Objective Evaluation of Physical Properties of Muffins With Fibersol®-HS Substituted for Sugar and Fat

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Introduction: Interest in health promotion through better nutrition has moved consumers to seek methods to fortify foods with ingredients that promote health. Plant-based sterols have been extensively used in functional foods to regulate cholesterol levels by lowering low-density lipoprotein cholesterol (LDL-C) level. Along with the increase in the number of functional foods with their distinguishing feature of potentially preventing the risks of chronic diseases, the market share for functional foods has also grown steadily during the last 10 years. The objective of the study was to develop sterol-enriched functional instant tea and to study its health effects.

Method: Black tea extract obtained from tea has been fortified with plant sterol and processed into instant form by use of appropriate techniques. After that, a placebo-controlled, randomized, double-blind, and human intervention trial was conducted to investigate the effects of the consumption of functional tea, formulated as an iced-tea beverage.

Results: Some 125 volunteers consumed 500 mL (~2 g sterol/d) of the functional tea drink at two servings per day for 4 weeks, and their LDL-C levels decreased by ~9% compared to the control group. In addition, significant decreases in the levels of apolipoprotein B, total cholesterol/high-density lipoprotein cholesterol (TC/HDL-C), and LDL-C/HDL-C were also observed. Other anti-atherogenic effects, including increased anti-oxidant status, adipokines, and endothelial function, improving the lipid and lipoprotein profile, may be attributed to the combined effects of sterol and tea.

Significance: As a result, enrichment of iced tea with plant sterol would provide a considerable contribution to public health.
This study is a double-blind, placebo-controlled crossover experiment with two trials (GS Method:

Introduction:

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Depolymerization of Sorghum Procyanidin Polymers Into Oligomers Using HCl and Epicatechin: Reaction Kinetics and Optimization

Procyanidins are bioactive food components with antioxidant, anti-inflammatory, and anti-cancer activities. However, majority of natural procyanidins are non-absorbable polymers with degree of polymerization (DP) above four. Hi-tannin sorghum contains abundant polymeric procyanidins (up to about 5%). Epicatechin and HCl were used to depolymerize sorghum procyanidin polymers into oligomers (DP 1-4) with better bioavailability. The objective of this research was to investigate the kinetics of this reaction and to optimize conditions to obtain the highest oligomer yield.

Method:

Polymeric procyanidins were isolated from sorghum bran and purified with Sephadex LH-20. Depolymerization was performed in 50% (v/v) 1-propanol aqueous solution at 50–80°C, pH 0.5–2.0, and epicatechin to procyanidin mass ratio 0.25:1.0 for 1–90 min. Kinetic models were fitted based on the relationship of remaining procyanidin polymer concentration and reaction time. A central composite design model was built to show the impact of temperature, pH, reaction time, and epicatechin to procyanidin mass ratio and their interactions on the yield of oligomers.

Results:

It was found that depolymerization followed a pseudo first-order kinetic model. The influence of temperature on the depolymerization followed Arrhenius equation and Ea was calculated as 83.0 kJ.mol-1. Increasing temperature from 50 to 80°C significantly enhanced reaction rate from 0.0278 min-1 to 0.3821 min-1. Moreover, decreasing pH from 2.0 to 0.5 dramatically cut half-time from 65.4 min to 3.0 min. More epicatechin also shortened half-time when monomer was not sufficient in the system. Furthermore, the analysis of variance of the response surface model revealed significance of temperature, pH, reaction time and epicatechin to procyanidin mass ratio on the yield of oligomers and a high R2 of 0.98 suggested the model fitted well. The optimized reaction condition was predicted at 74°C, pH 1.24, reaction time 61 min, and mass ratio 0.89. The predicted yield was 87.0±4.0%, which was close to the experimental yield of 86.0±1.2%.

Significance:

This study provided a practical approach to produce procyanidin oligomers from polymers as well as insight into reaction kinetics.

P03-087

Acute Effects of Ginseng Supplementation on Exercise Performance, Cognitive Function, and Fatigue Recovery

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Introduction:

The purpose of the study was to investigate the acute effect of ginseng supplementation (GS) on exercise performance, cognitive function, and fatigue recovery.

Method:

This study is a double-blind, placebo-controlled crossover experiment with two trials (GS and placebo). Twelve healthy adult males (age=31±6.86 years) were randomly assigned to either GS or placebo groups with 2 weeks wash-out period. The trials were consisted of 30 mins cycling exercise at 70-75% of VO2 max followed by 10 miles time trial with 30 mins resting periods. All subjects were tested for muscular power, strength, endurance, cognitive function, and fatigue. The total antioxidant activity (TAC), myoglobin, and IL-6 concentration were measured at baseline, during, and after experimental trials.

Results:

In a placebo trial, peak power and mean power levels were significantly decreased across time, F(1, 147, 13.24) = 4.63, G-G p = .039, n2p = .340, and F(1.46, 13.13) = 5.31, G-G p = .028, n2p = .371, while no differences were found in a ginseng trial. In a placebo trial, average reaction time (ART) was significantly delayed across time, F(1.29, 11.63) = 10.81, G-G p = .005, n2p = .546, and in a ginseng trial, no difference in ART was found across time, F(1.54, 13.86) = 4.02, G-G p = .051, n2p = .309. There was a significant increase in TAC across time in a ginseng trial, F(1.42, 11.37) = 5.07, G-G p = .035, n2p = .388, while no difference was found in a placebo trial. There was a significant decrease in cortisol levels across time in a ginseng trial (p<0.05). No difference was found in a placebo trial. No significant differences were found in other variables from placebo and ginseng trials. Ginseng supplementation shows positive effects on muscular power, reaction time, and total antioxidant capacity, indicating it’s a prospective candidate for ergogenic aids.

Significance:

Ginseng is widely used for its promising healing and restorative properties, as well as for its possible tonic effect in traditional medicine, and has recently become a popular supplement in western countries. However, there are contradictory results as to its effectiveness on exercise performance.

P03-088

Asian Adults Consume Substantially Fewer Empty Calories From Added Sugars and Solid Fats Than Other Race/Ethnic Groups in the United States: WWEIA, NHANES 2011-12

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Introduction:

More than two-thirds of adults in the U.S. are overweight or obese; and continued excess caloric intake may lead to obesity. The Dietary Guidelines for Americans recommend individuals limit intake of empty calories from added sugars and solid fats and choose nutritious foods instead, to maintain normal body weight. The research objective was to compare mean intakes of added sugars and solid fats consumed by Asian, non-Hispanic white (n-H white), non-Hispanic black (n-H black), and Hispanic adults in the United States.

Method:

Day 1 dietary data of adults, ages 20 years and over, in the “What We Eat in America, National Health and Nutrition Examination Survey 2011-12” were used. The adults were grouped by self-reported race-ethnicity. The study included 610 Asian, 1842 n-H white, 1274 n-H black, and 932 Hispanic adults. Pair-wise mean comparisons were made between the four race-ethnic groups, at alpha=0.01.

Results:

All comparisons reported in the abstract are statistically significant. Asians consumed the lowest amount of added sugars and solid fats. The mean (±SE) intake estimates of added sugars for Asians, n-H whites, n-H blacks, and Hispanics were 10.9±0.50, 18.3±0.62, 20.8±0.68, and 18.0±0.61 teaspoon equivalents, providing 9.2±0.41, 13.7±0.43, 15.7±0.47, and 13.3±0.42 percent of total calories for the day, respectively; and solid fats, 23.1±1.2, 38±1.0, 36±1.1, and 36±1.1 grams, providing 10.2±0.39, 14.8±0.35, 14.5±0.30, and 14.0±0.25 percent of total calories, respectively. The study showed, at the national level, Asians consumed the lowest percent (19±0.6) of empty calories, defined as the percent of calories from added sugars and solid fats; and the other three race-ethnic groups consumed 27 to 30 percent of total calories as empty calories.

Significance:

Overall, the study highlights a need for further reduction in empty calorie intake for most adults. Continued nutrition education is needed for adult consumers to choose foods and beverages low in added sugars and also to choose lean meat, low-fat dairy products, and foods prepared with unhydrogenated oils that are low in solid fats, when food shopping at the supermarkets. The findings are useful to food manufacturers, food policy makers, consumers, and nutrition educators.

P03-089

Chemopreventive Potential of Dried Unsweetened Coconut Flakes Against Azoxymethane-Induced Colonic Aberrant Crypt Foci (ACF) in Fisher 344 Male Rats

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Introduction:

Coconut flakes (CF) is a popular byproduct from the production of coconut milk and is utilized as a sweetener in Asian cuisine. The objective of this study was to examine the chemopreventive potential of feeding unsweetened CF on azoxymethane-induced colonic ACF in Fisher 344 male rats.

Method:

Rats were randomly assigned to control (AIN 93G diet) and 3 different treatment groups: 5% CF, 10% CF, 20% CF. At 7 and 8 w of age rats received s/c administered injections
of AOM at 24 mg/kg body weight. Rats were killed using CO2 asphyxiation at 17wk of age and aliquot storage. Total levels were determined microscopically. Activity of cellular hepatic detoxification and antioxidant enzymes, catalase (CAT), glutathione peroxidase (GPx) and glutathione (GSH) levels were determined according to standard protocols.

Results:
Rats fed CF at 5, 10, 20% had CAT activities of 4.10±0.01 U/mg, 3.39±0.07 U/mg and 3.33±0.04 U/mg, respectively. GPx activity was 95.08±0 nmol/min/mg, 141±0.02 nmol/min/mg and 130±0.05 nmol/min/mg for CF treatments at 5, 10, and 20%, respectively. GSH levels were 4.86±0 nmol/ml, 2.91±0 nmol/ml and 2.73±0 nmol/ml for rats fed diets of CF at 5, 10, 20%, respectively. Total ACF in rats fed diets of CF (5% - 3%; 10% - 6%; 20% - 16) were lower than the control (23%). Total crypts for 5% CF was 132; 10% CF 13 and 20% CF was 38. Results of this study suggest the potential of CF as a chemopreventive agent and also may play a role in enhancing the function of antioxidant and detoxification enzymes.

Significance:
Coconut flakes may be utilized as a functional ingredient in the food industry for use in development of food products.

P03-090

Antimicrobial Effects of Pomegranate Seed Oil on Rat Air-Pouch Model Inflammation
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Introduction:
There is a growing interest in the health benefits of conjugated fatty acids, especially in their antioxidant and anti-inflammatory activities. Punicic acid (PA; 9c11t13c-C18:3) is a conjugated isomer of α-linolenic acid found at high concentrations (55%) in pomegranate seed oil (PSO). This work aimed to investigate the effects of orally-administered PSO on acute inflammation and oxidative stress induced by carrageenan in a rat air pouch model.

Method:
Twenty male Wistar rats were divided into six groups: the sham control group, the carrageenan group (negative control), the indomethacin (positive control) and three PSO groups (oral doses of 2, 4, and 6 mL/kg). The rats in control groups were orally treated with phosphate-buffered saline. PSO was tested for its anti-inflammatory activity on rat subcutaneous tissue with carrageenan-induced air inflammation (air pouch model). Cell influx, levels of chemical mediators (TNFa (tumor necrosis factor α), IL6 (interleukin 6) and LT4 (leukotriene B4)), and oxidative stress parameters [SOD (super-oxide dismutase), GPx (glutathione peroxidase) activities and TBA (thiobarbituric acid reactive substances) levels] in the inflamed exudate were measured by optical microscopy, the enzyme-linked immunosorbent assay (ELISA) and spectrophotometry, respectively.

Results:
Oral treatment with PSO resulted in a dose-dependent reduction in cell migration as well as in a drop in IL-6, TNF-α and LT4 levels. However, it did not alter SOD, GPx and TBA levels in the inflamed exudate. These results show that PSO can exert in vivo anti-inflammatory effects by decreasing the secretion of cytokines without altering oxidative stress parameters. The mechanisms of action remain to be clarified.

Significance:
These results indicate that punicic acid, a naturally occurring conjugated linolenic acid (CLNA) isomer, can display significant anti-inflammatory activity in a rat model of acute inflammation, suggesting that this CLNA isomer could play an important role in the treatment of inflammatory disorders.
Results:
The overall textural acceptability was significantly high for tortillas made with tapioca and rice in comparison to potato. The physiological data of the tortillas correlated with the data from a descriptive analysis, which showed tortillas with potato starch were thicker and smaller in diameter, whereas tortillas with rice starch were thinner and evenly spread. The overall acceptability was high for potato starch followed by rice starch. The high acceptability of tortillas with potato starch is correlated with flavor analysis that showed tortilla with potato starch was less bitter, less salty and sweeter in comparison to other tortillas. The results indicated that incorporation of potato/rice starches may result in a formulation of finger millet tortillas with acceptable textural and sensory properties.

Significance:
Finger millet tortillas will provide a nutrient dense alternative to traditional tortillas for people with celiac disease and a potential medicinal food for people with diabetes.

P03-094
Effects of Corn Distillers Dried Grains (DDG) on Dough Properties and Quality of Chinese Steamed Bread
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Introduction:
Chinese steamed bread (CSB) produced exclusively with flour, yeast, and water is a traditional Chinese staple food. Steamed bread has 1,700 years of history and accounts for 30% of wheat end-use in China. The absence of added sugar and fat in CSB makes it more suitable for diabetic diets in comparison to traditional baked bread. The leanness of the CSB formulation, however, makes the dough more sensitive to added adjuncts such as fiber. CSB was made with varying levels of corn distillers dried grains (DDG), a coproduct of ethanol production. Adding DDG to wheat flour may not only add value to a corn co-product, but also improve the nutritional profile of wheat flour.

Method:
Varying levels (0%-25%) of DDG were used to replace all purpose flour (APF) in Chinese steamed bread formulations in order to increase dietary fiber and nutritional content. The effects of DDG on dough properties and quality of steamed bread were evaluated using instrumental methods (Farinograph, Mixolab, and Texture Analyzer) and expert sensory analysis.

Results:
The results showed that with increasing amounts of DDG, protein, and dietary content also significantly increased (up to 18.8% and 21.76%, respectively) for 100g of steamed bread (db). Water absorption of DDG fortified dough increased significantly while dough development time and dough stability decreased. The extensibility of dough decreased significantly with increasing levels of DDG. The addition of DDG led to a significant increase in hardness and adhesiveness in the finished product along with a decrease in cohesiveness. The chewiness of steamed bread increased with substitutions of 0% to 20% DDG. C-Cell image analysis of steamed bread crumb structure showed that number of gas cells decreased at higher substitution levels of DDG. Fortification with DDG reduced the brightness (L*) of flour blends and steamed bread. The specific volume of steamed bread decreased significantly with increasing amounts of DDG. Steamed bread containing up to 15% DDG were found to have acceptable qualities as assessed by a trained sensory panel.

Significance:
Combining DDG with wheat flour can improve the nutritional quality of bread in terms of protein and dietary fiber content.

P03-095
Antioxidant Properties of Whole Hemp Seed (Cannabis Sativa) Protein Hydrolysates
S. Rivera, Purdue University, O. Jones, A. Liceaga, Email: rivera60@purdue.edu

Introduction:
With the increasing popularity of value-added foods and health supplements, development of natural antioxidant ingredients is attractive to producers looking to enhance the nutritional value of foods. Hemp (Cannabis sativa) has been legalized in Canada and certain parts of the U.S. for industrial hemp fiber production, but the seeds of hemp are an undervalued by-product with potential use in the food sector. Previous studies using hemp protein isolate (HPI) have suggested that hemp protein hydrolysates (HPH) have strong antioxidant properties. However, obtaining HPI from hemp seeds is a laborious, multifaceted, and time-consuming process. To determine whether functional HPH could be extracted without an inefficient preliminary isolation step, whole hemp seeds were directly hydrolyzed by proteolytic enzymes, and the resulting antioxidant activity of HPH was compared to synthetic antioxidants BHT and BHA.

Method:
Whole hemp seeds were hydrolyzed at 30, 60, and 90 minutes with Alcalase® at 0.5, 1.5, and 3% (w/w) enzyme-substrate (E/S) ratio. Separation of the oil and protein phases was achieved during the final centrifugation step at 17,636 x g. Protein supernatant was freeze dried until analysis. Degree of hydrolysis (DH) was determined using the TNBS method. Ferric ion reducing capacity (FIRC) was assessed using 3 mg/mL HPH, whereas DPPH radical-scavenging activity (DPPH) was determined as 2 and 4 mg/mL HPH.

Results:
Results showed that there was no significant difference in DH within the 3% E/S treatments, ranging from 37-40% DH. For DPPH radical-scavenging activity, the 4 mg/mL HPH hydrolyzed for 90 minutes with 3% E/S had higher (p<0.05) scavenging activity (79%) than the 30- and 60-minute HPH (2 mg/mL) and was not significantly different from BHA and BHT (98%). The results for FIRC were comparable to other HPH values reported in literature, ranging from Abs700 = 0.18-0.33. These results show that variation in hydrolysis time did not have an effect on FIRC at a given E/S concentration.

Significance:
In conclusion, in this study HPH were successfully obtained from enzymatic hydrolysis of whole hemp seeds rather than HPI. The hydrolysates displayed comparable antioxidant capacity to that of commercial-synthetic antioxidants. Overall, these results merit further investigation of their antioxidant and other bioactive properties.

P03-096
Isolation of Barley (Hordeum Vulgare) Protein and Its Interaction With Flavor Compounds: A Comparative Study
M. Housse, McGill University, N. Khodaei, S. Karboune, Email: marika.housse@mail.mcgill.ca

Introduction:
The increasing trend toward development of high-protein food products has harbored keen interest in plant-based proteins from underexploited grain sources. This can provide a novel use for the barley grain; providing 8-13% protein and a source of essential amino acids, barley proteins have yet to be fully exploited for their functionalities. Protein/flavors interactions can be dominant and instrumental to the quality of high-protein products. These interactions can negatively alter aroma intensity and perception in the short- and long-term. Traditionally, grain proteins have been isolated using alkaline and solvent extraction methods, the latter of which impairs product purification and restricts use in food applications. The present study aims to develop an enzymatic approach to isolate proteins from defatted barley flour and investigate their interactions with selected flavors compared to protein standards (whey and pea).

Method:
The effect of reaction time (5 h vs 17 h) and enzyme concentration (1000-2000 U/g o-amylase; 66-132U/g amyloglucosidase, and 0.8 U/g b(1,3)/(1,4) glucanase) were investigated. For comparison purposes, two conventional protein extraction methods were carried out: alkaline extraction (0.05 M NaOH, 2 h) and sequential alkaline/isoelectric precipitation.

Results:
The enzymatic treatment with starch-hydrolysing enzymes (amylose and amyloglucosidase) led to a protein recovery yield of 45.6%. Sequential enzymatic treatment with b-(1,3)/(1,4)-glucanase (Trichoderma longibrachiatum) was also assessed. A protein recovery yield of 57.1% and protein content of 32.96% were achieved by alkaline treatment adjusted to pH 7.0, while a protein recovery yield of 51.4% and protein content of 69% were achieved by isoelectric precipitation extraction at pH 4.5. A- and y-hordein and A- and B-hordein protein fractions were most prominent, respectively. Sequential treatment with amyrase (Bacillus sp.), amyloglucosidase (Aspergillus niger) and alkaline extraction, gave a protein recovery yield of 62% (w/w), comprised mostly of D-hordeins. The protein/flavors interaction was assessed by estimating the proportion of unbound vanillin and quantifying binding affinity (dissociation constant k; enthalpy of binding ΔH°; entropy of binding ΔS°) by isothermal titration calorimetry. The effects of temperature (10, 50°C), incubation time and denaturation on the interaction will be discussed.

Significance:
This study expects to develop an efficient method for the isolation of barley proteins, outline their functionalities and determine their interactions with selected flavors.

P03-097
Purification and Characterization of Single Peptides From Soy Protein With Anti-Proliferative Activity Against Cancer Cells
N. Hettiarachchy, University of Arkansas, S. Rayaprolu, R. Liyanage, J. Lay, P. Chen, Email: nhet@uark.edu

Introduction:
Protein hydrolysates were prepared from soybean meals by proteolytic catalysis using Alcalase enzyme, tested for resistance against simulated gastro-intestinal juice, fractionated into definite molecular fractions and tested for anti-proliferation activity on human cancer cell lines. The objective of this study was to identify a single pure peptide with enhanced cancer cell anti-proliferation activity from a 10-50kDa peptide fraction that previously showed significant growth inhibition of blood, colon, and liver cancer cell lines.

Method:
The 10-50kDa soy protein fraction was purified using peptide specific affinity chromatography column attached to a reverse phase high performance liquid chromatography (RP-HPLC). The pure peptides were tested for anti-proliferation of CCRF-CEM blood cancer line, HCT-116 colon cancer line, and HepG-2 liver cancer cell line using (3-[4,5-dimethylthiazole-2-yl]-5-(3-carboxymethoxyphenyl)-2-(4-sulfophenoyl)2H-tetrazolium cell titrer assay and Trypan blue dye exclusion.
P03-098
Solubility, Functional Properties, ACE Inhibitory, and DPPH Scavenging Activities of Alcalase Hydrolyzed Soy Protein Hydrolysates
N. Hettiarachchy, University of Arkansas, M. Vallecios, R. Horas, L. Osorio, P. Chen, Email: nhettiar@uark.edu

Introduction:
Native soy protein (SPI) lacks solubility in mild acidic pH which is required for its application in clear beverages. The objective was to improve the solubility of SP at acidic pH by alcalase enzymatic hydrolysis and determine its emulsifying and foaming properties, and anti-hypertensive and anti-oxidant activities.

Method:
Soy protein isolate (SPI) was subjected to alcalase hydrolysis at pH 3.0, 3.5, and 4.0. Degree of hydrolysis (DH) was determined using an OPA (o-phthaldialdehyde) method. Emulsifying activity (EA) and emulsion stability (ES) were determined to evaluate the emulsifying properties, while foaming capacity (FC) and foam stability (FS) were determined for foaming properties of the hydrolysates. Anti-hypertensive and antioxidant properties were determined based on ACE-I (angiotensin-I converting enzyme) inhibitory and DPPH (2,2-diphenyl-1-picrylhydrazyl) scavenging activities. Data were statistically analyzed to compare means for the significance of differences at a significant level of 5%.

Results:
DH of SP hydrolysates at pH 3.0, 3.5, and 4.0 were: 5.0–10.7%, 2.3–6.1%, and 0.5–4.4%, respectively. Solubility of SPI hydrolyzed at pH 3.0, 3.5 and 4.0 ranged from 70.7–74.9%, 18.8–51.2%, and 7.1–40.4%, respectively. Maximum solubility of 74.9% was obtained when SPI was hydrolyzed with 1.5 U Alcalase/g protein at a pH 3.0. Emulsifying properties of SP hydrolysates at pH 3.0 and 4.0 ranged from 0.49 to 0.63 and 0.19 to 0.24 (EA), respectively, and from 12.2 to 14.7 min and 18.7 to 56.0 min (ES), respectively. FC and FS values of SP hydrolysate at pH 3.0 were 64.9 to 66.3 and 31.2 to 41.3 mL, respectively, and 25.5 to 35.2 min and 12.8 to 15.1 min, respectively. Controlled DH that generated smaller molecules could contribute to improved functionality by better introduction into interfacial surface film due to enhanced solubility, and detrimental effect on liquid lamella of the film. However, hydrolysis did not affect ACE-I inhibition and antioxidant activities in comparison to the SPI.

Significance:
Alcalase hydrolysis could be a promising method to enhance SPI solubility for application in clear acidic beverages.

P03-099
Application of Mid-Infrared Portable Spectrometry in Determination of Trans-Fatty Acid Content in Bakery Products
M. Shotts, The Ohio State University, L. Rodriguez-Saona, Email: shotts.5@osu.edu

Introduction:
In 2013, the US Food and Drug Administration announced plans to remove the generally regarded as safe (GRAS) status of trans-fats and/or partially hydrogenated oils (PHOs) and by June 2018, PHOs will be prohibited from being used. Our objective was to develop a predictive model to quantify trans-fat concentrations in bakery and snack food products using portable mid-infrared (MIR) spectrometers.

Method:
The approach was tested using 35 calibration standards (consisting of trielaidin in triolein and tripalmitin) and 89 bakery and snack products ranging from 0.5 to 64% trans-fat. Fat from test samples was extracted by blending products into powders with liquid nitrogen and extracting the fat via AOAC method #960.39. Spectra were acquired by directly placing the fat (200 μL) onto the temperature-controlled (65±1ºC) instrument. Spectra were acquired by directly placing the fat (200 μL) onto the temperature-controlled (65±1ºC) instrument. Linear regression and partial least squares regression (PLSR) models were developed using the calibration standards and extracted fats. Spectra using either the unique absorption signal of the C=H out-of-plane deformation band observed at 966 cm–1 or the spectral information on the 900-1200 cm-1 range.

Results:
The model performance was assessed using an independent validation set of bakery and snack products. The best model performance were obtained using selected trans-fat ranges of 0–8% and 0–16%. PLSR models showed better goodness of fit than the linear models in predicting trans fat levels. PLSR using the spectra of the bakery food products gave a standard error of prediction (SEP) of 0.5 grams of trans-fats per 100 grams.
Introduction:
The detection of pathogenic bacteria is an important aspect to ensure the safety and quality of the product. The food industry depends on early detection of these bacteria to provide food that do not represent a threat to the health and safety of consumers. Typical methods for the detection of pathogenic bacteria can take 3-7 days to give reliable results.

Method:
In order to obtain an effective and more rapid answer, the method for detection of pathogenic bacteria secondary metabolites by mass spectrometry can be used. The study of the behavior of NOW larvae as it pertains to pesticides exposure. Specifically, the larvae’s preferences were studied to determine to what extent they match the conditions encountered on the upper part of a leaf, since that is the part exposed to the most of the pesticide. Furthermore, the insect’s reaction to specific scents that could impact its attraction to areas of pesticide application was studied.

Method:
Various bioassays were conducted in order to determine the larva’s reactions to light (type, intensity, and direction), scent, and diet. In the case of the lighting conditions, the bioassays were tested in an ethanol-water mixture at 20°C. Thin cheese slabs were frozen using four typical methods, in order from slowest to fastest time-to-freeze: (1) a still air environment at room temperature (20.5 ± 0.5°C). Unfrozen cheese was used as a control to compare still air environment for 15-17 hours to equilibrate, and then tempered and thawed to a temperature of the product center from 21°C to -18°C.

Results:
The sample spectra showed peaks that can be related with proteins produced by S. Poona PTVS1 and S. Mbandaka 00-916-1. The first four conditions were cut out of the slabs for all quality attribute analyses. Browning was measured by reflectance colorimetry after heating the cylinders in a forced air oven preheated to 232°C for 9 minutes. Free-oil formation (liquidation and separation of fat) and meltability (spreading during cooking) were measured simultaneously using a modified Schreiber test. Texture was analyzed using large deformation via Texture Profile Analysis (TPA) and small deformation via rheology, utilizing both temperature and strain sweeps.

Results:
Unfrozen and frozen LPM5 Mozzarella showed no statistical differences for browning, free-oil formation, and meltability. Cheese texture was significantly affected by the freezing process. Freezing by all methods caused significant changes in hardness, cohesiveness and chewiness from TPA analysis, and melting point by rheological temperature sweeps.

Significance:
The outcomes from this research should assist frozen pizza manufacturers in selecting a freezing process to maximize LMP5 Mozzarella quality attributes. Future research should focus on understanding the influence of the freezing process on cheese texture.

P03-105
Evaluation of Catfish Skin Hydrolysates as a Glazing Material for Air-Blast Frozen Shrimp
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Introduction:
Catfish is one among the most widely consumed seafood in the United States. A by-product of this consumption is a large quantity of catfish skin (CS), approximately 8,200 metric tons in 2014. Enzymatic hydrolysis is used to produce protein hydrolysates from the skin. These hydrolysates have considerable antioxidant properties. Because shrimp mainly contain polyunsaturated fatty acids, shrimp may be susceptible to lipid oxidation during frozen storage. It is expected that glazing shrimp with catfish skin hydrolysates (CSH) would reduce the rate of lipid oxidation and preserve quality characteristics during frozen storage. The objective of this study was to evaluate CSH as a glazing material for air-blast frozen shrimp.

Method:
CS was obtained from a local seafood market. It was cleaned, minced, and hydrolyzed with food grade alkaline protease (0.5% w/v) at 60°C for 30 min. CSH was obtained after centrifugation at 7000 rpm for 20 min. Fresh shrimp were manually de-headed, de-shelled and placed in an air-blast freezer (-20°C) for 30 min before glazing. Shrimp were immersed in CSH solution for 1 min, drained for 30 s, and placed back in the air-blast freezer for completion of freezing. The shrimp were placed into Ziploc bags for storage at -20°C. Distilled-water-glazed shrimp (DW) and non-glazed shrimp (NG) were used as controls. CSH were evaluated for degree of hydrolysis and free radical scavenging activity (SA). Shrimp samples were analyzed during 60 days of frozen storage for oxidation (thiobarbituric-acid-reactive-substances; TBARs), color, texture, aerobic plate counts (APC), and moisture content. Triplicate experiments were conducted and the data was statistically analyzed (α = 0.05).

Results:
CSH had 15±1.1% degree of hydrolysis and 35.5±3.30 mM Trolox equivalent/S. After 60 days frozen storage, shrimps glazed with CSH (1.14±0.07) had slightly lower lipid oxidation than DW (1.27±0.17) and NG (1.36±0.09). However, no differences were found between treatments at 60 days of frozen storage APC, texture, moisture, and color.

Significance:
This study demonstrated CSH could be used a glazing agent to minimize lipid oxidation in shrimp during frozen storage for 60 days.

P03-106
Dietary Fiber as Frozen Protected Agent in Meat Products

Introduction:
Freezing and frozen meat products storage can affect the structural and chemical properties of muscle-based foods and influence their quality attributes such as thawing loss, color, and textural properties, and consequently, consumer acceptance. Some dietary fiber ingredients could be desirable for their nutritional properties but also for their techno-functional and physio-functional properties. Its technological effects on foods differ according to the quantity and nature of dietary fiber. Taken into account the technological properties of a tiger nut rich-fiber extract (TNFRE) obtained from its consumption is a large quantity of catfish skin (CS), approximately 8,200 metric tons in 2014. Enzymatic hydrolysis is used to produce protein hydrolysates from the skin. These hydrolysates have considerable antioxidant properties. Because shrimp mainly contain polyunsaturated fatty acids, shrimp may be susceptible to lipid oxidation during frozen storage. It is expected that glazing shrimp with catfish skin hydrolysates (CSH) would reduce the rate of lipid oxidation and preserve quality characteristics during frozen storage. The objective of this study was to evaluate CSH as a glazing material for air-blast frozen shrimp.

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P03-106
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Method:
Burgers without TNFRE and with 15% TNFRE added were elaborated, immediately vacuum-packaged, frozen and stored at -30°C in a freezer for until 4 months (samples for evaluation were taken at 30, 60, 90, and 120 days). For quality evaluation, proximate composition, microbial analysis, physicochemical properties, oxidation, and sensory analyses were made.
**Results:**
The use of 15% TNFRE in burgers not only increase their nutritional value (higher fiber content, mainly insoluble dietary fiber) without affect their acceptance, but also protect their quality characteristics during frozen storage. The quality characteristics that have been improved are mainly redness and oxidation stability; taken into account that color changes and oxidation reactions are the two principal processes implies in quality deterioration in meat products, TNFRE could be a good quality protect agent in burgers during frozen storage.

**Significance:**
These results have a great importance for both, consumers and meat industries which could increase the nutritional quality and the shelf-life of frozen burgers during storage using a natural extract.

**P03-107**

**Personality Traits Affect Habits of Posting Food-Related Images on Social Media**

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**Introduction:**
Food is an essential feature in everyday life, so it is not surprising that a significant proportion of pictures posted on social network platforms are food-related. Nevertheless, little is known about how this type of content uploaded in social media is associated with users’ personality traits and general behavior. This study focused on determining motivations that lead social media users to upload pictures of food, and aimed to investigate whether such behaviors are associated with personality and eating behavior traits.

**Method:**
A face-to-face survey was administered to 133 university students to assess their individual habits related to food-related image posts, personality traits, sensation seeking, and eating behavior. To determine the relationship between personality traits, eating behavior, and food-posting habits, Pearson correlation analyses were performed.

**Results:**
About 37% of participants considered the presentation itself to be the most important aspect of food-related image posts on social media. While overall frequency of food-related image posting was negatively correlated with the agreeableness trait (P = 0.023), it positively correlated with neuroticism-related personality traits (P = 0.01). Furthermore, marked gender differences were found with respect to the influence of personality traits on the frequency of posting food-related images. For men, unlike for women, the frequency of posting food-related images showed a positive correlation with a neuroticism-related trait (P = 0.044), but negative correlations with novelty (P = 0.007) and openness (P = 0.035) traits. Women, unlike men, demonstrated a positive correlation between their frequencies of eating out and posting food-related pictures with friends or family member (P = 0.009). In conclusion, this study demonstrates that food-related image posting habits on social media are related to users’ personality traits and social behavior.

**Significance:**
These findings provide an opportunity for food companies to better understand what aspects of food-related image postings are more relevant to social media users, as well as to food consumers in general.

**P03-108**

**The Role of Heat Treatment on Astringency and Rheology of Fluid Milk**

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**Introduction:**
Fluid milk may be pasteurized by high temperature short time pasteurization (HTST, >72°C for 15 s) or by ultrapasteurization (UP), >138°C for 2 s). Ultrapasteurization extends shelf life but also alters sensory properties. Literature suggests that UP increases milk astringency, but definitive studies have not demonstrated this effect. The objective of this study was to determine the role of heat treatment on astringency and rheological/tribological behaviors of fluid milks.

**Method:**
Raw, skim, and standardized 1% and whole (3.25% fat) milks were pasteurized at 140°C for 3.3 s, by indirect (IND) or direct steam injection (DIR) UP or by HTST (78°C, 15 s), homogenized at 20.7 MPa, and stored at 4°C. Astringency within each fat content was examined with a trained panel (n=22) using 2 AFC paired comparison tests at 1, 4, and 8 weeks after processing. Fresh HTST milks were processed at week 7 for week 8 evaluations. Instrumental viscosity and friction profiles were measured at 25°C at 1, 4, and 8 weeks. Milk processing was replicated in duplicate.

**Results:**
Both fat content and storage time impacted astringency perception. At weeks 1 and 8, for skim and 1% fat, IND-UP milks were more astringent than corresponding HTST milks (p<0.05). At week 4, skim DIR-UP milk was more astringent than skim HTST milk (p<0.05). Interestingly, friction data showed opposite trends. No differences in week 1 friction coefficients were observed in oral sliding speed range (30-100 mm/s). At week 4, 1% fat IND-UP milk had significantly higher friction coefficient values than 1% fat HTST milk at oral sliding speeds. No differences in astringency or friction coefficients at oral sliding speed range were noted among whole milks (p>0.05) at any timepoint (p>0.05). At all timepoints, UP milk showed greater viscosity than HTST milk for skim and whole milks.

**Significance:**
These results indicate that milk astringency-viscosity-friction relationships are complex, and further study is needed to determine these relationships.

**P03-109**

**Using Immersive Technologies to Study the Impact of ‘All-Natural’ Labeling on Perceived Food Quality and Liking in a Simulated Grocery Store Setting**

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**Introduction:**
The “all-natural” label is used extensively in the US, however is unregulated by the FDA. Moreover, many point-of-purchase locations employ servers that provide samples and call out specific label information to influence consumer’s purchase decisions. Despite these ubiquitous practices, it is unclear what information is conveyed to consumers by the “all-natural” moniker or how it impacts perceived food quality and acceptance. Presently, a novel approach incorporating immersive technology was used to simulate a virtual grocery store setting in which consumers were asked by a confederate to sample peanut butter (PB).

**Method:**
A confederate invited 120 subjects to sample identical PB. In condition 1, jar labels were removed. In condition 2 (C2), front-of-pack labels were revealed; labels on both jars were identical except that one contained the wording “all-natural.” Testing in condition 3 was identical to C2 except the confederate indicated that one sample used “all-natural ingredients.” In each condition, subjects rated liking of each sample and indicated the highest price they would pay for a 16-ounce jar. Panelists also indicated their level of agreement to 10 statements related to perceived PB quality and nutritional content. Data were analyzed using ANOVA. When the condition*C*PB interaction was significant, mean differences for each PB in each condition were assessed using paired t-tests.

**Results:**
Results indicated the “all-natural” label significantly improved consumers’ perception of PB quality and nutritional content but not liking or willingness-to-pay. Interestingly, with the addition of a simple call-out of the “all-natural” claim, these differences became even more pronounced and willingness-to-pay increased significantly by an average of 8% (S0.28) more per jar for the naturally labeled PB.

**Significance:**
In a virtual setting consistent with making food choices and purchases, an “all-natural” front-of-pack label improves consumer perceptions of product quality and nutritional content resulting in a willingness to pay a higher price for products so labeled. Additionally, information conveyed to consumers by employed servers has a further, substantial impact on these variables suggesting that consumers are highly susceptible to social influence at the point-of-purchase. Given these findings, efforts to regulate the meaning and use of the “all-natural” label seem substantiated.

**P03-110**

**Aroma Chemistry and Consumer Acceptance of Navy Bean Flour**

E. Szczypiel, Michigan State Univ, J. Vanderweide, E. Brock, S. Cho, J. Harte, Email: szychs7@msu.edu

**Introduction:**
Bean flour has been gaining in popularity among consumers due to its reported health benefits including reduced risk of heart disease, obesity, and diabetes. Extruded navy bean (Phaseolus vulgaris L.) flour can be considered as a cost-effective alternative to resource intensive traditional methods of processing. The objectives of this study were (1) to assess the volatile chemistry of extruded and commercial navy bean flour to determine the odor-active compounds using headspace solid-phase microextraction (SPME) combined with gas chromatography-olfactometry, and (2) to investigate consumer acceptance of navy bean crackers made with the extruded or commercial bean flour.

**Method:**
Headspace solid-phase microextraction (SPME) combined with gas chromatography-olfactometry (GC-O) was used to identify the odor active compounds. 7 panelists were familiarized with GC-O method and asked to sniff effluent of the bean flour headspace separated on an Rtx-1301 60 m column and report the character of each odor sniffed.

**Results:**
No differences in viscosity were observed for 1% fat milk at week 1; viscosity at week 4 from largest to smallest values were: IND-UP>DIR-UP>HTST. Whole milk had greater viscosity and smaller friction coefficients than 1% and skim milks (p<0.05).

**Significance:**
These results indicate that milk astringency-viscosity-friction relationships are complex, and further study is needed to determine these relationships.

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lipid oxidation prior to the experiment. Consumer acceptance data showed a significant preference for baked navy bean crackers made with the extruded bean flour over the crackers made with the commercial bean flour.

Significance:
Development of highly acceptable bean flours that are mindful of cost and resource waste will help increase consumption of healthful dry beans. This study further our understanding of the sensory implications of extrusion on bean flour acceptability and reveals that lipid oxidation in bean flour may impact consumer liking.

P03-111
Novel Creation of a Rum Flavor Lexicon Through the Use of Web-Based Material
C. Ike, University of Illinois, S. Lee, K. Cadwallader, Email: homes2@illinois.edu

Introduction:
Flavor lexicons help both manufacturers and consumers to communicate the intricacies of flavor nuances they experience within a product. Lexicon development typically requires the use of a trained sensory panel to evaluate a representative sample of the product category and generate terms that describe the products. Some product categories, such as rum, contain a large amount of product variation making it difficult to create a lexicon in this manner. Due to the simple standard of identify for rum, only that it be made from sugarcane byproducts, there is a huge amount of product variation that would require evaluating 100 or more different rums to create a complete flavor lexicon. Our aim was to create a flavor lexicon for rum through the use of web-based product reviews to minimize the cost and allow for inclusion of a greater number of rum products.

Method:
Web-based material consisting of blogs, company descriptions, and review websites, were used to amass the sensory terms. Each rum evaluation was coded for aroma, aroma-by-mouth, and taste attributes using the NVivo software. Once all evaluations were coded, word frequency analysis was conducted on coded attributes. Terms that appeared at least 10 times throughout the entire dataset were selected for the preliminary lexicon. A sorting exercise was performed to group the different terms into corresponding categories. Reviews for over 1,000 different rums were utilized and terms were collected from evaluations that described an array of rums, including white, gold, aged, and agricole rums.

Results:
The analysis of web-based material yielded 166 terms, sorted into 22 different categories. The most prominent terms included vanilla, oak, caramel, fruity, molasses, and baking spices.

Significance:
This is the first study to use web-based material for the creation of a flavor lexicon. The developed wheel demonstrates that web-based material can be used for products with large variation to create a lexicon, provided enough evaluations of the product exist.

P03-112
Effect of Pasteurization on Lemon Juice With Different Concentrations by Sensory Evaluation
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Introduction:
Lemonade is one of the most preferred fruit juices because of its sour and refreshing taste when mixed with mint and consumed cold, especially in summer. It is also very rich in nutrients, such as Vitamin C, and carbohydrates coming from dissolved sugar. Although lemon juice has low acidity, which prevents the growth of many organisms, spoilage is generally caused by yeast and molds due to considerable amounts of sugar and low pH. Potassium sorbate and sodium benzoate are commonly used as food preservatives in many lemonade drinks sold in markets. Mild pasteurization is an alternative process that might be used instead of food preservatives in many lemonade drinks sold in markets. Mild pasteurization process had an increasing effect on the redness (a value), while having a decreasing effect on yellowness (b value). There was no significant difference in pH values for fresh and pasteurized lemonade.

Significance:
Mild pasteurization could be used for preservation of lemonade drinks containing 15% lemon juice.

P03-113
Effect of pH-Induced Denaturation on the IgE-Binding Capacity of Shrimp (Penaeus Monodon) Tropomyosin
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Introduction:
Shellfish is one of the big 8 food allergens responsible for the majority of allergic reactions in the United States. Individuals that are allergic to shrimp has antibodies (immunoglobulin E, IgE) that bind with certain shrimp proteins. The major allergenic protein in shrimp is tropomyosin. Conservation of linear and structural epitopes of tropomyosin is crucial for IgE binding (allergenicity). Hence, food processing methods that can modify the structure of tropomyosin might be able to reduce its allergenicity. Studies on chemical modification of shrimp tropomyosin to reduce its allergenicity has not been explored extensively. Thus, the aim of this research was to determine the effect of pH-induced tropomyosin denaturation on its IgE binding capacity.

Method:
Commercial white vinegar was adjusted to pH 1.0, 2.5, 3.5, and 4.8. Whole shrimp were marinated in these solution for 1, 3, 6, and 16 hours. Properties such as vinegar uptake, muscle pH, and soluble protein concentration were determined. IgE binding capacity of tropomyosin in soluble and insoluble fraction were determined by indirect ELISA and western blot respectively. Quantitative data were analyzed using one-way ANOVA and significant difference among means were assessed at p < 0.05.

Results:
Diffusion of vinegar into shrimp tissue was promoted at pH 1.0 – 3.5 at all marination time, while the recovery of soluble proteins was significantly (p<0.05) reduced at the same pH range. SDS-PAGE analysis of the soluble extracts showed that major myofibrillar proteins, including tropomyosin, were not solubilized by the extraction buffer, especially after prolonged marination time except for samples marinated at pH 4.8. The IgE binding capacity of tropomyosin in the soluble extract was significantly higher in extract obtained from shrimp marinated at pH 4.8 compared with samples marinated at lower pH. However, examination of the insoluble protein fraction using western blot assay showed that tropomyosin retained its IgE binding capacity at all marination conditions used in this study.

Significance:
This work demonstrated the allergenic potential of tropomyosin at low pH regimes. This study also revealed the importance of analyzing both soluble and insoluble protein fraction in order to make accurate conclusion about the effect of a processing method on allergenicity.

P03-114
Genotypic Analysis of Shiga Toxin-Producing Escherichia Coli Strains Recovered From Produce Production Regions in California
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Introduction:
Shiga toxin-producing Escherichia coli (STEC) is recognized as a gastrointestinal pathogen and the leading cause of enteric infections and hemolytic uremic syndrome (HUS), a life-threatening condition characterized by thrombocytopenia, hemolytic anemia, and renal failure. Transmission occurs with consumption of contaminated foods, including raw produce. Salinas Valley in California is among the most productive agricultural regions of the United States and the biggest producer of leafy greens, and in recent years, several STEC outbreaks traced back to produce from this agricultural region.

Method:
In the present study, a total of 45 STEC isolates, recovered from animal sources, were examined by PCR to identify O and H antigens and 15 major virulence genes that are proposed to be associated with severe human disease.

Results:
Serogroup O157 represented 46.66% (21/45) of the recovered strains. Particularly, O157:H7 serotype represented 44.44% (20/45) of the isolates. A common virulence profile, eae, espP, katP, and ehxA, was identified in 33.33% (7/20) of serotype O157:H7 isolates. The relevant non-O157 serotypes, O113:H21 and O121:H19, represented 24.44% (11/45) of the recovered strains. A common virulence profile, eae, espP, katP, ehxA, nleB, was identified in 85.71% (6/7) of the O113:H21 serotype isolates, and in 50% of the O121:H19 serotype isolates, the predominant virulence profile was eae, espP, katP, ehxA, nleB, nleC, nleD, nleH-1. A total of 8.89% (4/45) of the strains recovered mostly from cattle and wildlife was non H typeable and a 20% (9/45) were non O typeable. Furthermore, no virulence genes were identified in 6.66% of the strains in this study.

Significance:
The results obtained in this study have indicated the presence of predominant serotypes and virulence genes, associated with human illness in STEC recovered from animal sources this agricultural region. These findings will also provide valuable information to help with the identification and prevention of outbreaks associated with foodborne pathogens.
Performance on Tomato Peeling
Comparison of Radiant Efficiency of Infrared Emitters and Their Performance on Tomato Peeling

Introduction:
Microcysts (MCs) are a family of cyanotoxins which are found in freshwater globally. The toxins cause chronic damage of liver, kidney, and reproductive system, and even promote tumor formation. Also, MCs were detected in fish and seafood grown in harmful algal bloom-affected water bodies. Moreover, using MC-contaminated water for agriculture could negatively affect crop yields and quality. MCs are resistant to sunlight exposure and boiling process. Previous studies focused on the certain type of MCs treatment, such as MC-LR and RR. However, the MCs produced by cyanobacteria are released into environment as a mixture of various congeners. Therefore, there is a need to develop cost-effective and environmentally friendly methods to degrade MCs efficiently. The objective of this study is to develop non-chemical and non-thermal methods that can be applied for treating MCs in water and food, without reducing the food quality. Therefore we investigated ultraviolet (UV) light and cold plasma for treating MCs in water first.

Method:
MCs were extracted from Microcystis aeruginosa cultured in CT medium using sonication, freeze-thaw lysis, and filtration with 0.45 μm pore-size membrane. MCs-containing solutions (10 ppb) were treated with UV (1470 μW/cm² or 180 μW/cm²) for 90 min and cold plasma for 210 min, respectively. For UV, nanoparticles of titanium dioxide (TiO2) were applied on the outside of container to test its synergistic effects. The MCs concentrations were measured with an enzyme-linked immunosorbent assay (ELISA).

Results:
With the UV (1470 μW/cm²), 90% and 95% reduction of MCs was observed within 30 min and 45 min, respectively. With additional TiO2, no significant enhancement was observed under 1470 μW/cm², however, under 180 μW/cm², it enhanced the MC degradation by 12.3% in 90 min. With the cold plasma, 90% and 95% degradation of MCs was observed within 2h and 3h, respectively. Large-scale cold plasma equipment could shorten the treatment time with the same degradation efficiency.

Significance:
Cyanotoxins present in water affect human health and food production, for example, irrigation and aquaculture. Cold plasma and UV treatment could serve as effective approaches for MC treatment in various matrices that can be applied for both household and commercial scales.

Inactivation of Aflatoxins B₁ and B₂ in Peanuts by Pulsed Light (PL)

Introduction:
Aflatoxins (AFTs) are secondary metabolites of Aspergillus flavus and Aspergillus parasiticus molds. They are potent toxicogenic, carcinogenic, and immuno-suppressive compounds commonly found in groundnuts and groundnut products. Many methods have been studied to provide food free of AFTs. Pulsed light (PL) treatment is one of these techniques, which showed promising results in the degradation of pure AFT dilution (97% reduction). In this study, the degradation of AFTs in AFT inoculated peanuts was determined after PL treatment using three distances (5, 7, and 10 cm) from the PL strobe and different exposing times.

Method:
Five grams of peanut kernels in an aluminum tray were PL treated with 4 modes: (1) conventionalventional, (2) vibrating conventional, (3) rotating glass tube, and (4) ice tray. Similarly, 5 grams of the slices of AFTs inoculated peanuts were PL treated. AFTB1 and AFTB2 contents were determined using an enzyme-linked immunosorbent assay (ELISA). The temperatures of PL-treated peanuts were monitored using an infrared thermometer and thermocouples to determine the actual temperature inside the kernel during PL treatment.

Results:
Results showed that PL treatment using a vibrating and a conventional conveyor for 240s at a 7 cm distance degraded AFTs by 60% and 44% respectively. The PL treatment on a conventional conveyor for 240 s and 5 cm reduced AFT by 55%. However, the surface of the peanuts was burned. Surface burning was avoided when ice was placed under the tray. The peanuts inside the rotating glass tubes treated by PL for 240 s at 7 cm had the lowest AFT reduction of 23%. PL treatment of 160 s at 5cm distance provided AFT reduction of 58% in sliced peanuts without burning the surfaces of the peanuts.

Significance:
This study indicates that PL illumination could degrade the AFTs in the peanuts as a result of PL’s photochemical effect.

Comparison of Radiant Efficiency of Infrared Emitters and Their Performance on Tomato Peeling

Introduction:
Tomato peeling is an important unit operation that requires a quick heating of tomato surface for achieving a good peeling performance and product quality, demanding a higher radiation intensity (flux). Infrared (IR) radiation heating can provide a useful temperature range for most food processing applications including peeling process. However, IR emitters differ in their characteristics and can be miss-applied to peeling process, resulting into a lower efficiency. The objective of this study was to compare the radiant efficiency of different IR emitters and evaluate their performance on tomato peeling process.

Method:
Gas-catalytic IR (GC-IR) emitter and four different types of electric IR emitters with same voltage input namely ceramic, pillard quartz elements (PQE), quartz tungsten (QT) and quartz halogen (QH) were tested during this study. A tomato cultivar, Heinz (H2) 6410, grown for peeling was used for conducting the peeling tests. The electric emitters were tested using a prototype IR heating system under similar conditions. The peeling performance was compared based on peeling easiness, peelability, peeling loss, color and texture of peeled products.

Significance:
We concluded that electric IR emitters with high radiation power output significantly reduced residence time to achieve acceptable peeling performance of tomato. A pilot-scale test using PQE with higher loading rates would be the next step to validate its promising potential for commercialization.

The Microbiological Safety of Sous-Vide Eggs

Introduction:
Sous-vide is an increasingly popular cooking method using relatively lower temperatures for extended times. The intent is to create a better quality product by not overcooking the outer portions of the food. The sous-vide method has been applied to shell eggs by chefs, and more recently, by home cooks. Due to the potential presence of Salmonella within shell eggs, there is a concern that the sous-vide time/temperature combinations may be insufficient to eliminate Salmonella. The objective of this study was to determine the microbiological safety of shell eggs cooked using the sous-vide method.

Method:
Shell eggs weighing between 57 to 62 g were purchased from a local commercial producer. The yolks of the eggs were injected with 200 μl of okayTyphimurium (ATCC 53647). The eggs were submerged in a circulating water bath at 60, 62 or 64 °C for up to 30 minutes. These temperatures are commonly recommended for sous-vide cooking of shell eggs. After cooking the eggs in ice water, the eggs were aseptically cracked and the contents were stomached and serial diluted before plating on Enterobacteriaceae Count Plate (3M™ Petrifilm™). Plates were incubated at 37 °C for 24 h before enumeration. Experiments were performed in triplicate with duplicate plating.

Significance:
This is the first study to analyze the safety of sous-vide eggs. The results show that sous-vide eggs, as typically prepared by chefs and home cooks, are safe. Now, consumers can enjoy the delights of eating sous-vide eggs without any worries.

Effect of Sucrose as a Cryoprotectant of the Gel-Forming Ability of Raw Blue Crab Meat During Frozen Storage

Introduction:
Cryoprotectants are commonly added to fish surimi to protect myofibrillar proteins from denaturation and aggregation during frozen storage, which results in loss of heat-induced gelling properties. This study explored the possible protective effect of added cryoprotectant on the gelling properties of raw blue crab meat (Callinectes sapidus) following frozen storage.
Method: Raw crabmeat paste, with or without cryoprotectant (6% sucrose), was subjected to 6 months isothermal storage at -20°C vs. 6 or 12 freeze-thaw (FT) cycles of -20°C to near 0°C. Formaldehyde content, protein solubility, and heat gelation properties were monitored by purpald test, bicinchoninic acid assay, and 5 mm ball penetration test, respectively.

Significance: Sucrose as a cryoprotectant prevented the loss of protein solubility, but did not inhibit the small (about 8-20%) but significant losses in gel strength, and slight decreases in gel deformability, noted after the various frozen storage treatments.

Results: Protein solubility decreased after 6 months isothermal frozen storage and 12 FT cycles (by 5% and 30% respectively). However, gel-forming ability did not significantly decrease in concert with this drop in protein solubility. No formaldehyde formation was noted in any treatment.

P04-002
Conformation Changes of White Croaker (Argyrosomus Argentatus) Surimi Protein Secondary Structures During Gelation Based on Fourier Transform Infrared Spectroscopy
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Introduction: Gelation is an important functional property of fish protein affecting the rheological and textural properties of surimi. A thorough understanding of the mechanisms that govern surimi gelation would be essential for the improvement of gel quality and texture.

Method: Fourier transform infrared spectroscopy was employed to investigate protein conformation changes, which played significant roles in maintaining stable surimi gel network during the formation of white croaker surimi gel, for exploring the effect of protein conformation on surimi gel network. Recorded FTIR spectra of surimi samples with different grades (A, AA, FA, and SA) were analyzed by peak fitting of the non-deconvolved and baseline corrected amide I bands (1600-1700 cm-1). Peak positions were assigned to individual structural components. By our proposed peak fitting approach, quantitative evaluation of the secondary structure was performed assuming peaks of Gaussian shape.

Significance: This work will contribute more insights into the surimi gelation process, which would be practically helpful for the improvement of surimi gel quality and texture.

Results: The result shows that α-helical structure was the main conformation of surimi proteins. During surimi gelation, α-helices of myosin partially changed into β-sheet, β-turn and random coil structures. In conclusion, β-sheet and random coil structures were the main protein conformations maintaining the structure of surimi gel, and β-sheet made the main contribution to gel strength.

P04-003
Accelerating Degradation of the Off-Flavor Causing Compounds 2-Methylisoborneol and Geosmin Under Weak Acidic Conditions
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Introduction: Off-flavor is a severe quality problem which has hampered the catfish industry for decades and caused significant economic loss. It has been widely recognized that two strong odorous compounds, 2-methylisoborneol (MIB) and geosmin (GSM), are mainly responsible for the off-flavor in catfish. Our previous study indicated that acetic acid could accelerate the degradation of GSM and MIB, and, subsequently, reduced the off-flavor. If the degradation mechanism was the dehydration of tertiary alcohols under acidic conditions, other edible acids might also be effective in chemical treatments to reduce off-flavor. To test this hypothesis, the effects of acetic acid, ascorbic acid and citric acid on the degradation of GSM and MIB were investigated and compared.

Method: An artificial off-flavor solution containing 100 ng/mL of GSM and MIB was prepared. Then, 5.0 mL aliquots of the off-flavor solution were mixed with 5.0 mL of treatment solutions containing 1.0% acetic acid, 1.0% citric acid, or 1.0% ascorbic acid, respectively, in 20 mL headspace vials. Then, a headspace solid-phase microextraction (HS-SPME) method coupled with GC-MS was employed to monitor the changes in GSM and MIB contents.

Significance: This study provides an in-depth understanding of the degradation of MIB and GSM under acidic conditions, which would help the catfish industry develop chemical treatment to reduce off-flavor in catfish fillet and improve product quality.

Results: All of the three acids were very effective in reducing MIB. The removal efficiencies of MIB of acetic acid, ascorbic acid, and citric acid were 96.4±0.1%, 97.7±0.4%, and 98.7±0.2%, respectively, suggesting most of the MIB in the solution were degraded during the process. Two major degradation products of MIB, i.e., 2-methylene-borneane and 2-methyl-2-borneone, were identified in the mixtures after all of the acid treatments. GSM was much harder to degrade, but the treatments were still able to notably reduce its contents. The removal efficiencies achieved by acetic acid, ascorbic acid, and citric acid were 18.2±0.9%, 28.3±4.0%, and 39.6±6.3%, respectively. For both MIB and GSM, the removal efficiencies increased with the increase of the strength of acid, suggesting their degradation mechanisms might be the dehydration of tertiary alcohols under acidic conditions.

P04-004
Influences of Seawater to Oyster Ratio on Depuration for Decontaminating V. Parahaemolyticus in Raw Oysters (Crassostrea Gigas)
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Introduction: Vibrio parahaemolyticus is a foodborne pathogen which causes acute gastroenteritis mainly associated with raw shellfish consumption. The Center for Disease Control and Prevention estimates that 45,000 cases of V. parahaemolyticus infections occur annually in the U.S. We recently developed a refrigerated seawater (12.5°C) depuration process capable of decreasing levels of V. parahaemolyticus in raw oysters by >3.0 log (MPN/g) in 5 days without adverse effects on oysters. This study investigated influences of seawater to oyster ratio on depuration for decontaminating V. parahaemolyticus in raw oysters with a goal of identifying proper seawater to oyster ratio to improve the efficacy of depuration process.

Method: Pacific oysters (Crassostrea gigas) were inoculated with five clinical strains of V. parahaemolyticus to log 4-5 MPN/g and depurated in UV-irradiated artificial seawater (ASW) with water to oyster ratios ranging from 1.0 to 2.0 liter of ASW per 40 oysters (40 oysters in 40, 60 and 80L ASW) at 12.5°C for 5 days. Populations of V. parahaemolyticus in oysters during depuration were analyzed every 24 hours using a three-tube most probable number (MPN) method described in the Food and Drug Administration Bacteriological Analytical Manual.

Significance: This study improved the efficacy of refrigerated depuration (12.5°C) to achieve >3.52 log MPN/g reductions of V. parahaemolyticus in the Pacific oysters after four days of processing.

Results: Depuration of 40 oysters in 40L of ASW (1:1 liter of ASW/oyster) for 5 days resulted in 2.45 log (MPN/g) reductions of V. parahaemolyticus in oysters while depuration of oysters in 60L (1.5:1 liter of ASW/oyster) and 80L of ASW (2:1 liter of ASW/oyster) for 5 days yielded 3.52-3.62 and 3.71-4.11 log (MPN/g) reductions of V. parahaemolyticus in oysters, respectively. Further studies of depuration with 2:1 liter of ASW/oyster using 35 oysters resulted 3.67 log (MPN/g) reduction of V. parahaemolyticus in 80L ASW confirmed that depuration at 12.5°C could deliver 3.68 and 3.69 log (MPN/g) reductions of V. parahaemolyticus in oysters, respectively, after 4 days of processing.

P04-005
Degradation of Histamine in Salted Fish Products by Halotolerant Bacillus Polymyxa
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Introduction: Salted and fermented fish product was reported to contain high levels of histamine. Although incidents of histamine poisoning following the consumption of these salted fish products have not been reported, they may have occurred but went unnoticed because symptoms of histamine poisoning closely resemble those of food allergies.

Method: Recently, the histamine-degrading isolate, Bacillus polymyxa D05-1, isolated from Taiwanese salted fish product exhibited high potential to degrade histamine in previous study. Therefore, the objective of this study was to investigate the effects of histamine-degrading isolate, B. polymyxa D05-1, added in commercial salted fish product for degrading histamine and the control of histamine in seafood. B. polymyxa D05-1 was added without (control) or with low (4.0 log CFU/g) and high (6.0 log CFU/g) cultures to the salted fish products and held at 30°C for 6 weeks in this study.

Significance: This study demonstrated that application of B. polymyxa D05-1 as additive in salted fish fermentation could degrade histamine and reduce the levels of histamine in fermented products. Therefore, this is an alternative method for the control of histamine in salted and fermented seafood.

Results: This study showed that the low and high spiked samples had lower TVB-N and histamine contents than control samples. In general, histamine contents in the both spiked samples markedly decreased during 6 weeks storage, whereas those of control samples increased with increased storage time. After 6 weeks storage, the histamine contents in high and low spiked samples were reduced for 45.8% and 36.0%, respectively, as compared to control samples.
P04-006
Comparison of Growth of Pathogenic and Non-Pathogenic Vibrio Parahaemolyticus at Various Temperatures
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Introduction: Vibrio parahaemolyticus is a foodborne pathogen frequently isolated from seafood, especially shellfish. It is known that most strains of V. parahaemolyticus are not pathogenic to human. Limited studies have been conducted to investigate the difference in growth and survival between pathogenic and non-pathogenic V. parahaemolyticus in various environments. This study investigated growth and survival of pathogenic and non-pathogenic V. parahaemolyticus strains at different temperatures (5-20°C).

Method: Strains of pathogenic (10290 and BE 98-2029) and non-pathogenic (090811Y02 and 100311Y04) V. parahaemolyticus were incubated in tryptic soy broth (TSB) with 1.5% NaCl (TSB-Salt) at 5, 10, and 15°C for 96 hours and 20°C for 36 hours. Tryptic soy agar (TSA) with 1.5% NaCl (TSA-Salt) was used to determine bacterial counts. The Tukey-Kramer HSD test was used for statistical analysis.

Significance: This study revealed differences between growth and survival rates of pathogenic and non-pathogenic V. parahaemolyticus strains at various temperatures. This information is useful to the risk assessment of raw and ready-to-eat seafood consumption.

Results: The growth rates (µmax) of pathogenic strains of 10290 and BE 98-2029 at 20°C were determined to be 0.33 and 0.36 log CFU/h, respectively, which were significantly lower (P < 0.05) than those of non-pathogenic strains 090811Y02 (0.42 log CFU/h) and 100311Y04 (0.41 log CFU/h). The growth rate of pathogenic strain of 10290 (0.06 log CFU/h) at 15°C (TSB-Salt) was significantly lower (P < 0.05) than those of strain BE 98-2029 (0.13 log CFU/h) and two non-pathogenic strains 090811Y02 (0.18 log CFU/h) and 100311Y04 (0.18 log CFU/h). These results indicate that pathogenic strains of V. parahaemolyticus seem to grow slower than non-pathogenic strains of V. parahaemolyticus at 15 and 20°C. At 10°C, non-pathogenic strain 090811Y02 decreased by 0.38 log while non-pathogenic strain 100311Y04 and pathogenic strains 10290 and BE 98-2029 increased by 0.99, 0.66, 0.42 log, respectively, after 96 hours. At 5°C, non-pathogenic strains 090811Y02 and 100311Y04 decreased by 3.09 and 3.07 log, respectively, while pathogenic strain BE 98-2029 and 10290 decreased by 2.51 and 1.09 log, respectively, after 96 hours.

P04-007
Characterization and Expression of an Algin Lyase From Ablalone Q. Zhang, Shanghai Ocean University, L. Wang, J. Yan, Email: byec@ sina.cn

Alginic oligosaccharides have good prospects because of their useful and biologically important functions. Alginic lyase can degrade alginate to alginate oligosaccharides. Alginate oligosaccharides have good prospects because of their useful and biologically important functions. Alginate lyase can degrade alginate to alginate oligosaccharides for large-scale application of alginate lyase to degrade the alginate needed to provide low-cost enzymes.

Method: The alginic lyase gene algI was amplified by PCR from the genomic DNA, which was obtained by RT-PCR from RNA extracted from the abalone hepatopancreas. The recombinant plasmid pET28a-algI was transferred into E. coli BL21, then induced and expressed. The enzyme properties were studied after being detected by polyacrylamide gel electrophoresis (SDS-PAGE) and purified through Ni-NTA.

Significance: Recombinase AlgI has a good prospect in production of alginate oligosaccharides due to its specificity in poly mannuronic acid, cold adaptation and thermal stabilities.

Results: The results showed that the relative molecular weight of new protein bands were 32 Kda. The enzyme activity and specific activity were 15.6 U/mL, 644.6 U/mL respectively after being purified and refolded, which were lower than those of Aplysia kurodai and Littorina brevica. The optimum temperature and pH were 35°C and 8, respectively. Only Poly mannurionate (polyM) was degraded rather than poly guluronic acid (polyG). The Km and Vmax values of alginate were 1.71 mg/mL and 19.08 U/mL, respectively.

P04-008
Bioethanol Production Using Pineapple Juice Obtained From Agroindustrial Residues A. Hernandez, Universidad de Costa Rica, G. Cabrera, Email: aliciah62@gmail.com

Introduction: Costa Rica is one of the major pineapple producers and exporters worldwide. However, some pulp with a high sugar content, remains on the fruit peels after mechanical peeling. This residue generates environmental problems and has a high value-added potential. The objective of this study was to produce bioethanol via fermentation using pineapple juice obtained from the peels.

Method: Milled peels were pressed, clarified and sterilized to obtain the juice. Fermentation was evaluated with Saccharomyces cerevisiae and Zyymonas mobilis, as well as different supplementation media (A and B), using a 22 factorial design. Fermentation was carried out on 5 L working volume bioreactors; temperature and pH were maintained at 30°C and 4.5 for both microorganisms. Saccharomyces fermentation was agitated at 75 rpm and Zymomonas at 20 rpm. Ethanol production and sugar concentration were quantified by HPLC during fermentation.

Significance: This research shows that the use of agroindustrial waste to produce bioethanol is feasible with various microorganisms and it can be performed without the need of nutrient supplementation.

Results: Some data for the pineapple peel: moisture was 86.2±1.10, sugar content of juice was 87.71±1.67 g/L, soluble solids 11.6±0.5 and pH of 4.16±0.52. Nutrient supplementation had no effect on ethanol production (p>0.05). There was no lag phase when using S. cerevisiae; logarithmic phase evaluated by optical density, beginning from 0 hours and lasting to 17 hours later. 100% of sugars were consumed and ethanol production was 37.22 g/L at 23 hours (81% of the theoretical value). Glycerol production reached 4.9 g/L. Fermentation time ended at 23 hours. Lag and logarithmic phase for Zymomonas ended after 3 hours and at 21 hours of fermentation, respectively. 94% of sugars was consumed and ethanol concentration reached 40.20 g/L (88% of the theoretical value). No glycerol was detected.

Maximum productivity achieved (2.4±0.2 g/L/h) was similar when using both microorganisms. Final fermentation time is between 23 and 25 hours. Productivity at the end of sugar consumption is higher (p<0.065) for the yeast (2.0±0.3 g/L/h). Although bioethanol yield is higher when using Zymomonas, we recommend to use yeast because the process can be easily developed.

P04-009
Validation of an Event Specific Quantitative Real-Time PCR Method for GM Soybean MON87751 and GM Maize MON87403 in Korea H. Lee, Ministry of Food and Drug Safety, Y. Kim, S. Kim, Y. Kwon, S. Hong, S. Kim, H. Yoon, W. Kim, Email: hayongl@korea.kr

Introduction: Cultivation of genetically modified (GM) plants has constantly increased for various reasons. Recently, two kinds of GM crops were estimated at the Ministry of Food and Drug Safety (MFDS) in Korea. In this study, we validated the methods for the detection of GM soybean MON87751 and GM maize MON87403.

Method: To validate the detection methods, GM or non GM samples were ground by an electric mill, then DNA extraction and purification were carried out using the Biorimeux’s automated NucliSENS® EasyMag system. DNA quantity and quality were determined by Nanodrop (Thermo, USA). Oligonucleotide primers and probes for MON87751 and MON87403 were synthesized by Cosmo Genetech (Cosmo, Korea). Quantitative Real-time PCR (qPCR) was performed by a LightCycler (Roche) in replicates of 3 (Life Technology, USA). In order to validate the methods, DNA samples containing GM at the mixing levels of 0.3, 1.3, 3.0, 5.0, and 10.0% were prepared and conducted qPCR. The precision of the method was evaluated as the RSD of reproducibility (RSDR) and repeatability (RSDr). Linearity (RQ), slope and PCR efficiency. We validated quantitative detection methods for two kinds of GM crops.

Significance: The results showed that validated methods would be applicable for the detection and quantification of both GM crops to ensure the appropriateness of food labeling in Korea.

Results: The results from both MON87751 and MON87403 showed that the values R2 were more than 0.98 and their RSDR and RSDr were less than 25%. The trueness, precision, and slope and PCR efficiency. We validated quantitative detection methods for two kinds of GM crops.

P04-010
Enhancing Extraction of Food-Grade Pigments From the Microalgae Chlorella Vulgaris Through Application of Ohmic Heating G. Fracolla, B. Fernandes, P. Geada, G. Patoa, G. Ferrari, A. Vicente, R. Pereira, Email: gl.fracolla@gmail.com

Introduction: The use of ohmic heating (OH) with the associated non-thermal effects due to the presence of an electrical field and frequency, has been suggested for extraction of compounds from biological matrices. Microalgae are considered as a very valuable source of compounds of interest for food sector (i.e. pigments, lipids, carbohydrates, and proteins) and the selection of extraction technique to recover these compounds is very challenging due to the intrinsic nature of the microalgae cell walls, which limits the mass transfer through it. The main objective of this study is to investigate the effects of OH on the extraction of pigmented solutes from Chlorella vulgaris.

Method: OH treatments of C. vulgaris cultures with a concentration of 0.33 g/L and electrical conductivity of 1 mS/cm were carried out by applying alternating sinusoidal waves
of 25 kHz and electric fields up to 50 V/cm. The operating temperatures range was from 22°C up to a maximum of 45°C. The extracted pigments were characterized by spectrophotometric and spectrofluorometric methods.

Significance: In conclusion, OH has the potential to improve extraction of solutes from a non-concentrated culture of C. vulgaris at mild temperatures and low alternating electric fields. Further studies are necessary for a better understanding of the mechanisms involved in the OH assisted extraction process (e.g. effects of using different electrical frequencies and types of electrical wave). However, the demonstration of the positive effects of OH on the extraction of food-grade nutrients is particularly significant due to its potential use in the market of healthy foods, under the operational parameters tested – i.e. low electric fields, high frequency and low cell concentration – which favor energy efficiency and process reliability.

Results: Results showed that extraction yield of total pigments in the OH assisted process was 156 times higher with respect to that of a conventional extraction process, being the concentration of chlorophyll a, b and carotenoids in the aqueous medium of 0.6±0.04 μg/mL, 0.49±0.01 μg/mL and 0.48±0.05 μg/mL, respectively. Indeed, the concentration of chlorophyll a, b and carotenoids in the extracts obtained with the conventional process was 0.13±0.02 μg/mL, 0.33±0.04 μg/mL and 0.14±0.01 μg/mL, respectively.

P04-011
Determination of Lectins Presence With Hemagglutination Activity in Musa Cavendish Banana
C. Soto, CREAS, A. Olivares, J. Concha, S. Marchant, Email: carmensoto@creas.cl

Introduction: Lectins are a group of not-immune proteins, diverse and highly distributed in plants, animals and fungi. They have been studied because of its diverse functions and potential use in pharmaceutical industry. Lectins participate in physiological processes such as cell adhesion; development, differentiation and cell proliferation; and being responsible for recognition between sperm and ovum during fertilization. The potential biological activity of lectins includes functions such as antitumor, antifungal, antibacterial, immunomodulatory, anti HIV and mitogenic.

Fruits of genus Musa (mainly green banana) are sources of lectins. These fruits are one of the largest crops worldwide. However, yellow bananas (Musa cavendish, dessert banana) are not extensively studied. This study aimed to determine the presence of lectin in Musa cavendish and determine its hemagglutination activity in human erythrocyte lines.

Method: Samples of whole banana (pulp and peel) were freeze-dried and grinded; then, lectin extraction was done using a Tri-HCl buffer solution 1M pH 7.4, 8 and 9 at 25 and 35°C during 24 hours. After that, a salting in-salting out process was done using ammonium sulphate followed by a dialysis process. Protein content was determined in the original extract and the dialyzed extract. In addition hemagglutination activity was determined using A, B, AB, and O type erythrocytes.

Significance: The work confirms the presence of lectins in Musa cavendish bananas, those with hemagglutination activity, laying the foundation for further studies on the potential of this fruit and its products on human health.

Results: The presence of lectins was tested in banana, establishing that the best extraction conditions were Buffer Tri-HCl pH 9; for temperature no variation was quite different between 25°C and 35°C, obtaining values of 0.75 gprotein/L from 10 g banana/100 mL. The hemagglutination activity was observed with all the erythrocytes used, being more important in O+ group, suggesting a potential specificity of these lectins for Fuc-Gal sugars.

These results motivate to evaluate new alternatives to recover lectins from yellow banana, and explore other activities, with a focus in human health.

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P04-012
Investigating the Chemical Basis of Functionality Differences Between Beet and Cane Sugar Sources in a Model Egg White Foam
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Introduction: Though often used interchangeably, researchers have identified differences in functionality between beet and cane sugar sources in some food products. For example, previous research reported sensory differences between pavlova cookies made with beet and cane sugar. Beet sugar pavlova cookies were softer and wetter on the inside than cane pavlova cookies, implying that water loss during baking is slowed in beet sugar pavlova, allowing for water to remain longer in the foam matrix. Furthermore, the rate of water loss during baking affects whether the final product is in the glassy or rubbery state after baking, leading to textural and stability concerns. To alleviate these concerns, a longer baking time for beet sugar pavlova is required.

Significance: This work highlights differences in functionality between beet and cane sugar sources when used in egg based baked products, and raises issues to consider when choosing a sucrose source.

P04-013
Optimization for the Efficient Cycloamylose Production From Various Rice Starches
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Introduction: Cycloamylose (CA) is a cyclic molecule consisting of α-1,4-linked D-glucose residues and can be obtained by treatment of amylase with 4-α-glucanotransferase. However, mass production and application of CA were limited due to the high cost. Therefore, the purpose of this work was to optimize for the efficient cycloamylose (CA) production from various rice starches by isomylase and 4-α-glucanotransferase.

Method: Starches of 5 Korean rice cultivars, Dodamsal (DD), Saegoomi (SG), Lipummi (IP), Sintohuekim (SH), and Geonganghongmi (GH) were isolated by alkaline extraction method. Five rice starches (1% w/v) were debranched with isomylase (5.0 U/g starch) in different reaction time (0, 2, 4, 6, 8, 10, 12 and 15 hrs) and coupling with Thermus aquatics 4-α-glucanotransferase (TAαGTase). The enzymatic efficiency of CA production was examined in terms of reducing power, amylase content, HPSEC, HPAEC, and MALDI-TOF MS.

Significance: This result revealed that the optimum concentration of isomylase and TAαGTase were 3U/g for 6 hrs and 100U/g for 8 hrs for producing the highest yield of linear starch and adding the debranching step to the rice starches increased the production of CA by increasing the amylase content.

Results: Reducing power was rapidly increased after isomylase treatment for 6 hrs and then reached to plateau. The apparent amylase content was greatly increased to 60.38~68.72% with 5 U/g of isomylase for 8 hrs. After the debranching, high molecular weight amyllopectin fraction increasingly disappeared and α-1,4-linkage gluans gradually degraded which observed the final average molecular weight of 4 x 10⁴ Da. Upon 4-α-glucanotransferase treatment, peak of α-1,4-linkage gluans gradually shifted to right and peak of cyclic gluans continuously developed, indicating the cyclization reaction occurred as measured using HPAEC and MALDI-TOF MS. The purified CA obtained ranged from degree of polymerization (DP) 17 to 32. The maximum yield of CA production from DD, SG, IP, SH, and GH were 49.24, 44.35, 31.86, 32.70, and 29.99%, respectively. Therefore, DD might have more benefits for CA mass production and industrial applications, which showed the highest CA production yield.

P04-014
Extraction, Characterization, and Physical and Enzymatic Treatment of Alkali-Extractable Corn Arabinoxylans
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Introduction: Beverages containing fibers are an effective alternative to improve the consumption of fibers. However, the high viscosity of dietary fibers can cause an undesirable mouthfeel, especially when high amounts of fiber are added. The aim of this work was to investigate the effect of physical and enzymatic treatments, and their combination on the viscosity behavior of alkali extractable-banana xylans (CAX).

Method: Defatted, destarched, and proteolyzed corn bran was suspended in 1 N NaOH at 60°C for 4 hours in the presence of hydrogen peroxide and alkali extractable arabinoxylans (CAX) were precipitated with ethanol 95%, with further fractionation at 0-60% ethanol. The following treatments were applied: (i) Homogenization with two stage high pressure homogenizer, 7 times at 17,000-19,000 psi (CAX-H); (ii) Enzymatic treatment with xylanase enzyme for 24 hs at 40°C (CAX-E); and (iii) Homogenization followed by enzymatic treatment (CAX-H+E).

Significance: Results showed that homogenization alone is not an effective process to decrease viscosity.
the viscosity of fibers solutions. However, changes in molecular conformation during homogenization promote a more effective subsequent enzymatic treatment, which reduce the fiber molecular weight and produce lower viscosity of their solutions in comparison with solutions prepared with fibers only enzymatically treated.

### Results:

- Glycolyzed residues composition (gas chromatography) of CAX was rhamsose (0.11%), sucrose (0.30%), arabinoside (31.84%), xyllose (53.24%), galactose (9.69%), and glucose (4.82%).

### Viscosity measurements (shear rate range 0.01 to 300 s^-1) of 0.5% fiber solutions showed Newtonian behavior for all the samples.

- Homogenization process did not affect the viscosity (CAX: 0.063, CAX-H: 0.068 Pa.s), meanwhile the enzymatic treatment decreased the viscosity 10 times and the combination of homogenization and enzymatic process decreased the viscosity even further (CAX-E: 0.0063 and CAX-H-E: 0.00047 Pa.s). These results were related to the molecular weight distribution (size exclusion chromatography): homogenization did not change the molecular weight distribution (CAX: 628 kDa, CAX-H: 337 kDa), in contrast enzymatic treatment and the combined processes decreased the molecular weight (CAX-E: 331 kDa, CAX-H-E: 315 kDa) of the fibers. Dynamic light scattering measurements (90°) showed that CAX has larger molecules (239 and 1061 nm) than CAX-E (6.76, 36.4, and 221 nm).

### P04-015 Prediction of Swelling Kinetics of Waxy Native Maize Starch

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### Introduction:

Starch pasting behavior greatly influences the texture of a variety of food products such as canned soup, sauces, baby foods, batter mixes etc. The annual consumption of starch in the U.S. is 3 million metric tons. The overall goal of this investigation is to characterize the relationship between pasting behavior of starch and its structure and composition.

### Method:

In this research, evolution of granule size distribution of waxy native maize starch when subjected to heating at constant temperatures of 65, 70, 75, 80, 85, and 90°C was characterized using Static Laser Light Scattering. The structure of waxy maize starch was characterized by molecular weight distribution and second virial coefficient as obtained from light scattering as well as by transmission electron microscopy.

### Significance:

The results from this investigation will provide information with regard to the connection between the structure, composition, and architecture of the starch granules and its pasting behavior in order to arrive at a rational methodology to design modified starch of desirable rate of digestion and texture.

### Results:

- As expected, swelling was more pronounced at higher temperature and resulted in a shift of granule size distribution to larger sizes with a corresponding increase in average size from 13 µm to 23-26 µm. Most of the swelling occurred within the first 10 min. Pasting behavior of waxy maize at different temperatures was also characterized from the measurements of G’ and G” for different heating times. At holding time of 2 min, G’ was found to increase with temperature though it decreased at larger holding times. This behavior is believed to be due to the predominant effect of swelling at small times. However, G” was insensitive to temperature and holding times. Polymer solution theory was applied to predict the evolution of average granule size of starch at different heating rates in terms of its molecular weight, second virial coefficient and granule elasticity and compared with experimental data.

### P04-016 The Influence of Ultrapasteurization by Indirect or Direct Steam Injection on Sensory Perception of Skim and 2% Fat Milks

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### Introduction:

Fluid milk is traditionally pasteurized by high temperature short time (HTST) pasteurization which requires heating to at least 72°C for 15 s. Ultrapasteurization (UP) extends milk shelf life and is defined as heating to at least 138°C for 2 s. However, Ultrapasteurization (UP) extends milk shelf life and is defined as heating to at least 138°C for 2 s. The influence of these two methods on milk flavor has not been widely investigated. The objective of this study was to compare the effect of HTST, IND-UP, and DSL-UP on sensory perception of skim milk.

### Method:

- Raw skim and raw standardized 2% fat milks (50 L each) were obtained in duplicate on different days and pasteurized at 78°C for 15 s (HTST) or 140°C for 2.3 s by IND-UP or DSL-UP. Milks were cooled and stored at 4°C. Analysis of aroma active compounds was conducted after 0, 3, 7, and 14 days by solid phase micro-extraction (SPME) followed by gas chromatography-mass spectrometry (GC-MS) and gas chromatography-offactometry (GC-O). Selected compounds were quantified by standard curves. Results were analyzed by univariate and multivariate statistics.

### Significance:

An understanding of the flavor chemistry of heat-treated milk is required to characterize flavor profiles and to identify the source(s) of flavors.

### Results:

- Forty nine aroma-active compounds were identified and quantified in the milks, with differences in profile and relative concentration of volatile compounds influenced by fat content and heat treatment (p<0.05). More aroma active compounds and higher relative abundances of sulfur and Maillard reaction volatiles were detected in UP milks compared to HTST milks (p<0.05). Many aroma active compounds decreased in UP milks with storage (p<0.05). The major aroma active compounds in milk are hydrogen sulfide, dimethyl sulfide, 2-butanone, and furfural in UP-DSI, diacetyl, 3-methyl butanal, dimethyl disulfide, methional, and benzaldehyde in UP-IND, and carbon disulfide, 1-octen-3-one, and 1-octen-3-ol in HTST milk, respectively.

### P04-018 Association of the Hydrophobic Drug Meloxicam With Native Bovine Casein Micelles

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### Introduction:

Caseins (αs1-, αs2-, β-, and κ-casein) account for 80% of the total protein content of the bovine milk and form casein micelles (CM; D = 110-130 nm, ca. 1015 micelles /mL of the bovine milk) that natively bind low molecular weight hydrophobic compounds by UP can be achieved by indirect heat (IND-UP) or by direct steam injection (DSI-UP). Little research has compared flavor and volatile compounds among HTST and both types of UP milk. The objective of this study was to compare the flavor and volatile compound profiles of milk subjected to HTST, IND-UP, or DSL-UP.

### Method:

- Raw skim and raw standardized 2% fat milks (SO L each) were obtained in duplicate on different days and pasteurized at 78°C for 15 s (HTST) or 140°C for 2.3 s by IND-UP or DSL-UP. Milks were cooled and stored at 4°C. Analysis of aroma active compounds was conducted after 0, 3, 7, and 14 days by solid phase micro-extraction (SPME) followed by gas chromatography-mass spectrometry (GC-MS) and gas chromatography-offactometry (GC-O). Selected compounds were quantified by standard curves. Results were analyzed by univariate and multivariate statistics.

### Significance:

An understanding of the flavor chemistry of heat-treated milk is required to characterize flavor profiles and to identify the source(s) of flavors.

### Results:

- Forty nine aroma-active compounds were identified and quantified in the milks, with differences in profile and relative concentration of volatile compounds influenced by fat content and heat treatment (p<0.05). More aroma active compounds and higher relative abundances of sulfur and Maillard reaction volatiles were detected in UP milks compared to HTST milks (p<0.05). Many aroma active compounds decreased in UP milks with storage (p<0.05). The major aroma active compounds in milk are hydrogen sulfide, dimethyl sulfide, 2-butanone, and furfural in UP-DSI, diacetyl, 3-methyl butanal, dimethyl disulfide, methional, and benzaldehyde in UP-IND, and carbon disulfide, 1-octen-3-one, and 1-octen-3-ol in HTST milk, respectively.
and ultracentrifugation, respectively. Less than 5.0% of the recovered hydrophobic drug was found associated to milk fat. The results support the hypothesis that native CM have ability to associate with hydrophobic molecules.

**P04-019**

**Fat and Sugar Reduction in Ice Cream Employing Inulin as Fat and Sugar Replacer**  
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**Introduction:**
Ice cream is a frozen food that is composed of two phases. The continuous phase is a high-viscosity phase with unfrozen water, dissolved sugar and milk proteins. The dispersed phase comprises three main structural components: air cells, ice crystals, and emulsified fat globules. In ice cream, fat and sugar had an important role to stabilize the whole system, besides their contribution to texture. Fat or sugar reduction implies changes in ice cream properties, and the use of fat and/or sugar replacers can compensate textural characteristics and melting properties. Inulin, a prebiotic, can be employed to replace both fat and sugar in ice cream.

The aim of this study was to reduce simultaneously both butyric fat and sugar content in ice cream formulation employing inulin as fat/sugar replacer, via response surface methodology.

**Method:**
Butyric fat and sugar were systematically replaced with inulin employing a rotatable central composite design at full factorial design level with 20 runs, including full factorial level central point, to elaborate a standard ice cream. Ice cream base apparent viscosity, ice cream overrun, melting properties, and texture (compression and penetration) were determined.

**Results:**
Butyric fat reduction decreased ice cream base viscosity, with a minor effect due sugar and inulin. In ice cream overrun, higher yield was observed at high butyric fat concentrations, but at lower fat content the interaction with sugar and inulin compensated this parameter. For melting properties, inulin and its interaction with sugar reduced melting rate and the first drop time. At the experimental conditions, there was no difference in ice cream hardness or compression force when inulin was employed to replace both butyric fat and sugar.

**Significance:**
According to our results, incorporation 3% of inulin made possible to reduce 30% of butyric fat and 12% of sugar, resulting in a healthier ice cream with lower saturated fat and caloric content, besides to contain a prebiotic ingredient as inulin, with enhanced melting properties with no detrimental effect on ice cream textural properties.

**P04-020**

**The Effect of Blending Pure Alpha-Lactalbumin With Whey Protein Isolate on Heat Stability in Solution**  
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**Introduction:**
When fortifying nutrition products with protein, protein blends from different sources are commonly used to circumvent cost, flavor, functionality and processing challenges inherent to various sources. One challenge for whey proteins is their tendency to lose solubility when heated. This limits their use in thermally processed beverages and nutritional products, and affects processability in infant formula. Pure alpha-lactalbumin is one option to offer high quality nutrition with improved heat stability, but the inherent to various sources. One challenge for whey proteins is their tendency to lose solubility when heated.

**Method:**
Solutions were prepared by dissolving mixtures of Davisco Alpha-lactalbumin and two sources of WPI in deionized water at varying ratios and total protein levels. Aliquots of 10 mL were placed in 14 mL test tubes and immersed in 95°C water for 10 minutes. After one hour of cooling, phase changes in the samples were noted.

**Significance:**
Blending alpha-lactalbumin with WPI, or by extrapolation, using less pure alpha-lactalbumin, should not be expected to offer significant heat stability advantages. Surprisingly, small amounts of WPI (presumably beta-lactoglobulin) enhanced whey protein products, should not be expected to offer significant heat stability advantages. Blending alpha-lactalbumin with WPI, or by extrapolation, using less pure alpha-lactalbumin is one option to offer high quality nutrition with improved heat stability, but the inherent to various sources. One challenge for whey proteins is their tendency to lose solubility when heated. This limits their use in thermally processed beverages and nutritional products, and affects processability in infant formula. Pure alpha-lactalbumin is one option to offer high quality nutrition with improved heat stability, but the inherent to various sources. One challenge for whey proteins is their tendency to lose solubility when heated.

**Results:**
The native heat stability of Alpha-lactalbumin is dramatically reduced when blended with WPI. Blending with a membrane-produced WPI caused a linear decrease in the protein concentration at which gelation occurs, proportional to the fraction of WPI. Blending with an ion exchange WPI at any level 5% or higher reduces the critical gel point concentration to that of the pure WPI.

**Significance:**
Oxidative stress is a central point, to elaborate a standard ice cream. Ice cream base apparent viscosity, ice cream overrun, melting properties, and texture (compression and penetration) were determined.

**Results:**
Butyric fat reduction decreased ice cream base viscosity, with a minor effect due sugar and inulin. In ice cream overrun, higher yield was observed at high butyric fat concentrations, but at lower fat content the interaction with sugar and inulin compensated this parameter. For melting properties, inulin and its interaction with sugar reduced melting rate and the first drop time. At the experimental conditions, there was no difference in ice cream hardness or compression force when inulin was employed to replace both butyric fat and sugar.

**Significance:**
According to our results, incorporation 3% of inulin made possible to reduce 30% of butyric fat and 12% of sugar, resulting in a healthier ice cream with lower saturated fat and caloric content, besides to contain a prebiotic ingredient as inulin, with enhanced melting properties with no detrimental effect on ice cream textural properties.

**P04-021**

**Reliability of Proton NMR Spectroscopy for the Assessment of Frying Oil Oxidation**  
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**Introduction:**
Although there are many analytical methods developed to assess oxidation of edible oil, it is still common to see a lack of consistency in results from different methods. This inconsistency is expected since there are numerous oxidation products and any analytical method measuring only one kind of oxidation product cannot give a satisfactory description of oil oxidation. For this reason, it has been stressed by several scientists that a method that combines the concomitant detection of many different oxidation products is necessary for a more consistent assessment of oil oxidation. Furthermore, under frying conditions, some standard methods detecting minor oxidation products such as hydroperoxides, conjugated dienes, aldehydes, and epoxides were found to be less reliable than methods detecting major oxidation products such as total polar compounds (TCP), polymerized triacylglycerols (PTAG) and fatty acid composition. The 1H NMR spectroscopy method should be as reliable as these three methods since NMR signals directly reflect the change in fatty acid composition. The aim of this study was to evaluate correlations between the 1H NMR spectroscopy method and the conventional methods measuring TCP, PTAG, and fatty acid composition to confirm the reliability of this method.

**Method:**
This study specifically focused on the reliability of the NMR method for soybean oil and two other vegetable oils rich in oleic acid under frying conditions. Therefore, three oils were heated at 180°C and correlations between methods were evaluated with simple linear regressions using the JMP program.

**Significance:**
The proton NMR has been further proven to be a very reliable, convenient analytical method for assessment of oil oxidation.

**Results:**
It was found that the NMR method correlates very well with three conventional methods. Comparisons between our new methods and earlier NMR methods reported by Satio and Shahidi research groups in 1980s and 1990s will be discussed. This presentation will also provide a convenient procedure for the practical analysis of oxidized oil.

**P04-022**

**Spray Dried Microcapsules of Essential Oils With Antioxidant Activity**  
C. Asensio, Univ. Nacional de Cordoba, A. Grosso, M. Larrauri, R. Olmedo, V. Nepote, N. Grossio, Email: cmasensio@agro.unc.edu.ar

**Introduction:**
There is a growing interest in research, development, and commercialization of sensitive packed food ingredients. Microencapsulation provides protection from adverse environmental conditions and can prolong the shelf-life of ingredients. The objectives of this work were to encapsulate mint (M) and oregano (O) essential oils, and to evaluate the antioxidant activity of the microcapsules at two storage temperatures.

**Method:**
Hydroxypropyl methylcellulose and maltodextrin were used as wall materials. The core consisted of essential oils (M or O) dissolved at 10% w/w in neutralized peanut oil. Two core/wall ratio were used (1:1 and 1:2). Four emulsions (M1:1, M1:2, O1:1, O1:2) were prepared. A mini spray dryer (B-290) was used to obtain the microcapsules. Capsules were stored at 23°C (room temperature, RT) and 6°C (fridge, F) during 90 days.

**Antioxidant activity assays (DPPH and ABTS), total phenolic content (TPC) and volatile compounds (SPME-CG) were measured every 30 days after encapsulation.** Experimental design was 8 treatments x 3 repetitions x 4 storage days. ANOVA and Fisher-LSD test were used for statistical analysis.

**Significance:**
Oregon essential oils microcapsules presented better antioxidant activity than mint. This activity is better preserved when microcapsules are stored at fridge temperature. A high wall material content of microcapsules lessens the antioxidant activity of the encapsulated compound.

**Results:**
Antioxidant activity values and volatile compounds significantly change during storage after the encapsulation process (p<0.001). At day 0 of storage, O1:1 capsules exhibited the best antioxidant activity in DPPH (IC50 14.1) and ABTS (7.7 mg Trolox/g), followed by O1:2 capsules. No significant differences were found in M1:1 and M1:2 capsules. At the end of the storage (day 90), significant differences were found between samples and storage conditions (p<0.001). O1:1-F samples had the highest values for DPPH (21.1 IC50), ABTS (7.31 mg Trolox/g), TPC (43.78 mg gallic acid/g), followed by O1:1-R, O1:2-F and O1:2-R. O1:1 carried the highest content of antioxidant volatile compounds (thymol, 4-terpineol, and γ-terpinen) at the end of storage (p<0.05).
Introduction:
Radio frequency (RF) technology is being used in industrial application for disinfection, disinfestation and drying of food products. The aim of this study was to investigate the effect of RF processing at disinfestation and disinfection temperatures on the quality of bread flour.

Method:
Bread flour was RF treated to four different final temperatures of 65, 85, 95, and 105°C. The effect of RF processing on the quality of bread flour was evaluated analyzing its physico-chemical and functional properties as well as the impact on the flour’s microbiota.

Results:
The study shows that with increasing temperatures of the RF treatment the quality of the bread flour changes as defined by the measured properties. The functional properties decrease by increasing temperature severity. The mixing time reduced from greater than 20 minutes to about 10 minutes, the bread making ability dropped from excellent (65°C) to unsuitable (>95°C). In addition the gluten quality index decline as well. The physical properties such as Falling Number and viscosity both increased with increasing temperatures as measured by Rapid Visco-Amylo-Graph. The Falling Number increased from 246 seconds at 65°C to 378 seconds at 105°C. The moisture content and water activity in all trials decreased by a maximum of 1.67% and 0.04% respectively. A microbial reduction of 1.5 log in coliforms was achieved in temperature ≥85°C.

Significance:
This study suggested that RF disinfection process can be used for treating bread flour up to 60-85°C with little impact on its quality. Because of the hypothesized breakdown of gluten at temperatures ≥95°C the bread flour RF processed at disinfection temperatures could be suitable for gluten-reduced bakery products such as sponge cake.

Introduction:
In Nigeria, fish consumption accounts for about 35% of the animal protein and, a good proportion of the consumed fish are sourced from rivers, lakes and the coastal waters. The Bonny and Cross River systems are among the most stressed rivers in the Niger Delta, which is one of the major oil exploring regions in the world, with several oilfields and industrial facilities located within the system. During exploration, production, refining, transportation, and storage of petroleum and its derivatives spillage could occur adversely affecting the quality of the aquatic ecosystem. Polycyclic aromatic hydrocarbons (PAHs) originate from natural and anthropogenic sources such as incomplete combustion of organic matters, inputs from oil spills, ship traffic, urban run-off, and waste water discharges. They are characterized by such properties as lipophilicity, semi-volatility as well as genotoxic, mutagenic and carcinogenic properties. They are also known to possess chemical stability as part of their affinity to lipids in their various oxidation states may have similar aroma properties. Interestingly, during an investigation of the thermal degradation of the monosaccharides namely glucose and rhamnose under basic conditions, we identified a major and unique furanone having the molecular weight of 130 amu. We hypothesized that this adduct is the reduced form of Furaneol dissolved in dimethyl-sulfoxide but were improved to 71.1% and 73.7% for 20 μg/mL CAPE dissolved in dimethyl-sulfoxide but were improved to 71.1% and 73.7% for 20 μg/mL, nanocapsulated CAPE and further improved to 90.0% and 86.9% by 20 μg/mL nanocapsulated CAPE and 0.3 w/w thymol.

Method:
The repeated temperature cycles facilitated the dispersion of SFAEs and improved the preparation of transparent dispersions. The final concentrations of SFAEs and propylene glycol were 1%w/w and 20%w/w, and the maximum CAPE concentration was 0.11w/w in the dispersions remaining visually transparent after 30-day storage at ambient condition. The hydrominamic diameter of the dispersion with 0.11w/w CAPE increased from 71.8 to 137.2 nm after storage, and the unstable dispersions had about 50% CAPE in the precipitate based on HPLC analysis. Addition of 0.3%w/w thymol improved the concentration of CAPE in stable dispersions to 0.15w/w, and the hydrominamic diameter decreased from 98.7 to 89.7 nm after 30-day storage. At a 2 μg/mL dose, the nanocapsulated CAPE was more effective than that dissolved in dimethyl-sulfoxide in inhibiting HCT-116 (27.5% vs. 43.2%) and MCF-7 (23.4% vs. 40.4%) cells. These effects are promising for the development of novel drug delivery systems for colon cancer treatment. The repeated temperature cycles facilitated the dispersion of SFAEs and improved the preparation of transparent dispersions.
Development of a Functional Food Product Using Coconut Flour and Soybean Seedling Sprouts
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Introduction:
Functional foods with phytochemicals, may function as antioxidants by inhibiting free radical formation. Coconut (Cocos nucifera L.) a fruit that is part of the family Arecaceae and may be beneficial in enhancing the acceptance of a food product. Sunflower (Helianthus annuus L.) is an annual flower native to the Americas and is harvested to obtain its seeds.

Method:
The objective of this study was to investigate the phytochemical content (total phenolic, total flavonoid) as well as the physiochemical (color, water activity, pH), rheological characteristics and antioxidant potential (DPPH, FRAP) of a smoothie beverage composed of coconut flour and sunflower seeds with two selected natural flavors (mint-CMS, ginger and lime-CGL). Proximate (moisture, protein, fat, ash) parameters were determined. Sensory acceptability was determined using a 5-point hedonic scale.

Significance:
The results showed that coconut flour and sunflower seeds may be utilized within the industry to increase the health benefits of a food product while adding flavor. The presence of two functional ingredients may increase the health promoting benefits of a food product.

Results:
Total phenolic and flavonoid contents were 42.57±7.97 mg GAE /100g (CMS), 38.03±13.33 mg GAE /100g (CGL) and 30.37±14.45 mg CE/ 100 g (CMS), 55.56±15.49 mg CE/ 100 g (CGL). Free radical-scavenging ability (DPPH, IC50) value was IC50-5 mg/ml for CGL and IC50-20 mg/ml for CMS. Ferric reducing antioxidant potential (FRAP) was 147.5±10.10 mmol/Fe+2/g, and 134.6±0.50 mmol/Fe+2/g for CGL and CMS respectively.

Effect of Cooking on Isoflavones and Phenolic Acids of Prosoy Soybean (Glycine Max) Sprouts
S. Kumar, Mississippi State University, S. Chang, Email: shwetnutrit@gmail.com

Introduction:
An important attribute for the quality and market acceptability of the sweet potato is its sweetness. Difference in sweetness among varieties is due to the content of different sugars. Information on the intensity of sweetness and sugar content in sweet potato to establish selection standards in breeding programs for tropical environments is limited.

Method:
Sensory evaluation and chemical analysis of sugar content for Sweet Potato (Ipomoea Batatas (L.) Lam.) Cultivars in Puerto Rico
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Introduction:
An important attribute for the quality and market acceptability of the sweet potato is its sweetness. Difference in sweetness among varieties is due to the content of different sugars. Information on the intensity of sweetness and sugar content in sweet potato to establish selection standards in breeding programs for tropical environments is limited.

Significance:
This research will help to establish selection standards in breeding programs of sweet potato for tropical environments.

Results:
Training and selection of panelists was performed by difference and intensity tests. Two sensory panels were conducted based on the sweetness attribute of the sweet potato. Through a Rating Test, a trained panel (nine panelists) selected the five sweetest varieties. In this test, Nemagold was the variety with the highest intensity of sweetness (5.44±0.07 to 5.74±0.07). Viscosity for the CMS smoothie on day one and day seven was 146 Pas and 41 Pas and for the CGL beverage viscosity decreased from 483 Pas to 37 Pas. Consumer acceptance questions indicated that consumers are interested in purchasing a smoothie with health benefits and taste.

Effect of Cooking on Isoflavones and Phenolic Acids of Prosoy Soybean (Glycine Max) Sprouts
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Introduction:
Soy sprouts possess health-promoting phenolic components, which are susceptible to damage by heating. On the other hand, soy sprouts need to be cooked to palatable quality before consumption. This study's objective was to comprehensively investigate the free-form and total contents of individual phenolic acids and isoflavones in soy sprouts as affected by cooking.

Method:
A food-grade cultivar Prosoy with a high protein content was germinated for 1, 2, 3, 5, and 7 days and cooked till palatable for 20, 25, 5, and 7 min, respectively. Free phenolic acids were extracted with acidified aqueous methanol; and total phenolic acids were extracted with ethyl acetate after alkaline hydrolysis. Isoflavones were analyzed by HPLC using an internal standard method.

Significance:
This study provides a comprehensive understanding of the type, form and quantity of individual phenolic acids and isoflavones as affected by cooking of sprouts. The new information obtained in this study will be useful for the soy sprout industry and for the consumers for enhancing health.

Results:
Results indicated that out of the total 15 phenolic acids identified in raw soybean, and raw and cooked sprouts, germination increased the content of gallic, syringic, 2, 3, 4 trihydroxybenzoic, p-coumaric + syringaldehyde (PCA+SD), m-coumaric, and o-coumaric acid among cinnamics.

Changes in Isoflavones and Phenolic Acids in Soybean Products as Affected by Fermentation and Non-Fermentation Processing Techniques
S. Ramari, Mississippi State University, S. Chang, Email: shwetnutrit@gmail.com

Introduction:
Secondary metabolites such as phenolic compounds in soybean have health benefits that are significantly affected by processing. However, in literature comprehensive comparisons of processing effects on individual phenolic acids and isoflavone compositions across different methods are lacking. This study's objective was to investigate the free phenolic acids and total individual phenolic acids, as well as isoflavone content in soybean products, as affected by processing.

Method:
Prosoy, a high protein soy cultivar, was processed into soy milk (heated before and after filtration, respectively), tofu (pressed and filled tofu), natto (2, 4, and 6 day storage at 4°C), tempeh (2, 4, and 6 day storage at 4°C), and soy-yogurt (2, 4, 6, 8 day storage at 4°C). Free phenolic acids were extracted with acidified methanol; conjugated phenolic acids were extracted with ethyl acetate after alkaline hydrolysis in the presence of EDTA and ascorbic acid, and isoflavones with acetonitrile. All compounds were quantified by HPLC.

Significance:
This study advanced knowledge of processing effect on the health-promoting phenolic compounds in soy products, and the information is useful to the food industry and consumers.

Results:
A total of 15 phenolic acids were identified in raw soybean and the profile of phenolic acids differed in each processed product. The predominant phenolic acids in raw soybean were 2,3,4 trihydroxybenzoic (TBA), syringic acid among benzoics; p-coumaric + syringaldehyde (PCA+SD), m-coumaric, and o-coumaric acid among cinamics. In soy milk and yogurt, syringic, vanillic, PCA+SD, sinapic, and o-coumaric were the principal phenolic acids. In pressed tofu, protocatechuic acid and PCA+SD, while in filled tofu vanillic and sinapic acids, in addition to the aforementioned, were major phenolic acids. In natto, the predominant acids were TBA, protocatechuic, syringic, vanillic, and syringaldehyde. In tempeh, syringic acids, gallic, TBA, and syringic acids were the major phenolic acids. Total individual phenolic content in each processed (14-166 µg/g) product was significantly lower compared to raw soybean (200 µg/g). The subtotal benzoic group was higher (p <0.05) than the cinnamic group in raw soybean, natto, and tempeh. Phenolic content in natto decreased (p<0.05) while in yogurt it increased (p < 0.05) with storage time. Total isoflavones of raw soybean, soy milk, yogurt, and filled tofu was higher (p < 0.05) than natto and tempeh.

Changes in Isoflavones and Phenolic Acids in Soybean Products as Affected by Fermentation and Non-Fermentation Processing Techniques
S. Ramari, Mississippi State University, S. Chang, Email: shwetnutrit@gmail.com

Introduction:
Soybean (Glycine max) is an annual flowering plant native to the Americas. It is harvested to obtain its seeds.
Introduction:
Soymilk, a nutritious beverage, is highly susceptible to a number of unfavorable physical and biochemical changes during storage. One of the problems is that the formation of large particulates after processing that negatively affect the sensory quality. Objective of this study was to evaluate the efficacy of ultra-high pressure homogenization (UHPP) in the presence of hydrocolloids to augment the physico-chemical properties to enhance shelf-life of processed soymilk.

Method:
Soymilk containing different concentrations (0.01, 0.02, and 0.05%, w/v) of two hydrocolloids (k-carrageenan (k-C) and gum arabic (GA)) was subjected to three levels of UHPP (70, 140, and 210 MPa) and stored at 4°C for five weeks. Emulsion properties, including droplet surface energy (SE), zeta-potential (ζ-P), mean globular particle size, and antioxidant properties (AP) of treated soymilk were investigated. Data were analyzed using a series of t-tests.

Significance:
The study can potentially lead to a considerable economic benefit to the soymilk industry by providing valuable information to extend shelf-life of soymilk.

Results:
Results showed that soymilk containing 0.05% k-C processed by UHPP of 210 MPa markedly improved storage properties, evident by significantly (P<0.05) enhanced SE and absolute ζ-P (16 and 39% augmentations, respectively) compared to the unhomogenized soymilk with no hydrocolloid in the first week of storage, a trend that was noted throughout the study (36 and 135% enhancements, respectively, after five weeks). The soymilk homogenized with 210 MPa also exhibited significantly (P<0.05) lower (60%) mean globular particle size in the initial week and maintained the trend throughout the third week of storage (29% reduced mean particle size of the treated soymilk compared to the untreated one). AP measured by the efficacy of soymilk to quench peroxyl and alkoxyl radicals generated in-vitro tended to exhibit a steady increase (indicated by a decrease in luminol-induced chemiluminescence resulting from the pyrolysis of 2,2’-Azobis(2-methylpropionamide) dihydrochloride) with increasing levels of UHPP – conceivably due to the pressure induced enhancement of surface areas of the samples, which led to more facilitated electron transfer for scavenging of radicals. Soymilk with 0.05% k-C subjected to 210 MPa exhibited a 7.6% increase in AP, compared to the unhomogenized soymilk with an equal concentration of k-C.

P04-033
Dehydration and Absorption Behavior of Wheat Germ in a Vertical Batch Fluidized Bed
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Introduction:
Wheat germ (WG) is a highly nutritive part of wheat kernels, separated during milling as a by-product. Improper drying results in acceleration of molds growth or lipid oxidation. Fluidized bed dryer (FBD) is preferred among other drying methods such as oven drying due to its even thermal distribution and short residence time. Industrial FBDs usually allow dried products to undergo a cooling process in the drier whereby cool air is introduced to bring down the temperature before products are retrieved. This process is vital to prevent dried products from experiencing sudden surge in moisture absorption due to the vast temperature difference and also reduce the chance of condensate production on the surface. Focusing only on the drying behavior would not be sufficient for industrial drying process planning. Therefore, the objective of this study is to investigate the dehydration and absorption behavior of WG in a vertical batch FBD.

Method:
Moisture behaviors of WG were observed experimentally by varying different system parameters, i.e. drying air temperature of 50, 80, and 120°C, velocity of 1000 and 3000 rpm, and sample holdsups of 2 kg. WG were sampled at specific time intervals with their moisture content (MC) and water activity (Aw) measured. The experiment was designed to obtain a final product at around 40°C with Aw of 0.3 ± 0.1.

Significance:
This experiment illustrates the importance of matching air temperature to its velocity. Maxima in drying air temperature and velocity may not provide the highest DR and AR. Knowledge of such effects gives the base for process planning by with the efficiency of FBD can be improved and the process more effectively optimized.

Results:
Results indicated air temperature and velocity sharing a direct proportional relationship with both MC dehydration (DR) and absorption rate (AR). However, in terms of Aw, only at 80°C did the DR increase with increasing velocity. AR calculated by MC and Aw were significantly slower than their DR regardless of air temperature and velocity. Both DR and AR calculated by MC and Aw were highest at 80°C.

P04-034
Purification and Stabilization of Pear Protease and Its Functional Characterization
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Introduction:
Pear (Pyrus spp.) is typically eaten fresh and often consumed in processed foods such as juice, puree, or jams. For many years, pear has been used not only as one of the most common edible fruits but also as a meat tenderizer in food systems. As natural meat tenderizer, enzymes such as actinidin, bromelain, or ficin showed practical limitations due to their non-uniform or over activity on meat proteins. However, pear protease was emphasized as the ideal meat tenderizer to prevent over decomposition or mushy spots in meat compared to bromelain or actinidin.

Method:
So far, no study has been applied the purified pear protease to characterize pear protease function with for enzyme kinetics. At this time, we purified pear protease and stabilized it by addition of 5% dextrin in order to maintain the enzyme stability in the long-term. Pear protease was functionally characterized with respect to pH, thermodynamics, and enzyme kinetics.

Significance:
These result indicated that purified pear protease could be applicable as desirable protease for tenderization with high proteolytic activity and stability in food industry. This work was financially supported by the Cooperative Research Program for Agriculture Science & Technology Development (Project No. PJ01002403) and Brain Korea 21 Center for Green Food & Food Materials, Department of Food Science and Technology, Chonnam National University, Gwangju 61186, Korea

Results:
Pear protease was purified from Asian pear by cysteine extraction and 60% ethanol precipitation. It was stabilized by addition of 5% dextrin during lyophilization by freeze-drying (dry) or concentration by evaporation at 65-70°C (liquid). By addition of 5% dextrin, dry protease exhibited 22-42% higher enzyme activity than liquid protease. Pear protease was stable at a pH range of 5-8 with an optimum pH of 6.5. From Arrhenius plots, liquid protease showed higher temperature dependency (23.49 kJ/mol) than dry protease (18.62 kJ/mol) due to its higher activation energy. The kcα/km, catalytic efficiency of enzyme, was similar with 2.9 and 2.7 μmol/min with dry and liquid proteases.

P04-035
Effects of Polyphenol Compounds on the Oil Oxidation in Soybean Oil in Water Emulsion
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Introduction:
Antioxidant activity of polyphenols has been reported, and plant food materials including herbs are good sources of polyphenols. Composition of polyphenols is dependent on their sources. Rosmarinic acid is relatively common in herbs such as rosemary, basil, and oregeno, and caffeic acid and p-coumaric acid are more frequently found in thyme and oregeno. It was suggested that different antioxidant activity among various herbs could be resulted from difference in polyphenol composition. However, there were a few reports on the relationship between polyphenol composition and antioxidant activity in the real food systems. The antioxidant activity of each polyphenol compound which are commonly found in herbs was compared in this study to estimate the role of each polyphenol compound in herbs as antioxidant on the iron-catalyzed oxidation of oil in the O/W emulsion.

Method:
Rosmarinic acid, caffeic acid, gallic acid, p-coumaric acid, and catechin were separately added to the acidic soybean oil in water (40:60, w/v) emulsion (pH 4.0), and the oil in the emulsion was oxidized with iron (II) sulfate (5 mg/kg) at 25°C for 12 days. Degree of oil oxidation was evaluated by headspace oxygen contents by gas chromatography, peroxide formation by ferric cyenate method, and p-anisidine value by the AOCs method.

Significance:
The results indicated that rosmarinic acid, caffeic acid, gallic acid, p-coumaric acid, and catechin improved the oxidative stability of oil without any significant difference among another, and suggested that other components in herbs other than polyphenols significantly affect the iron-catalyzed oxidation of oil in an acidic O/W emulsion.

Results:
Addition of each polyphenol compound significantly improved the oxidative stability of oil in the emulsion based on consumption (<0.1512 mmol O2/mL/day) and production of primary (hydroperoxide value: <0.0280 mmol CuO/kg/day) and secondary (p-anisidine value: <0.2629/day) oxidation products. The control emulsion without any polyphenol compound showed a rate of oxygen consumption, peroxide production, and anisidine value of 0.2629 mmol O2/mL/day, 0.0733 mmol CuO/kg/day, and 1.2146/day, respectively. There was no significant difference in the antioxidant activity among polyphenol compounds added (p>0.05), and degradation rates of the polyphenol compounds were not significantly different (p>0.05), either.

P04-036
Interaction Mechanism Between Lactoferrin and Casein in Bovine Milk
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Introduction:
Lactoferrin (LF) is a kind of alkaline glycoprotein with multiple bioactivities, which mainly exists in bovine whey protein. The low LF content in bovine milk and its interaction with casein micelles, a negatively charged colloid that forms a large colloidal complex (LF-CM), results in lower content of LF in whey and low yield of LF during separation.
Method: In this study, skim milk was chosen as raw material to verify the interaction between LF and CN by membrane filtration, SDS-PAGE, and ELISA. The content of LF was determined by ELISA and particle size changes of LF-CM were inspected through the laser diffraction technique after regulating the system factors, i.e., temperature, pH, and NaCl ion strength. To optimize the conditions factors that can promote LF to release from LF-CM. Moreover, the thermodynamic parameters between LF and different caseins (α-casein(ACN), β-casein(BCN), κ-casein(KCN)) by isothermal titration calorimetry (ITC) have been investigated.

Significance: In this paper, through studying the influence factors of the interaction between casein micelles and lactoferin, and the thermodynamic parameters, such as binding point, combined enthalpy, combined entropy, and so on, we will further expound the interaction mechanism between LF and casein micelles, and provide some scientific basis for the extraction and separation of LF in industrial production.

Results: Results showed interactions between LF and CN by adopting the methods of membrane filtration, SDS-PAGE, and ELISA. The optimal parameters that promote LF to release from LF-CM were 35°C, pH 6.4 and 300 mM/L NaCl. The highest concentration of LF release was 48.18 mg/L. Meanwhile, milk particle size distribution under different operation conditions showed that the particle size of casein solutions became smaller under pH 6.4, temperature 35°C, 300 mM/L NaCl, which further verified that LF released from LF-CM under these conditions. The results of interaction between LF and caseins (ACN, BCN, KCN) determined by ITC showed that LF can interact with three kinds of caseins more efficiently at 25°C than at 45°C. According to the different affinity, LF has two ACN binding sites, three BCN binding sites, and three KCN binding sites.

P04-037
Effect of Molecular Size and Glycerol Addition on Tg and Molecular Mobility in Amorphous Dextran Matrices Detected by Riboflavin Phosphorescence
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Introduction: Amorphous carbohydrates are widely used for encapsulation and preservation of bioactive materials in foods and pharmaceuticals. Recent studies have suggested that the secondary relaxation of the excipient, rather than the glass transition temperature (Tg), determines the stability of their labile content. It was also found that the addition of glycerol could suppress the secondary relaxation and result in more stable systems.

Method: To better understand how molecular size and the addition of glycerol influence Tg and molecular mobility, we used luminescence spectroscopy and riboflavin as an optical probe to investigate the physical properties of a series of amorphous dextran and glycerol-dextran films. Our previous research has shown that phosphorescence from riboflavin is sensitive to secondary relaxation in amorphous carbohydrates: as the secondary relaxation becomes more prominent, the phosphorescence is quenched and its lifetime shortens.

Dextran samples of 6,000, 9,000, and 40,000 Da were used to prepare pure amorphous dextran films. The mass fraction of glycerol was varied between 0-0.36 in the glycerol-dextran (Mr ~ 6,000) films. Differential scanning calorimetry (DSC) was used to measure the Tg of the dextran variants. Riboflavin was incorporated into the matrices and its phosphorescence was monitored from -30 to 100°C as an indicator for secondary relaxation and mobility.

Significance: This investigation provides insights into the relations between molecular size, the addition of glycerol, Tg, and molecular mobility and suggests that phosphorescence from riboflavin can be used to optimize matrix composition and monitor stability for encapsulation applications.

Results: Our results showed that as the molecular size increased, Tg increased; while the as the glycerol content increased, Tg decreased. At the same temperature, the phosphorescence lifetime is the longest in 6,000 dextran film (26 ms at 20°C) compared with dextrins of higher molecular weight (20 ms at 20°C), indicating that mobility increased with molecular size. The lifetime did not exhibit significant difference when glycerol content was lower than 0.1, but at the same temperature, the lifetime significantly shortened to 19 ms and 9 ms when glycerol content was 0.22 and 0.36, respectively.

P04-038
A Comparison of Thiamine Mononitrate and Thiamine Hydrochloride Amorphous Solid Dispersions
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Introduction: The common synthetic salt forms of thiamine (Vitamin B1) used for food fortification are thiamine mononitrate and thiamine hydrochloride. Although both commercially available synthetic forms are crystalline, upon their introduction into complex food formulations and exposure to food processing conditions such as grinding, freeze drying, or spray drying, they may convert to the amorphous form. The properties of crystalline and amorphous structures are different, and amorphous forms tend to recrystallize over time. The objectives of this study were to: (1) prepare amorphous forms of thiamine mononitrate and hydrochloride using solid dispersion and lyophilization techniques, and (2) investigate and compare the role of polymers on inhibiting the crystallization of thiamine mononitrate and thiamine hydrochloride, correlating their hygroscopicity, glass transition temperatures, and physical interaction abilities.

Method: The following polymers were used to create the vitamin solid dispersions: pectin, κ-carrageenan, gelatin, sodium carboxymethyl cellulose, and hydroxypropyl methylcellulose. Powder X-ray diffraction, differential scanning calorimetry, and Fourier transform infrared spectroscopy were used to monitor the stability of samples stored at select temperature (25, 40°C) and relative humidity (0, 32, 54% RH) conditions over time.

Significance: Different salt forms of thiamine have distinct physicochemical properties in amorphous solid dispersions, which will contribute to formulation opportunities and challenges for optimizing the delivery of the vitamin in foods.

Results: Neither thiamine hydrochloride nor mononitrate could be made amorphous in the absence of a polymer, but both could form amorphous solid dispersions in the presence of the polymers. The amount of polymer needed to create amorphous vitamin structures was greater for thiamine mononitrate; for example, 40% pectin was enough to form thiamine hydrochloride amorphous solid dispersion, while at least 90% pectin was needed for thiamine mononitrate. All samples were more stable at lower temperature and RH conditions. Physical stability was more dependent on intermolecular interactions than on the glass transition temperature or hygroscopicity.

P04-039
Bitter: Understanding How Protein, Lipids, and Oil-in-Water Emulsions Influence Perception
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Introduction: Many drugs and psychochemicals are bitter, leading to non-compliance with prescriptions and avoidance of foods. It would be useful to suppress bitterness without adding sugar. The goal of this study is to investigate (i) the binding of bitters (quinine, Q, and caffeine, C) by whey protein isolate (WPI) and lipids and (ii) the suppression of bitterness by proteins and oil-in-water emulsions. We hypothesize that the degree of binding will differ for Q and C and that the perceived bitterness will depend on the unbound rather than total bitterant concentration.

Method: Partitioning (LogKow) was measured for C and Q using vegetable oil and water in a shake flask method. Protein binding used a WPI solution of C and Q followed by filtration and collection of supernatant. Bitterant concentration was measured by HPLC. Consumer sensory tests (n=100) were used to measure scaled sample bitterness.

Significance: In conclusion, binding of bitter compounds by protein and oil reduces perceived bitterness but not by as much as expected from the reduction in aqueous concentration. This finding has implications for the formulations of oral pediatric medications and foods enhanced with phytochemicals.

Results: Consistent with our hypothesis, there was a difference in DPI binding. C interacted minimally while the proportion of bound Q increased with protein concentration. A sensory panel assessed the bitterness of C (1.8, 5.7, and 18 mM) and Q (0.056, 0.10 and 0.18 mM) solutions with 0% or 1% WPI. There was no significant effect for C solutions, but WPI decreased the bitterness of Q. This is consistent with our hypothesis that higher binding results in lower bitterness, but the magnitude of reduction was not large.

C and Q yielded LogKow values of -1.32 and 2.97 respectively establishing Q as a hydrophobic bitterant. Fat was assessed in an o/w emulsion with WPI as the emulsifier. An increase in fat from 0.5% to 2% caused a significant decrease in bitterness perception rather than total bitterant concentration.

P04-040
Effect of Abuse Conditions on Important Mint Flavor Components of a Mojito Alcoholic Beverage
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Introduction: Mojito is a popular cocktail that consists of white rum, citrus juice and mint. The main flavor components of mojito are citrus and mint. It is known that heat and light are two major factors that lead to flavor deterioration in citrus products. However, there is little research investigating heat and light effects on mint oil or other mint products. This specific research objective focused on the effect of heat and light on the isomerization of menthone to isomenthone, which are two important compounds in mint flavor.

Method: Bottled mojito samples were divided into six groups and each group was treated by heat or light treatment for twelve months. Temperature range of thermal treatments
was from 40°F to 100°F. The effect of light was investigated by an indirect sunlight, and direct sunlight treatment. Volatile analysis was conducted via purge and trap Gas Chromatography Mass Spectrometry (GC-MS) and volatiles were separated with a ZB-WAX column. Aroma activity was determined by Gas chromatography-olfactometry (GCO). Retention indices were used to convert retention times from GC-MS and GCO into system-independent constants.

**Significance:**
This research revealed the influence of heat and light on important mint flavor components of mojito, which is a real food system. Understanding these influences could help beverage producers create improved flavor stable products.

**Results:**
Isomerization of isomenthone to menthone occurred in heat-treated mojito samples and this reaction was favored by increasing temperature. Menthone has been reported to have both alkyl residues in the equatorial configuration, making it more thermally and kinetically stable than isomenthone. Therefore, it is expected that with increasing temperature more isomenthone was found to convert to menthone because of the stability of the molecule. Menthone has a more desirable minty odor than isomenthone, thus the presence of menthone is preferred. Menthol concentration was not influenced by temperature or indirect sunlight. However, menthol concentration was highest in the direct sunlight treatment suggesting that intense light abuse will lead to the formation of this compound in a mint beverage system.

**P04-043**
Inactivation of Escherichia Coli K12 on Raw Almonds Using Supercritical Carbon Dioxide and Thyme Oil

**Introduction:**
The consumption of raw almonds contaminated by Salmonella and enterohemorrhagic *Escherichia coli* has resulted in several outbreaks. Propylene oxide is commonly used to reduce microbial populations of bulk raw almonds in the U.S., but it is highly flammable and is carcinogenic. Supercritical carbon dioxide (scCO2) has been used commercially in decaffeination because it is generally recognized as safe (GRAS), inflammable, and nonresidue. scCO2 is also used to extract essential oils from plant materials, and essential oils are known GRAS antimicrobial preservatives effective against both *Salmonella* and *E. coli*. The objective of this study was to investigate the possibility of combining scCO2 and thyme oil (TO) to reduce *E. coli* K12 inoculated on raw almonds.

**Method:**
Raw almonds were inoculated with ~6 log (CFU/g) *E. coli* K12 by dipping in a culture broth with ~10 log (CFU/ml) *E. coli* K12 for 2 min followed by drying overnight in a biosafety cabinet. The inoculated almonds were batch-treated with scCO2 alone at different combinations of temperature (T), pressure (P), and duration (t) using a composite rotatable design (CCRD). For treatments with TO, inoculated almonds were submerged completely in TO for 10 min, and then subjected to the same conditions as scCO2 treatments.

**Significance:**
Our results showed that the combination of scCO2 with essential oils could be a potential water-free technology to improve the microbiological safety of raw almonds.

**Results:**
Overall, the incorporation of TO during the scCO2 treatment significantly improved the disinfection effectiveness. For example, the treatment by scCO2 alone at 15.0 MPa and 70°C for 30 min resulted in a 2.97 log (CFU/g) reduction, while the reduction was 4.91 log (CFU/g) for the TO and scCO2 combination. According to the response surface analysis in the CCRD, the log reduction of bacteria can be modeled by:

\[
3.16 + 0.8T + 0.11P + 0.059t + 0.52TP + 0.39Pt - 1.06P^2
\]

The optimal treatment parameters from this model were 70°C, 14.8 MPa, and 75 min, corresponding to the maximum log reduction of 4.26 log (CFU/g). Experiments under the optimal parameters resulted in a 4.06 log (CFU/g) reduction. Since TO can be extracted by scCO2 during depressurization, the aroma of almonds was weaker when compared to TO alone treatment.

**P04-044**
Moisture Sorption Isotherms of Flavored Malt Powders

**Introduction:**
Moisture sorption isotherms describe the relationship between moisture content and water activity (a*) (equilibrium relative humidity at constant temperature and pressure). The knowledge of sorption isotherms is of great importance for the design and optimization of drying equipment, design of packages, predictions of quality, stability (caking), shelf-life, and for calculating moisture changes that may occur during storage.

**Method:**
Three different flavors, dulce de leche, chocolate strawberry, and chocolate sea salt are three different flavors, dulce de leche, chocolate strawberry, and chocolate sea salt are commonly included in the formulation of flavored malt powder. When they are stored at room temperature, these powders indicate tendency for caking. Thus, this study was undertaken to develop moisture sorption isotherms of flavored malt powders, and identify the critical water activity at which caking occurs. The moisture sorption isotherms were determined using the AquaSorp Isotherm Generator using the Dynamic Drewpoint Isotherm (DDI) method at three temperatures of 15°C, 25°C, and 40°C in a relative humidity range of 37 to 70%.

**Significance:**
Consumers can enjoy flavored malt across the world.
Results:
These flavored malt powders showed typical type II isotherm curves. The equilibrium moisture content decreased with increasing temperature. The change in shape of the curve, based on the temperature, was minimal for dulce de leche and chocolate sea salt flavored malt, whereas a significant temperature effect on the adsorption was observed for chocolate strawberry flavored malt. However, the second derivative graph showed the expected critical water activity changes with temperature. The critical water activity is represented by the initial inflection point in the moisture sorption isotherm and for the tested samples, it indicated that the critical water activity would depend on the glass transition temperature. Based on the moisture sorption isotherm, approximate critical water activity values for dulce de leche flavored malt are 0.47 at 15 and 25°C and 0.36 at 40°C and these critical water activity values are higher for other two flavored malts compared to dulce de leche flavored malt.

P04-045
Drying and Decontamination of Almonds by Sequential Infrared and Hot Air Drying
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Introduction:
The harvesting practice of shaking mature almonds to the ground and drying them on the ground for several days may increase the risk of contamination with enteric pathogens, such as Salmonella, a major cause of almond recalls and almond-linked outbreaks. Additionally, rain events during the harvest season may cause complete loss of a crop due to a lack of adequate drying technology.

Method:
The objectives of this research were to develop a sequential infrared and hot air (SIRHA) drying method for almonds and evaluate its effectiveness in simultaneous drying and decontaminating almonds. The almonds were shacked to the ground, sprinkled with water, and the wet almonds were collected from the orchard after one week. The almonds in their hull were then dried in the SIRHA dryer using different time-combinations of infrared (IR) radiation and hot air (HA) to determine optimum drying conditions. Almonds in their hull were also inoculated with E. faecium and dried with the latter conditions to evaluate the decontamination efficacy of the SIRHA method.

Significance:
These findings indicate that SIRHA drying may be used to dry whole almonds and simultaneously decontaminate their hulls while also reducing microbial loads on shells and kernels, which may reduce the risk of cross-contamination in the processing plant.

Results:
IR and HA drying at an almond surface temperature of 70°C required 2 h and 5 h, respectively, in order to decrease the moisture content (MC) of the whole almonds from 21.8% to 11.9% (critical value of 7%), and the IR drying method at 70°C for 1 h followed by HA at 170°C to an MC of 7% required 3 h, resulting in a saving of 2 h (40%) of drying time compared with HA drying. The SIRHA drying with tempering (2 h of IR drying and 2 h of tempering (holding) at 70°C) followed by 2 h HA drying resulted in an E. faecium population size reduction of 4.63±0.71, 2.41±0.39, 1.69±0.31 log CFU/g on the almond hulls, shells and kernels, respectively. No significant difference in peroxide value and free fatty acid contents was observed for almonds dried with SIRHA and HA.

P04-046
Drying and Quality Characteristics of Kale Under Infrared Heating
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Introduction:
Kale is particularly rich in antioxidants and has the highest antioxidant activity against hydroxyl radicals among 22 commonly consumed vegetables. However, it has a short shelf life at ambient temperature and can be spoiled easily after harvest. The objectives of this study were to develop a drying method for kale using infrared (IR) radiation heating and evaluate the quality attributes of dried kale compared to hot air (HA) drying.

Method:
Fresh kale was shredded into uniform size of about 5cm x5 cm and dried using electric IR heating and hot air (HA) to a moisture content of 5%. Drying was conducted at the preset oven temperature of 65°C and 70°C for IR and at air temperature of 60°C, 65°C and 70°C for hot air tests. The evaluated quality characteristics included color, rehydration rate, shrinkage degree, crispness, chlorophyll, carotenoids, phenolics and vitamin C contents, and DPPH scavenging activity.

Significance:
The findings from this research demonstrated that the infrared drying is a very promising method for drying kale to be consumed as dehydrated chips or rehydrated vegetable.

Results:
Results showed that IR drying at 60°C, 65°C, and 70°C required 70, 60, and 50 min, respectively, compared to 5, 4, 5, and 4 h of drying times required by HA drying at corresponding 60°C, 65°C, and 70°C. IR drying at 70°C reduced the drying time by 190 min or 79.17% compared to HA at 70°C. The infrared dried kale samples had a significantly higher quality attributes in terms of chlorophyll, carotenoids, and phenolics and vitamin C contents, and DPPH scavenging activity due to significant reduction in the drying time by IR drying. The IR dried kale samples had an attractive dark green color compared to that of HA dried samples, which had a light green color. The IR dried samples also exhibited a higher rehydration ratio after soaking in water.

P04-047
Vacuum Impregnation and Vacuum Frying to Produce Potato Chips With Phenolic Compounds of Red Beetroot
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Introduction:
Recently, there has been interest in increasing the functionality of snack foods. Beetroot extract contains a high level of antioxidants that are associated with the reduction of chronic disease and cancer risks. In this study, potato chips were enriched with phenolic compounds of beetroot extract without affecting the organoleptic properties of classic potato chips.

The aim of this study was to enhance the performance of low-value food using vacuum impregnation technology, and to examine the retention of the phenolic content of potato chips after being fried under vacuum and atmospheric frying conditions.

Method:
To introduce the antioxidant compounds of beetroot extract directly into the porous structure of the potato matrix, potato slices were impregnated using a vacuum impregnation method. A vacuum was applied at different pressure and times and the optimum conditions were 600 mm-Hg for 10 min and the atmospheric restoration for 10 min. Impregnated potato slices were then fried either under atmospheric pressure at 165°C for 4 min or vacuum fried at 130°C for 4 min. Both frying methods used a de-oiling system after frying, which consisted of centrifuging the chips for 40s at 8.1 g-force in the atmospheric fryer and 63 g-force in the vacuum fryer.

The antioxidant compounds of the potato chips were extracted in acetone-water (7:3, v/v) and observed by spectrophotometer at 765 nm. Results were expressed as mg Gallic acid equivalent (GAE) mg dry weight. The oil content of the fried chips was measured using a Soxtec System HT extraction unit with petroleum ether as the solvent.

Significance:
Vacuum frying is an alternative technology to produce healthy functional snacks with desirable quality attributes, and to increase the consumption of phenol-rich products, particularly among children and young people.

Results:
Vacuum fried potato chips retained around 45.34% of total phenols, whereas potato chips fried under atmospheric pressure preserved only 19.17% of their initial total phenol content. Furthermore, vacuum fried potato chips absorbed about 35% less oil than atmospheric fried chips.

P04-048
Vacuum Impregnation of Potato Chips With Green Tea Phenolic Compounds
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Introduction:
Due to the current consumer health concerns about processed foods, there is increasing interest in foods with higher nutritional value. One method to improve the nutritional value is to increase the health-beneficial compounds to the food matrix. Potato chips are one of the most popular snacks in the US, however they do not have any nutritional value. The purpose of this study was to increase the nutritional value of potato chips by introducing phenolic compounds from green tea extract using two processes: vacuum impregnation (VI) and vacuum frying (VF). The objective was to test the feasibility of these two processes for the production of potato chips enriched with antioxidants and measure the final product quality in terms of oil content, moisture content, texture, and color.

Method:
Total phenolic content (TPC) was used to test the optimal pressure and green tea extract concentration values for the VI process. A green tea concentration of 0.0175 mL/ mL distilled water and a pressure of 600 mm gave the maximum TPC of 105.45 mg phenols/100 g of dry matter. The potato chips were fried in a vacuum at oil temperatures of 90°C, 100°C, 115°C, and 130°C for times of 25, 20, 12, and 5 min, respectively. All potato chips were kept at a moisture content below 2% db.

Significance:
This research will aid the understanding of functional foods and their various applications in the food industry.

Results:
The final oil content values after VF for each temperature from 90°C to 130°C were 11.8, 10.1, 12.8, and 24.7% db, respectively. The TPC values for each temperature range were 23.42, 34.08, 39.67, and 79.64 mg/ 100 g of dry matter. Contrary to anticipated behavior, the total phenolic content increased with increasing temperature. This may be due to oil contamination with residue phenolic compounds from previous tests. Hardness of the final potato chip increased with decreasing moisture content (non-linear behavior). The green-red and blue-yellow chromaticity was not significantly different for all groups of potato chips. Potato chips fried at 90°C and 100°C were lighter in color (higher L* value, lower browning) than those fried at 115°C and 130°C.

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P04-049
Development of Beeswax Oleogels and the Influence of Gelator Concentration and Oil Type on Their Final Properties
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Introduction:
Concerns regarding food nutritional value, sensory attributes, and consumer health urge to get a valid and feasible answer. The use of food-grade materials that guarantee gel-like behaviour and address consumer needs is currently essential in food industry. Structuring edible oils (i.e. oleogels) can be the response for such challenge, offering a healthier alternative (e.g. replacing saturated and trans fats) with tailored functionalities (e.g. different melting behaviour). This work focused on how different types of oil phase – medium chain triglycerides (MCT) and long chain triglycerides (LCT) – influence the gelation process of beewax and the properties of the organogels produced thereof.

Method:
Oleogels were stabilized at different temperatures and qualitative phase diagrams were constructed to identify and classify the type of structure formed. The microstructure of gelator crystals was studied by polarized light microscopy. Melting and crystallization phenomena were evaluated by differential scanning calorimetry and rheology (flow and small amplitude oscillatory measurements) to understand organogels’ behaviour under different mechanical and thermal conditions.

Significance:
The structuring process supported by medium or long-chain triglycerides oils was an important exploit to apprehend the impact of different carbon chain-size on the gelation process.

Results:
Results showed that the increase of beewax concentration leads to higher values of storage and loss moduli (G’, G”) and complex modulus (G*) of oleogels, which is associated to the strong network formed between the crystalline gelator structure and the oil phase. Crystalization occurred in two steps (well evidenced for higher concentrations of gelator) during temperature decreasing. Thermal analysis showed the occurrence of hysteresis between melting and crystallization. Small angle X-ray scattering (SAXS) analysis allowed a better understanding in terms of how crystal conformations were disposed for each type of oleogel. LCT-based organogels presented different spacing and placement between crystals, in a lamellar and micellar conformation, while MCT-based organogels presented a more uniform structure. Nevertheless, no rheological differences were observed between oleogels produced using MCT and LCT.

P04-050
Influence of 3D Printing Parameters on Physical Properties of Printed Materials and Their Pellets Made With Gelatinized Waxy Rice Doughs
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Introduction:
3D printing (3DP) is a powerful process for making a three-dimensional solid or semi-solid object by using an additive process where successive layers of material are laid down in different shapes. Commercial 3DP technology is used for both rapid prototyping and distributed manufacturing with applications in architecture, aerospace, dental and medical industries, industrial design, education and many other fields. 3DP technology can also be used in food manufacturing, such as chocolate with human faces and sugar with sculptured shapes. Basically, many types of 3DP are now available. Although granular or powder bed and inkjet head 3DP methods are used in some foods, application of food 3DP is limited by food properties, and the extrusion printing method is more suitable then others. The objective of this research was to investigate application of 3DP to snack foods made with gelatinized waxy rice doughs (GWRDs).

Method:
The influence of 3DP parameters on the printing processes and physical properties of GWRDs were studied, and rheological properties of GWRDs and expansion ratios (ERs) of their pellets were also analyzed. With various moisture contents, GWRDs were 3D-printed from extrusion nozzle (EN) of a delta-type 3DP printer to its stage, laid down in different 3D shapes for drying, and tempered to be pellets. The apparent viscosity (AV) of GWRDs was measured by Brookfield viscometer. The integrity of product shape was also observed.

Significance:
The conclusions of this research provided valuable 3DPM information for manufacturing various 3D shapes of pellets. These data about 3DPM parameters would be a good reference for new development of third-generation snack foods with special 3D structures.

Results:
Results showed rheological properties of GWRDs were important for 3DP. While waxy rice (%) was between 25~30% under extrusion flow rate 1.44~2.04g/min, printing processes were smooth and the shapes of products were all complete. Their AVs, distributed from 3,850,000~4,820,000cPs with 0.09 rpm spindle speed, were suitable for 3DP. The movement speed of EN was also critical point for 3DP. It should be neither slower nor faster, and 10mm/s~30mm/s would be great for keeping the flow rate stable and making end-product texture crispy. Their ERs were between 4.0~5.9.

P04-051
Intermolecular Interactions and Structure Characterization of Anthocyanin With Different Protein Matrices
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Introduction:
Polyphenols are micronutrients related to the prevention of degenerative diseases. However, bioavailability is limited due to lower intrinsic activity, poor absorption, high metabolization, or rapid elimination. Anthocyanins, water-soluble flavonoids derivative of polyphenols, are plant pigments responsible for color in fruits and vegetables. Stability of anthocyanins is affected by structure, pH, temperature, light, oxygen, metal ions, and intermolecular association. In some food systems, polyphenols exist as conjugates with proteins, which have a stabilizing effect, resulting in insoluble protein-polyphenol complexes. We aimed to investigate the effects of protein encapsulation of anthocyanin to increase absorption and bioavailability. The objectives were to characterize the interactions and structure of anthocyanin-protein particle formation and to evaluate and compare the engineering of self-assembled structures according to the combination of anthocyanin with different protein matrices.

Method:
Anthocyanins (ANC) from black carrot, purple sweet potato, and acai were encapsulated with whey protein isolate (WPI), whey protein concentrate (WPC), alpha-lactalbumin (A-L), and soy protein (SP). Particles were synthesized by acid precipitation of ANC-protein complexes. Morphology of particles was evaluated using a Transmission Electron Microscope (TEM). Entrapment efficiency of complexes was determined using a spectrophotometer to evaluate the remaining ANC in the supernatant after centrifugation of particles. A rheological analysis was carried out by dynamic frequency sweeps to obtain relaxation times where the structure form is maintained as well as Zero-Shear-Viscosity (ZSV) values.

Significance:
The characterization of these interactions between ANC-Protein provides a better understanding of their properties, structure size, and structure type, which can be later used to develop practical applications as carrier complexes.

Results:
Microscopic evaluations were consistent with the results from spectrophotometer analysis where complexes formed with A-L and WPI showed a higher number of entrapped ANC particles at 85.5% and 80.3% efficiency, respectively, in comparison to WPC (71%) and SP (72.4%). WPI and A-L showed the highest ZSV values, indicating the highest level of interaction between the constituents of each complex. Moreover, anthocyanin obtained from purple sweet potato and black carrot were more available and easier to encapsulate than from acai, as shown in the TEM images; this was observed in complexes formed with A-L and WPI.

P04-052
Effect of Infrared Radiation Drying on Sensory Characteristics of Rice
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Introduction:
Infrared (IR) drying has been proved by our research team to have high moisture diffusivity corresponding to a high drying rate for rough rice. Simultaneously, effective disinfection, disinfection, and stabilization could be achieved without milling quality loss. Additionally, extended shelf life with maintained physicochemical properties for rough and brown rice could be achieved using IR drying. However, the effect of IR drying on sensory properties for rough and brown rice need to be further investigated. The aim of this study was to study the impact of IR drying on the sensory quality of rough and brown rice.

Method:
Samples of freshly harvested medium grain rice variety M206 with initial moisture content of 25.03±0.21 % (db) were used. They were dried using IR, hot air at 43°C, and ambient air for comparison. For IR drying, rice was heated to a temperature of 60°C followed by 4 h tempering and natural cooling. The dried samples were divided into two portions, which were respectively used as rough and brown rice for storage at 35±1°C with relative humidity of 65 ±3 % for 7 months. Fourteen descriptive texture attributes at different phases of sensory evaluation were determined by a trained panel, beginning with the feel surface evaluation of the rice when it was first placed in the mouth and ending with residual characteristics after swallowing.

Significance:
It is concluded that IR drying could be used as a feasible efficient drying technique for rice to better maintain sensory quality.

Results:
The IR dried rice showed higher springy (4.1±1.6) and hardness (6.3±1.0) intensities than the springy (3.2±1.0) and hardness (5.7±1.3) of rice dried with ambient. The intensity of initial sticky coating intensity, stickiness to lips, and intensity of cohesiveness of the cooked rice kept decreasing during storage. However, these attributes of IR dried rice showed less decrement after 7 months of storage.
P04-053  
Process and Formulation Effects on the Quality of Flat Plate Dried Pomace  
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Introduction:  
Pomace is a co-product of the fruit and vegetable processing industry; it has potential applications as a source of food ingredients but is currently underutilized. Drum drying is one method that could be used to dry and stabilize pomace. However, the quality effects of the dryer surface temperature, product dwell time, content of carrier, and content of added water (to aid in application of the pomace to the dryer surface), have not yet been explored.

Method:  
In this work, a flat plate heater was used to simulate the surface of a drum dryer. Industrially-produced carrot pomace of initial moisture content of 84.8% (wet basis) was used as the starting material. Based on a central composite response surface design, various feed blends of pomace, maltodextrin (carrier), and water were dried on the flat plate at varying surface temperatures for varying lengths of time. The heating oil temperature was maintained at 132°C in a pre-drying stage, and a drying period of 3 hours was maintained, plus a 1 min hold time. Represented conditions that would be achievable on a typical drum dryer. Regression equations were generated for the L* (lightness), a* (greenness/redness), and b* (blueiness/yellowness) color values of the dried material, as well as for the overall color change (ΔE) and hue.

Significance:  
The results of this work will inform the design of a solar thermal-powered drum dryer that can produce high-quality dried specialty crop purees and pomaces.

Results:  
The R² values for the fits of these quality metrics were 87.3%, 93.9%, 89.5%, 80.6%, and 92.8%, respectively. The significance of the various formulation and process variable terms, as well as that of their square and interaction terms, was determined. L* and hue were significantly (p<0.10) affected by the drying time and the squared terms for the pomace:water ratio, maltodextrin content, and drying time. To minimize the color change, assays were done at 9°C to 132°C and a drying period of 3 hours. The heating oil temperature should be minimized, while dwell time, content of maltodextrin carrier, and content of added water should be maximized (while still using conditions that produce a fully-dried product).

P04-054  
Antimicrobial Effect of Essential Oils Against E. Coli O157:H7 and Salmonella on Fresh Herbs  
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Introduction:  
Consumer awareness of fresh herbs and demand have increased in recent years due to health benefits and distinct aroma in prepared food. There are specific markets for local growers, especially for organically grown herbs. Fresh herbs have been implicated in illnesses associated with Salmonella, E. coli O157:H7 and Cyclospora. Limited treatment options are available in the processing of fresh herbs to prevent the spread of foodborne pathogens. In this study, plant-based essential oils were evaluated on fresh herbs for their antimicrobial properties against Salmonella and E. coli O157:H7.

Method:  
Fresh herbs (Basil, Parsley, Tarragon, Cilantro, and Dill) were inoculated with cocktails of various pathogens. In this study, plant-based essential oils were evaluated on fresh herbs for their antimicrobial properties against Salmonella and E. coli O157:H7.

Significance:  
The results of this work will inform the design of a solar thermal-powered drum dryer that can produce high-quality dried specialty crop purees and pomaces.

Results:  
The R² values for the fits of these quality metrics were 87.3%, 93.9%, 89.5%, 80.6%, and 92.8%, respectively. The significance of the various formulation and process variable terms, as well as that of their square and interaction terms, was determined. L* and hue were significantly (p<0.10) affected by the drying time and the squared terms for the pomace:water ratio, maltodextrin content, and drying time. To minimize the color change, assays were done at 9°C to 132°C and a drying period of 3 hours. The heating oil temperature should be minimized, while dwell time, content of maltodextrin carrier, and content of added water should be maximized (while still using conditions that produce a fully-dried product).

P04-055  
Survival of Salmonella Enterica on Soybean Sprouts Following Treatments With Gaseous Chlorine Dioxide and Biocontrol Pseudomonads  
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Introduction:  
Control of Salmonella enterica on sprouts and minimally processed, ready-to-eat foods and vegetables is important for food and consumer safety. The aim of this research was to assess the effects of gaseous chlorine dioxide (ClO2) and biocontrol microorganisms (Pseudomonas chlororaphis and P. fluorescens) and their combinations on the survival of S. enterica on soybean sprouts.

Method:  
Soybean sprouts were subjected to dip-inoculations with S. enterica prior to application of P. chlororaphis (PC) or P. fluorescens (PF) and were stored 24 h at 5°C. Soybean sprouts were treated with 0.4 mg/L gaseous ClO2 for 1 h (90% R.H., 13°C). S. enterica was enumerated on XLT-4 medium (37°C) and Pseudomonas strains were quantified on PAF Agar (26°C).

Significance:  
This suggests that combination treatment, gaseous chlorine dioxide, and biocontrol bacteria can enhance the safety of soybean sprouts.

Results:  
The reduction of S. enterica on soybean sprouts by the two biocontrol microbes were not significantly (P>0.05) different and ranged from 0.37-1.07 log cfu/g of sprouts when computed relative to the untreated controls. Inactivation of S. enterica by gaseous chlorine dioxide varied with storage time following treatment. The pathogen populations were reduced by 3.2 log cfu/g (0 h), 5.09 log cfu/g (24 h), and 3.99 log cfu/g (48 h).

P04-056  
Modeling the Inactivation of Botrytis Cinerea by Single and Combined Pulsed Light and Ozone Treatments  
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Introduction:  
Botrytis cinerea, a phytopathogen agent that causes gray mold disease, could provoke alterations in postharvest strawberry and blueberry fruits and consequently reduce its shelf-life. Habitual application of fungicides may cause resistance due to its genetic plasticity, with the corresponding serious environmental damage. This research aimed to investigate the effect of ozone and pulsed light (PL) treatments, applied individually or in combination, on Botrytis cinerea in peptone water, as environmentally friendly alternatives to synthetic fungicides. A Weibull type distribution of resistance model was applied to characterize inactivation kinetics.

Method:  
For single treatments, conidia suspensions of B. cinerea in peptone water (105 conidia/mL) were treated with ozone (2 ppm O3 in the liquid phase, 2 to 16 min, 20 ± 1°C, 500 mL in a bubbling column (2000 mL)) or with PL (Xenon lamp, 3 pulses/s, 360 µs, 5 mL, 1 to 40 s, doses: 1.19 - 47.8 J/cm2, final temperature ≤ 20°C). For the combined treatments, conidia exposed to O3 during 2 to 16 min were treated in sequence with PL during 20 s. Survival population during treatments was monitored by the colony count technique (Malt Extract Agar, 5 days, 23°C). Experiments were done in triplicate. Exposure to 40 s-PL led to 3.5 log-cycles of conidia reduction while B. cinerea population inactivation was achieved by 14 min- O3 treatment. Sequential combination O3-PL allowed the inactivation of the fungus conidia with lower doses of both agents (only 6 min- O3 and 20 s-PL).

Significance:  
These results indicated the potential of O3 – PL combination for inactivating B. cinerea in berry fruits. Studies in vivo must be done to confirm doses and the impact on quality.

Results:  
Survival curves resulting of single and combined treatments were notoriously nonlinear, with marked upward concavity. The fit to the Weibullian model was adequate (R²adj = 0.95–0.97). Residual plots were generated and the normality of residuals distribution was verified. Heavy tails in frequency distribution of resistances of PL- exposure conidia would indicate the presence of cell subpopulations highly resistant. Combined treatments resulted in a reduction in the mean inactivation time and its variance.

P04-057  
Development of an Ultraviolet Light Oven to Decontaminate Fresh Produce for Home and Restaurant Use  
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Introduction:  
Foodborne illness outbreaks have been associated with the consumption of fresh produce that was contaminated with pathogens. Current control measures are often not very effective as demonstrated by the recent outbreaks involving fresh produce. In this study, we intended to develop a UV oven to decontaminate fresh produce for home and restaurant use.

Method:  
We first determined the effect of UV on the inactivation of Salmonella. Tap water inoculated with a four-strain cocktail of Salmonella was treated by 10 ppm chlorine or UV light (0.2, 2, 13 and 28.6 mW/cm²) for 5 s to 5 min.
We next evaluated the decontamination efficacy of this UV oven on blueberries. Blueberries were spot- or dip-impregnated with the cocktail of *Salmonella* and dried. The blueberries (50 g) were then washed in agitated tap water for 1-10 min while being irradiated by UV light of 0.2, 2, and 28.6 mW/cm². They were also tested in 10 ppm chlorine or tap water for comparison purpose. The UV oven was finally tested on a larger blueberry sample. Blueberries (170 g) spot- or dip-impregnated with *Salmonella* were washed in agitated tap water for 1 or 10 min while being irradiated by UV light of 2 and 28.6 mW/cm².

Significance: In conclusion, the UV oven developed could be used at home or restaurants to decontaminate blueberries and potentially used to decontaminate other types of fresh produce.

Results: UV treatments with intensity ≥ 2 mW/cm² and treatment time ≥ 30 s achieved higher *Salmonella* inactivation than the 10 ppm chlorine treatment. For example, the 2 mW/cm² UV treatment and 10 ppm chlorine treatment for 1 min reduced *Salmonella* by 7.8 and 5.0 log, respectively. Additionally, increasing the UV treatment time enhanced *Salmonella* inactivation.

For spot inoculation, UV treatments were more effective than chlorine or water washing. For dip inoculation, the 2 mW/cm² UV treatment was comparable to chlorine washing, while 28.6 mW/cm² UV treatment was the most effective, achieving 3.8 log reduction for the 1 min treatment.

P04-058
Comparative Analysis of CRISPR in *Vibrio Parahaemolyticus* From Different Sources
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Introduction: Clustered regularly interspaced short palindromic repeats (CRISPR) have been recently discovered in archaea and bacteria. It can encode a sequence-specific defense mechanism against bacteriophages and limit horizontal gene transfer in prokaryotes. In order to get novel insights into the role of CRISPR in different sources of *V. parahaemolyticus*, 43 strains isolated from clinical samples and 33 strains from environment were analyzed. Simultaneously we also analyzed the CRISPR in whole genome sequences from GenBank database.

Method: The PCR-centered approach was used to detect the CRISPR loci in all 76 V. parahaemolyticus strains and all the CRISPR sequences were analyzed using CRISPR finder.

Significance: CRISPRs don't have characteristics of an active immune system in that their evolutionary patterns don't fit the quick and constant evolutionary pace of such a system. The ecology of *V. parahaemolyticus* does not seem to have selected CRISPRs as a rapid way to acquire adaptive immunity against foreign DNA. But, since CRISPRs are maintained in most *V. parahaemolyticus*, this certainly suggests that CRISPRs have additional functions.

Results: Among the environment strains, the CRISPRs were small and remained unchanged for long periods of time. In all clinical strains, single nucleotide polymorphisms (SNPs) had been introduced into the spacer, while someone that had a new spacer inserted. These changes contributed to environment and clinical differences. But all sequence analysis of the CRISPR arrays revealed that no spacers had matched the bacteriophages or plasmids. It was difficult to conceive the *V. parahaemolyticus* CRISPRs as an active immune system against phages.

P04-059
Profiles and Dynamics of Volatile Compounds of Chinese Steamed Bread Fermented With Different Species of Yeast Isolated From Traditional Chinese Sourdough
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Introduction: Chinese steamed bread has been consumed as a staple food in China for nearly 2000 years. It is traditionally fermented with sourdough, which is dominated by yeasts and lactic acid bacteria. The microbiota of sourdough has a significant influence on the overall quality of steamed bread. The objective of this study was to unravel the roles of different species of yeast towards conferring aromatic properties to steamed bread.

Method: A total of 105 yeast strains isolated from fifteen sourdough samples, representing different regions of China, were grouped using random amplified polymorphic DNA (RAPD) analysis followed by identifying representatives of each group using 26S rRNA gene sequencing. All yeast species were profiled based on their ability to ferment different sugars and to produce gases during dough fermentation. Volatile compounds were extracted and identified by solid phase microextraction (SPME) and GC-MS, respectively, from dough and steamed bread samples fermented by different yeast species. The changes in volatile compounds during a prolonged fermentation time of 12 h were also observed. To further elucidate the mechanism of aroma formation, research on transcriptome and metabolome is to be conducted in our next step. A principal component analysis (PCA) was performed to analyze the relationship among the doughs fermented with different species of yeasts.

Significance: Our results show that different species of yeasts isolated from traditional sourdough have different profiles of aroma compounds, and some species of yeasts may be promising substitutes of baker' yeast.

Results: Six species of yeasts were found, namely *Saccharomyces cerevisiae*, *Candida humilis*, *Pichia membranifaciens*, *Pichia kudriavzevi*, *Wickerhamomyces anomalus*, and *Saccharomycopsis fibuligera*. Surprisingly, *C. humilis* showed significantly higher ability to produce gas during dough fermentation as compared to *S. cerevisiae*, a most widely used yeast around the world in the bakery industry. A total of 40 volatile compounds were found, consisting of 17 alcohols, 8 aldehydes, 4 ketones, 7 acids, 3 esters and 1 olefin. The most commonly detected compounds include ethanol, 2-methyl-1-propanol, phenylethyl alcohol, 3-methyl-1-butanol, 1-hexanol, decanal, hexanal, hexanoic acid, and ethyl acetate. The concentration of most volatile compounds slightly decreased after a steaming process and most of the volatile compounds increased after a prolonged fermentation.

P04-060
Screening of Bacteriocin-Producing *Pediococcus Pentosaceus* From Mongolian Cheese and Study of Physicochemical Characteristics of Bacteriocin
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Introduction: In order to develop a kind of safe and effective food bio-preservative, the physicochemical characteristics of bacteriocin C-2-1, produced by *Pediococcus pentosaceus* isolated from Mongolian cheese, was systematically studied.

Method: The strain was identified by 16S rDNA gene sequence homology analysis, inhibitory activity was analyzed by the well-diffusion method, and the molecular weight of the bacteriocin was detected by Tricine-SDS-PAGE.

Significance: Bacteriocin C-2-1, sourced from Mongolian cheese, was heat stable and active at wide pH, which indicates it would have potential application of biopreservatives for dairy products.

Results: The highest bacteriocin production (5120 AU/ml) was noted at stationary phase after 22–26 h of growth in MRS broth at 30°C against *L. monocytogenes* ATCC 19114. Bacteriocin C-2-1 could significantly inhibit against a part of the gram-positive bacteria, but was inactive against gram-negative bacteria and yeast. The mode of activity against *L. monocytogenes* was bactericidal. No change in activity was recorded after treatment at temperature range 60°C to 90°C, and after treatment at pH values between 2.0 and 9.0. In addition, the bacteriocin was resistant to treatments with SDS, Tween-20, Tween-80, urea, NaCl, and did not adhere to the surface of the producer cells and the molecular weight was between 5.8 kDa and 7.8 kDa, as determined by Tricine-SDS-PAGE.

P04-061
The Role of *Listeria Monocytogenes* Z in GSH Regulation in Response to Sodium Hypochlorite Stress
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Introduction: Sodium hypochlorite (NaOCl) is widely used as a disinfectant and it can effectively kill bacteria, fungi, and viruses. Bacteria activate the expression of antioxidant mechanisms to detoxify reactive oxygen species (ROS) and to repair the damage. However, the mechanism of NaClO-activated protection is not clear in *Listeria monocytogenes*. In present study, we indicated the role of the general stress response alternative sigma factor, σB, and an isogenic sigB gene mutant strain.

Method: The bacterial viability under NaClO stress was detected with dilution method of plate counting from different growth periods at different gradients of time. The extracellular and intracellular productions of ROS was detected by the reduction of nitro blue tetrazolium (NBT) to nitro blue diformazan. The expression value of redox-related genes and intracellular productions of ROS was detected by the reduction of nitro blue tetrazolium (NBT) to nitro blue diformazan. The expression value of redox-related genes was observed by real-time quantitative PCR (RT-qPCR) assay.

Significance: To prove this hypothesis, three genes (sodA, perR, ohrA) related to ROS detoxification and one (recA) related to repair effect were selected to study sigB role in oxidative stress regulation. As shown in result, the gene expression level of ohrA gene was 220-fold increased in mutant-type but only 40-fold increased in wild-type under NaClO stress. This finding indicated that ohrA factor may regulate or act together with the important gene expression level of ohrA gene.
P04-062  
Impact of Short-Wave Ultraviolet Light (UV-C) Combined With Mild Temperature on the Inactivation of Some Microorganisms in Carrot Beverages  
S. Guerrero, Buenos Aires University, M. Garcia Carrillo, M. Ferrario, M. Schenk, Email: sguerrero@di.fcen.uba.ar

Introduction: UV-C has significant promise to reduce the microbial contamination levels for a wide range of beverages. Due to the presence of suspended aggregates, particles, many fresh juices transmit relatively little UV light, and consequently, the efficiency of the pasteurization process is reduced.

Method: The aim of this study was to evaluate the inactivation of Escherichia coli ATCC 35218, Saccharomyces cerevisiae KE162 and Pseudomonas fluorescens ATCC 49383 in fresh filtered carrot juice (Cj), muslin cloth, adjusted pH: 5.0, 7.1 waitress, absorptivity coefficient: 0.26 cm⁻¹ turbidity: 716±1 NTU, particle size:D(2.1): 5.1±1.1 µm, D(4,3): 60.8±8.7 µm). Juices (750 mL) recirculated through an annular reactor consisting of two serially connected UV-C lamps during 15 min (1.6 L/min, 0.0-11.4 kJ/m², temperature: 20°C, 40°C, and 50°C).

Results: After 20°C-UV-C exposure, 2.7-4.1 log-reductions were obtained in Cj and 2.0-2.9 log-reductions in COB1, being E.coli and P. fluorescens more sensitive than S. cerevisiae. Lower absorbance (absorptivity coefficient), aggregation (D(4,3)/D(2,1) ratio) and turbidity of Cj compared to COB1, could be responsible for the observed higher inactivation in Cj. Notwithstanding, UV-C inactivation improved with mild temperatures during the inactivation curve shape, but microbial resistance thermodependence differed among species. In COB1, mild heat treatments were ineffective (minor than 0.6 log-reductions) while 2.67-6.04 log-reductions were achieved with UV-C/T treatments, thus obtaining additive and even synergistic effects. Weibull and Modified Gompertz models were successfully used to complementary characterize microbial inactivation (R² > 97.0-99.5). Modified Gompertz model better described UV-C/T inactivation curves, which exhibited sigmoid shape. Single UV-C weibull resistance frequency distributions were skewed to the right, with high variance, tail and, excepting for S. cerevisiae, without mode. Combined UV-C/T treatments (40°C and 50°C) generated narrower frequency distributions more skewed to the right, with low variance, mean and without mode and tail.

Significance: This study gives useful quantitative information regarding the effect of UV-C treatment for carrot beverages.

P04-063  
Study of the Inactivation of Alicyclobacillus Acidoterrestris Spores by Pulsed Light Technology in Apple Juice  
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Introduction: A. acidoterrestris is a thermo-acidophilic, heat-resistant bacterium which is capable of surviving the pasteurization procedures normally applied to fruit juices producing taint compounds. The purpose of this study was to analyze the response of A. acidoterrestris ATCC 49025 spores in different apple juices as affected by PL with different temperature and IS.

Method: ATCC 49025 spores in different apple juices as affected by PL with different temperature and IS. The purpose of this study was to analyze the response of surviving the pasteurization procedures normally applied to fruit juices producing taint compounds. In COBJ, mild heat treatments were ineffective (minor than 0.6 log-reductions) and shelf life of foods. In the design of the food irradiation process, the knowledge of the microbial resistance for up to 24 hours stored outside of the cooler. One such food ingredient is salted butter, which can be stored in the melted form at either room temperature or near a grill with a shelf life of two or three months. The melted butter may not be covered resulting in possible contamination from an external source such as air and/or an application brush.

Significance: The present study demonstrated the importance of initial A. acidoterrestris juice contamination on PL inactivation as well as the potential use of mild heat build-up to enhance PL effectiveness.

P04-065  
The Microbiological Stability of Salted Butter Stored at 26.7 and 37.8°C for 24 Hours  
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Introduction: With an increase in the number of restaurants serving breakfast for an extended period of time during the day, the food safety (especially related to contamination at the store) of ingredients used to produce these food items, which are often held at room temperature, must be ascertained. One such food ingredient is salted butter, which can be stored in the melted form at either room temperature or near a grill with a shelf life of two or three months. The melted butter may not be covered resulting in possible contamination from an external source such as air and/or an application brush.

Significance: A 1.35% salt concentration (main factor controlling bacterial growth) is within specification but at the very low end, thus, giving the organisms the best opportunity to grow in the salted butter. As a safeguard, good sanitation practices should be made with uncovered melted salted butter stored in the restaurant during operations.

Results: The salt, water activity, and pH of the salted butter used were 1.35%, 0.906, and 6.73, respectively. After 24 hours of storage at both temperatures, the salted butter did not support the growth of the four inoculated organisms. Therefore, with regards to the four organisms tested in this investigation, salted butter will remain stable and not be a microbiological hazard for up to 24 hours stored outside of the cooler.

P04-066  
Radiation Resistance of Non-O157:H7 Shiga Toxin-Producing Escherichia Coli Suspended in Refrigerated Catfish Fillet Meat  
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Introduction: Irradiation (gamma) irradiation is a sustainable and important non-thermal treatment that has been very effective in controlling microorganisms and improving the safety and shelf life of foods. In the design of the food irradiation process, the knowledge of the radiation resistance of the target organism in a specific food commodity is required. Research was conducted to determine if acid adaptation of non-O157 Shiga toxin-producing Escherichia coli (STEC) provides resistance to gamma irradiation.

Method: In this study the radiation D10 values of non-O157:H7 STEC serovars O26:H1, O45:H2, O115:H2, O111:NM, O121:H9, and O145:NM grown under conditions to induce acid tolerance, and then suspended in catfish fillet meat, was determined. The inoculated catfish meat was irradiated at low dose of 0.027 kGy/min at refrigeration (4°C) temperature. The mean plate counts of the treated samples (N) were divided by the average control plate counts (No) to give a survivor ratio (N/No). The log10 (N/No) of this ratio was then used for determination of D10-values by taking the reciprocal of the slope following linear regression as determined by least squares analysis. Each experiment (D10 determination) was conducted independently three times. A minimum of 5 dose points (e.g., 0.5, 0.3, 0.6, 0.9, 1.2, 1.5, and 1.8 kGy) were used. Statistical analysis
functions of MS Excel (Microsoft Corp., Redmond, WA) were used for routine calculations (D10 determination). Every D10 value was obtained with R-square > 0.9 when linear regression performed.

Significance:
The result obtained will assist seafood industry in designing acceptance limits on critical control points that ensure safety in eliminating the possible presence of the foodborne STEC pathogens.

Results:
The D10 values, the radiation dose needed to inactivate 1 log of pathogen, of the non-O157:H7 STECs grown under conditions of neutral pH (TSB: tryptic soy broth with no added glucose) ranged from 0.183 to 0.294 kGy. The D10 values for 5 of the 6 non-O157 STEC serovars were significantly lower (0.138 – 0.226 kGy) when grown in TSB supplemented with 3% glucose to induce acid tolerance, as opposed to neutral pH, indicating less resistance to gamma irradiation.

P04-067
Synergistic Lethal Effects between Gaseous Essential Oils against Listeria monocytogenes
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Introduction:
We screened gaseous essential oils (EO gases) inhibitory to Listeria monocytogenes, evaluated their antimicrobial activities, and identified the combinations of EO gases causing synergistic lethal effects against L. monocytogenes.

Method:
In total, 100 types of commercially available EOs were purchased and their inhibitory activities against L. monocytogenes were determined using a vapor diffusion assay.

Significance:
These results indicate that the amounts of individual EO gases used to inhibit the growth of L. monocytogenes could be significantly reduced by combining those EO gases without loss of their antimicrobial activity. Information reported here will be useful when developing antimicrobial packaging systems with minimizing the sensorial changes of foods.

Results:
As a result, 43 types of EO gases showed inhibitory activities against L. monocytogenes. For the selected EO gases, their minimal inhibitory concentrations (MICs) and minimal lethal concentrations (MLCs) against L. monocytogenes were measured. Cinnamon (from bark), cinnamon (from leaves), thyme thymol, oregano, and clove EO gases showed the lowest MIC (0.0781 µL/mL) and MLC (0.0781 µL/mL). Finally, synergistic lethal effects between EO gases against L. monocytogenes were evaluated using a modified checkerboard assay. A combination of cinnamon (from leaves) and thyme thymol EO gases, a combination of cinnamon (from bark) and oregano EO gases, a combination of cinnamon (from bark) and thyme thymol EO gases, a combination of oregano and thyme thymol EO gases at ratio of 2:1, and the combination of clove and thyme thymol EO gases at ratio of 1:1 showed FICs of 0.28, 0.028, 0.38, and 0.50, respectively.

P04-068
Allly Isothiocyanate (AITC) by Triacetyele-β-Cyclodextrin (TACD) and Its Potential Application in a Polymer Extrusion Process for Food Packaging
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Introduction:
Triacetyle-β-cyclodextrin (TACD) modifies cyclodextrin by replacing the OH groups of the conventional β-cyclodextrin with acetyl groups (COCH3), and significantly improves compatibility with hydrophobic polymers such as low-density polyethylene (LDPE), while normal β-cyclodextrin (β-CD) decreases the physical/barrier properties of the extruded films. In this test, allyl-isothiocyanate (AITC), a strong natural antimicrobial agent, was encapsulated into TACD, and the AITC-TACD complex was impregnated into LDPE to develop antimicrobial functional film for food packaging application.

Method:
Unlike conventional β-CD, AITC is not soluble in water and requires a different approach to encapsulate the AITC. TACD was mixed with AITC and different solvents (isopropanol, acetone, chloroform, and the mixture was kneaded and ground using a mortar and pestle using three different times (8, 16, and 24 minutes) of manual mixing. The encapsulation efficiency of the prepared TACD-AITC complex was measured by UV-Vis spectrophotometer, differential scanning calorimetry (DSC), and thermogravimetric analysis (TGA). As the next stage, TACD was incorporated and extruded with LDPE by cast film extrusion process. 0, 1, 2, and 3% of the TACD: LDPE matrix films were prepared. The overall property changes (gas barrier, mechanical strength, and morphology) were then analyzed and compared to β-CD: LDPE films.

Significance:
TACD-AITC impregnated LDPE film has high potential to improve food safety without damage LDPE's original properties.

Results:
The results suggested that acetone and water mixture achieved the highest AITC encapsulation in the TACD under 16 min of kneading. Thermal analysis (DSC and TGA) indicated that AITC was truly encapsulated in the hole of TACD molecule rather than surface adsorption on TACD. The overall property changes (gas barrier, mechanical strength, and morphology) were then analyzed and compared to β-CD: LDPE films. TACD:LDPE film showed statistically similar tensile strength and oxygen transmission rate to LDPE control while β-CD:LDPE films had 50 and 35% reduction, respectively. In addition, a significantly enhanced TACD distribution was observed in the matrix films, compared to β-CD:LDPE films.

P04-069
Hydroxpropyl-β-Cyclodextrins and Plasticizers Modulate the Load Capability of Monoterpeno Alcohols in Hydrophilic Polymers: Application to the Design of Active Food Packaging
P. Hernandez Munoz, L. Higuera, G. López-Carballa, E. Almenar, R. Gavara, Email: pherinan@iata.csic.es

Introduction:
Nowadays consumers demand natural products with minimal processing and free of synthetic preservatives. Active packaging technologies based on films incorporating naturally occurring antimicrobial volatiles could be an approach to the preservation of minimally processed foods. These films do not require being in contact with the food product to be active and the release of the volatile can be triggered by different stimuli. A major drawback in the development of these systems is that a high percentage of the active agent is evaporated or inactivated during film processing. The aim of this work has been to avoid volatile losses during film processing. It has been studied the effect of hydroxypropyl-β-cyclodextrins and hydrophilic plasticizers on regulating the load capability of volatile monoterpenes in preformed hydrophilic films.

Method:
Films incorporating hydroxypropyl-β-cyclodextrins at the 1:1 weight ratio and plasticized with 35% glycerol or propylene glycol were prepared by casting and conditioned at different relative humidities. Sorption properties of the films for different monoterpenes compounds having phenolic or non-phenolic lineal or cyclohexyl alcohol structures were studied after their immersion in the volatile liquids. The amount of compound in a film was determined by thermal desorption coupled to gas chromatography. The antimicrobial activity was evaluated by the microaomosphere test against E. coli and S. aureus.

Significance:
Developed films could be used as carriers and release devices of naturally occurring volatile liquids for the design of active food packages.

Results:
Chitosan films presented a considerably capability to retain monophenolic compounds with values ranging from 430% for meta-cumemol to 100% for guaiacol depending on the film formulation; these values were two order of magnitude higher than those of compounds not wearing phenol group. Affinity between the double bonds of benzene and polar groups of the film could explain that behavior. Films plasticized with hydrophilic propylene glycol diminished their affinity for monophenolic compounds whereas no changes were observed in the retention of non-phenolic monoterpenes. Substituting chitosan by polyvinylalcohol polymer considerably decreased the retention of monophenolic compounds. All the compounds presented antimicrobial activity against assayed bacteria whereas the activity of the films was directly related to the content in the volatile.

P04-070
Preparation and Characterization of a Bio-Nanocomposite Film Based on Sweet Potato Starch and Thyme Essential Oil
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Introduction:
The volume of plastics discarded annually creates a substantial waste disposal issue. Wheat starch, wheat gluten, soy and whey proteins have frequently been used for biodegradable packaging while there is a potential allergenicity if these compounds migrate onto food products. In readily available vegetable which is cultivated extensively for its nutritious value and readily available vegetable which is cultivated extensively for its nutritious value and readily available vegetable which is cultivated extensively for its nutritious value and readily available vegetable which is cultivated extensively for its nutritious value and readily available vegetable which is cultivated extensively for its nutritious value. The aim of this work has been to avoid volatile losses during film processing. It has been studied the effect of hydroxypropyl-β-cyclodextrins and hydrophilic plasticizers on regulating the load capability of volatile monoterpenes in preformed hydrophilic films.

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The difference between factors and levels was evaluated by the analysis of variance (ANOVA). Duncan's multiple range tests were used to compare the means to identify which groups were significantly different from other groups (P < 0.05).

Significance:
These results suggest that EPS may provide a viable solution to the waste disposal of foods' plastic packaging materials.

Results:
The results showed that incorporating MMT into EPS film greatly improved (P < 0.05) the firmness, water gain and water vapor permeability. It was also shown that the combined effects of MMT and TEO improved tensile strength, elongation and tristimulus color values (P < 0.05). These improvements could be related to the MMT exfoliation and good interaction between EPS and MMT in the presence of TEO.

P04-071
Effect of UVC Irradiation on Cranberry Juice-Alginate Edible Film Properties
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Introduction:
Studying different aspects of edible films and coatings production for improving their properties and investigation on their usage and potentialities have attracted many researchers, especially in recent years. Shortwave ultraviolet irradiation (UVC) has been used to increase the tensile strength of selected edible films, because it enhances the cross-linking processes. Therefore, the objective of this research was to determine the effect of UVC on selected properties of edible films prepared from alginate and cranberry juice.

Method:
Films were prepared by casting with commercial cranberry juice, alginate (1.5%), glycerol (1%) and calcium chloride (1%). For UVC-treated films a dose of 23.4 J/m2 was applied. UVC-treated and untreated films were characterized measuring their thickness, color parameters (L, a, b), net color change, percentage of elongation, tensile strength, water vapor permeability, and film solubility.

Significance:
Cranberry juice-alginate edible film properties were improved by means of UVC. The effect of the UVC irradiation may increase if the films were exposed to higher doses. Further research on the effect of the UVC radiation in edible films made from polysaccharides and fruit juices is needed in order to provide information for their possible use as food packaging or edible coatings.

Results:
No significant difference (p > 0.05) was observed between thicknesses of studied films nor between the color parameters of the films before and after exposure to UVC. Films treated with UVC significantly (p < 0.05) increased their tensile strength from 2.46 to 3.98 MPa. This increase suggests that UVC irradiation enhanced cross-linkage of the polymer chains. However, elongation of the UVC treated films decreased significantly (p < 0.05). Since in the irradiated films, crosslinking of the polysaccharide chains was promoted this limits their flexibility. UVC irradiation slightly decreased permeability and water solubility of studied edible films; although, this decrease was not significant (p > 0.05) UVC irradiation had an effect on the mechanical properties of the films made with alginate-cranberry juice, without significantly altering their color (p > 0.05).

P04-072
Water Vapor Permeability of Biodegradable Films Synthesized From Binary Mixtures of Carrageenan With Other Biopolymers
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Introduction:
Biopolymers have been proposed as an alternative to mitigate environmental problems caused by synthetic food packaging. However, films made from biopolymers do not meet the necessary physical requirements for food storage. This is why it is necessary to explore different mixtures of biopolymers and determine their physical properties. Through surface response designs, this study evaluated water vapor permeability (WVP) of films made from carrageenan (C) in binary mixtures with modified starch (MS), chitosan (Ch), sodium alginate (Ag), or carboxymethyl cellulose (CMC) using different concentrations of glycerol as plasticizer.

Method:
The WVP of films made from each tested binary mixture of biopolymers was evaluated by two experimental designs with three center points. The evaluated factors were the proportion of the biopolymer mixture (10%-90%, 50%-50%, or 90%-10%) and the amount of glycerol used (30%, 40%, or 50%) relative to the amount of biopolymer tested. The casting method was applied for film preparation; film-forming solutions at 1% concentration were prepared and dried for 8 h at 35°C. For WVP determination, the ASTM (2010) E96/E96M procedure was utilized.

Significance:
Our results demonstrated that it is possible to obtain continuous, uniform, compact, and translucent films with tested biopolymers that meet water vapor permeability requirements for appropriate storage of selected foods.

Results:
Studyed factors and their interactions were statistically significant (p < 0.05) on films' WVP. There was a direct correlation between increasing glycerol and an increase in WVP. A high concentration of C resulted in a decreased WVP. There are also clear differences among tested biopolymers, WVP behavior of carrageenan films with starch or CMC is similar and of the same magnitude, while for chitosan WVP values were considerably lower. The WVP was minimized (when the film was formed of C and Ag) at high concentrations of Ag and low concentrations of glycerol. In general, the addition of tested plasticizer increased WVP. WVP behavior can be explained due to the intermolecular interactions between tested polymers and studied plasticizer.

P04-073
Comparative Study of Phenolic Content and Antioxidant Activity in Astringent and Non-Astringent Persimmon Fruits During Development and Ripening
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Introduction:
Persimmon fruit (Diospyros kaki L.) is a good source of polyphenols, which are beneficial for physiological functions, including antioxidant, detoxifying and antimicrobial properties. Persimmons have short commercial life with non-astringent varieties ready for marketing when fruit has enough orange color, while astringent varieties are bitter at maturity and required to be ripened. The progressive changes of health-promoting phenolic compounds during fruit development and ripening have not been reported. This study's objective was to characterize and compare phenolic contents and antioxidant properties of four Japanese varieties with the Native American variety grown in Mississippi.

Method:
Persimmon fruits were allowed to grow and ripen on trees and harvested every two weeks from July to November 2015. Phenolic compounds from fresh persimmon fruits were extracted with methanol in the presence of 1% 2,6-di-tert-butyl-4-methylphenol.

Results:
Results indicated that Hanafuyu and Jiro, the non-astringent varieties were lower (p < 0.05) in total phenolic content (TPC), total flavonoid content (TFC), condensed tannin content (CTC), total tannin content (TTC), DPPH, and ferric-reducing antioxidant power (FRAP) compared to astringent varieties such as Saijo, Tanenashi, and Native American. Phenolic compounds and DPPH and FRAP values of each variety decreased as the fruit matured and ripened. TPC decreased from 65-117 to 11.9 mg ce/g, TFC from 16-49 to 2-6 mg Ce/g, CTC from 11-123 to 0.5-9 mg Me/g, and TTC from 13-146 to 2-8 mg Te/g over 19 weeks for all varieties. DPPH and FRAP values of non-astringent varieties (304-367 μmol Te/g) and astringent varieties (559-746 μmol Te/g) decreased by 36-89% and 25-82%, respectively. ORAC value of the Native American variety was higher (100.7 – 516.5%) than all varieties throughout the growth period. At the end of ripening stage, Native American was higher (p < 0.05) in TFC, DPPH, FRAP and ORAC than all varieties, while no significant difference existed in TFC, CTC, and TTC among astringent varieties. Significant correlations existed between phenolic compositions and antioxidant properties in persimmons.

Significance:
This study provides new information for selection of the optimum time to harvest fruit for the retention of maximum health-promoting phenolic substances in persimmon fruits that would aid in marketing of persimmons produced in Mississippi.

P04-074
Microbial Decontamination of Cherry Tomato by Microwave-Powered Cold Plasma Treatment
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Introduction:
The health benefits associated with consumption of fresh fruits and vegetables maintain a high consumer demand for a wide range of pre-packed ready to use products. Cold plasma (CP) is a nonthermal method to inactivate undesirable microbes and extend the preservation of foods' plastic packaging materials.

Results:
The CPT at 827 W for 9 min resulted in the highest reduction of Salmonella and, (2) study the effects of CPT on the morphological changes of cherry tomato skin and the growth of Salmonella in cherry tomato during storage at 4 and 25°C.

Method:
Cherry tomato (Solanum lycopersicum var. Cerasiforme) was treated by CPT using helium as the CP-forming gas. Experimental variables for optimizing CPT conditions included plasma generation power (400-900 W) and treatment time (2-10 min). A central composite method was applied to investigate the interactions among the variables of Salmonella reduction, weight loss, and surface temperature of cherry tomato. Cherry tomato was treated with the optimum CPT conditions and stored at 4 and 25°C and 85 ± 5% relative humidity for 28 d to study the growth of Salmonella and, (2) study the effects of CPT on the morphological changes of cherry tomato skin and the growth of Salmonella in cherry tomato during storage at 4 and 25°C.

Results:
The CPT at 827 W for 9 min resulted in the highest reduction of Salmonella (3.5 ± 0.1 log CFU/cherry tomato reduction) with temperature increase of 3.0 ± 0.3°C. The optimum CP generation power and treatment time against Salmonella inhibition were 900 W and 10 min, respectively, and the treatment with the conditions did not appreciably
modify surface morphology of cherry tomatoes, but effectively inhibited the growth of *Salmonella* at 4°C (P < 0.05). However, the growth-inhibiting effect of CPT was not demonstrated at 25°C (P > 0.05).

**Significance:**
Microwave-powered CPT using helium demonstrated a potential for improving microbial safety of cherry tomato against *Salmonella*, minimizing the deterioration of its food quality during storage at 4°C.

**P04-075**

**Drum Drying of Mango Pulp as an Alternative to Produce Fruit Powder: Performance of Different Additives**

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**Introduction:**
Mango is an important source of nutrients, and the use of fruit powder as an ingredient could give naturalness and healthiness to products. The objective of the study was to evaluate the use of different additives in drum drying of mango pulp.

**Method:**
Commercial mango pulp (PU) (−15°C) was employed, and the experiments were performed in a single cylinder drum dryer, with 0.5 m2 of drying area, indirectly heated by saturated steam (5 kgf/cm2 ⏐ −15°C), with a residence time of 15 seconds. The additives employed were glyceryl monostearate (GM), maltodextrin 10DE (M10) and 20DE (M20), maize starch (S). The trials according to additive mixtures were: 1) PU + 3% + 0.5%GM; 2) PU + 3% + 1%M10 + 0.5%GM; 3) PU + 3% + 1%M20 + 0.5%GM; 4) PU+3%M10 + 0.5%GM; 5) PU + 4%S +1%GM; 6) PU without additives (blank). The amounts were calculated on total pulp solids (dry basis). After drying, products were milled using a grinder mill and analyzed with respect to moisture content, total polyphenols, Vitamin C, total carotenes, β-carotene, water activity, hygroscopicity, and solubility.

**Results:**
The mean values of moisture content and water activity were 0.75 ± 0.02% and 0.205 ± 0.014, respectively. The hygroscopicity, solubility, and carotene retention values did not differ significantly (p>0.05) between the treatments, and the mean values were 26.5 ± 0.7%, 78.2 ± 0.5%, 90.9 ± 3.6%, respectively. Regarding the color, the product of test 3 had the best Chroma, however, it was the darkest one (lower L*). Although it resulted in the highest polyphenol retention (86.6 ± 0.4%), trial 6 (pure pulp) had poor performance in general, especially in retention of Vitamin C (39.3 ± 0.6%). Trial 1 stood out with higher yield (8.00 ± 0.23 kg/h m2), Vitamin C retention (61.0 ± 0.7%), and β-carotene retention (89.6 ± 2.8%).

**Significance:**
The results of this study showed that additives are required in drum drying of mango pulp, but in low concentrations, resulting in high quality products. This process represents an alternative option compared to processes like spray drying, which is more additive demanding, and freeze-drying, which is more costly.

**P04-076**

**Modeling Growth of Cold-Adapted *Listeria innocua* and *Listeria Monocytogenes* on Fresh Baby Spinach Leaves Under Different Cold Storage Temperatures**

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**Introduction:**
Predictive models are valuable tools for manufacturers to develop process controls to decrease the risk of pathogen contamination in fresh and fresh-cut produce. These predictive models can also provide an estimate of the produce shelf life based on “microbial safety” and useful input to quantitative microbial risk assessment tools to evaluate the growth of pathogens in fresh and fresh-cut produce during several stages of processing and distribution. The objectives of this study were to (1) validate the use of cold-adapted *Listeria innocua* as a surrogate for cold-adapted *Listeria monocytogenes* to predict the growth of the pathogenic strain on fresh baby spinach leaves; (2) develop and validate a dynamic model for prediction of growth of cold-adapted *L. monocytogenes* and *L. innocua* under different cold storage temperatures.

**Method:**
Five-grains of fresh baby spinach leaves were dispersed into sterile stomacher bags (18 oz), inoculated with 1ml of 102 CFU/ml of cold-adapted *L. innocua* and *L. monocytogenes*. Samples were vigorously shaken for 1 min to spread the innoculum over the sample and then placed in an incubator at constant temperature (3, 5, and 8°C). Growth data for *L. innocua* and *L. monocytogenes* were collected at each temperature. Two replications were performed for each temperature. Growth curves were fitted by Baranyi model to predict the initial cell concentration, (yo), lag time, (tlag), maximum cell concentration, ymax, and maximum growth rate, ymax. For each microorganism, a dynamic model was developed and validated for ymax, lag, and ymax. The accuracy factor, (Af), bias factor, (Bf), and the standard error of prediction, (%SEP), were also calculated and evaluated between observed data and predicted values.

**Results:**
The results indicate that the lag time of *L. monocytogenes* is significantly shorter than that of at 5°C and 8°C. Although *L. monocytogenes* can still grow at 3°C, *L. innocua* did not. The developed secondary models displayed a good agreement between the observed and predicted values for both microorganisms.

**Significance:**
These findings will be useful to develop quantitative risk assessment models to assess the risk of contamination of fresh baby spinach leaves throughout the processing and distribution channels.

**P04-077**

**Heat Transfer Modeling of Innovative Infrared Heating for Pear Peeling**

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**Introduction:**
Infrared-dry-peeling involves comprehensive heat transfer phenomena covering radiative and convective heat transfer on the surface, as well as conduction inside the product. There is a significant need to model temperature distribution to achieve high peeling performance and advanced product quality. Therefore, the objective of this research was to develop a mathematical model of heat transfer during IR heating for pears. With validated modeling results, critical operation parameters including layout of sample loading and rotation speed can be adjusted to enhance the heating uniformity, system capacity, energy efficiency, and the ultimate quality of products.

**Method:**
Two-dimensional cylindrical symmetric heating transfer model has been developed for an electric IR heating system. The system comprised of two ceramic infrared emitters (FTE, Ceramics Ireland Ltd, 1000 W, 60°×245 mm surface area, 100 mm gap, and 0.93 emissivity). The surface temperature for emitters was 601 ± 25°C and the gap between two emitters was 100 mm. Radiative energy was assumed to be absolutely absorbed by the surface other than regarded as exponential decay heat source along the thin surface layer. Model was validated with surface temperature measured by infrared camera (FLIR E40) on the bell equator.

**Results:**
According to the model, the top, bottom, and neck parts had lower temperature because of the geometry effect. Moreover, the inner part (flesh) remained around room temperature when the skin layer was heated up to 115°C. The large gradient of temperature between skin and flesh benefits the inner part quality due to low temperature, meanwhile, the rapid surface heating was ideal for peeling.

**Significance:**
It has been concluded that IR dry-peeling as a rapid surface heating technology has a promising potential in replacing the conventional lye and steam peeling to address the immediate and long-term goals of water supply, salinity management, energy efficiency, and quality assurance in the pear processing industry.

**P04-078**

**Phenolic Substances and Antioxidant Properties of Wine Made From Eight Varieties of Muscadine Grapes**

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**Introduction:**
Muscadine grape (*Vitis rotundifolia Michx.*) and its wine products are becoming more acceptable due to potential health benefits that are associated with high phenolic substances in the wine products. Several high yielding muscadine grape varieties grown in Mississippi have not been tested for phenolic and antioxidant capacities. Our objective was to analyze phenolic substances and antioxidant capacities of wine made from eight varieties of muscadine grapes.

**Method:**
Muscadine grapes of Carlos, Covart, Creek, Late Fry, Lumas, Noble, Pineapple, and Scruppernong were harvested in September of 2014. Wine was made and analyzed for up to 50 days of fermentation. Total phenolic content (TPC), total anthocyanin content (TAC) and condensed tannins content (CTC) were determined, and the antioxidant capacities were tested via 2, 2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging activity and oxygen radical absorbance capacity (ORAC) assays. Authentic standards of 18 phenolic acids, 14 flavonoids and two stilbenes were employed for identification and quantification by liquid chromatography. Data were analyzed by statistics for variance, Pearson correlation coefficient and mean difference significance at p<0.05.

**Results:**
The results showed that Creek wine had the highest TPC (2527.68 µg/mL), total benzoic acids (TBA) (822.54 µg/mL) and stilbenes (2.13 µg/mL), while Noble wine contained the highest TAC (18.741 µg/mL), CTC (1240.00 µg/mL), total cinnamic acids (TCA) (82.17 µg/mL) and total flavonoid content (519.06 µg/mL), Gallic acid (164.61 – 242.40 µg/mL) and salicylic acid (81.47 – 466.58 µg/mL) were the major phenolic acids in all eight varieties of wine, whereas catechin, epicatechin, and rutin were the major flavonoids among them (17.65 – 74.85 µg/mL, 57.45 – 286.85 µg/mL, and 17.65 – 74.85 µg/mL, respectively). Creek wine showed the highest antioxidant properties (35.95 and 40.81 mM Trolox equivalents for DPPH and ORAC assays, respectively). Correlation analysis demonstrated that TCA, TBA, total phenolic acids and SC significantly (p<0.05) correlated with DPPH values (r = 0.92, 0.83, 0.87 and 0.71, respectively), and the r value between TPC, and ORAC value was 0.90.
Effect of Chestnut Shell Extract on the Inactivation of Foodborne Pathogens Inoculated on Beetroot Leaves
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Introduction: Fresh vegetables such as beetroot (Beta vulgaris L) leaves can easily become contaminated by foodborne pathogens. Therefore, a suitable method is required for decontamination of fresh vegetables from pathogenic bacteria. There have been many studies aiming to replace chemical sanitizers with natural antimicrobial agents. Recently, new approaches have been developed using food-by-product extracts as novel antimicrobial agents. Chestnut (Castanea crenata) shells are a by-product from chestnut processing and contain considerable amounts of phenolic compounds such as tannins. Therefore, the objective of this study was to examine the antibacterial properties of chestnut shell extract (CSE).

Method: CSE was prepared and its antibacterial properties were examined. In addition, we assessed the combined effects of CSE, fumaric acid (FA), and mild heat (MH), on the inactivation of Escherichia coli O157:H7 and Listeria monocytogenes inoculated on beetroot leaves. We treated samples with different concentrations of CSE or FA, as well as combinations of 0.5% CSE/0.5% FA and 0.5% CSE/MH at 50°C/0.5% FA.

Results: Our results showed that, among the treatments, the combined treatment of CSE/MH/FA was most effective, reducing the populations of E. coli O157:H7 and L. monocytogenes on beetroot leaves by 3.18 and 3.76 log CFU/g, respectively. In addition, the initial populations of pre-existing bacteria on beetroot leaves were reduced by 2.58 log CFU/g after combined treatment with CSE/MH/FA. The inactivation effect was retained during storage at 4 °C for 8 days.

Significance: These results indicate that the combined treatment of CSE, FA, and MH can be effective in the decontamination from foodborne pathogens and the improvement in the microbial safety of beetroot leaves during storage.

Use of Semi-Refined Carrageenan as a Water Binder in Deli Turkey Breast
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Introduction: Carrageenan is a high molecular weight linear hydrophilic polysaccharide comprising of repeating galactose units and 3,6-anhydrogalactose units. Kappa and iota carrageenan show most benefits in meat applications as water managers and texture modifiers. Kappa carrageenan forms strong brittle gels while iota carrageenan gels are less strong repeating galactose units and 3,6-anhydrogalactose units. Carrageenan is a high molecular weight linear hydrophilic polysaccharide comprising of

Results: These results indicate that the combined treatment of CSE, FA, and MH can be effective in the decontamination from foodborne pathogens and the improvement in the microbial safety of beetroot leaves during storage.

Use of Methylcellulose as a Replacer of Meat in Beef Patties
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Introduction: Advances in processing technology of methylcellulose (MC) have made it an alternative binder/extend for comminuted meat products. MC is a functional non-allergic polymer powder that has been widely used in non-meat food products as an emulsifier, thickener and gelling agent. MC is manufactured by a substituting reaction whereby hydroxyl residues (-OH functional groups) are replaced with methoxyl (-OCH3 groups). Various types of MC are made depending on the number of hydroxyl groups substituted on linked glucose molecules. MC is USDA FSIS approved and listed on Directive 7120.1 for various comminuted meat and poultry products where binders are permitted not exceeding 3.5% of product formulation. The objective of this study was to evaluate cooked yields, texture profile analysis, and freeze-thaw purge of beef patties using MC and carboxymethyl cellulose (CMC) to replace a portion of the meat block.

Method: The experimental design for the beef patties was as follows: Control, TRT 2: 1% MC + CMC blend, TRT 3: 0.75% MC + CMC blend, and TRT 4: 0.5% MC + CMC blend. Beef patties were evaluated for cooked yield by difference in weight before and after cooking. Texture profile analysis was done on patties warmed on a flattop grill using a Texture Analyzer equipped with a ½” diameter stainless steel probe. Freeze-thaw purge was measured by difference in weight before and after thawing of packaged patties. Statistical analysis was performed using ANOVA (P<0.05) with StatView for Windows on three replications.

Results: Cooked yields were significantly (P<0.05) higher for TRT 2, TRT 3 and TRT 4 compared to control. The hardness value for TRT 2 was significantly (P<0.05) higher, while gumminess and chewiness were not significantly different from control. Hardness, gumminess and chewiness values for TRT 3 and TRT 4 were significantly (P<0.05) lower compared to control. Freeze-thaw purge was significantly (P<0.05) lower for all treatments compared to control. All treatments achieved higher yielded blend costs savings compared to control.

Significance: MC is a functional, non-allergic ingredient that can be utilized as a binder/extend in comminuted meat and poultry products. MC is made from a sustainable ingredient source that offers unique attributes for processed meat products.
P04-083

Strategies to Enhance Pulsed Light Inactivation of *Salmonella* spp. in a Blueberry Washing System With Hydrogen Peroxide and Chlorine

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Introduction:
Recent foodborne illness outbreaks of pathogens associated with blueberry raised concerns about its microbial safety. Blueberries are usually picked and sold as fresh without a washing or any other decontamination step. For other purposes, they are commonly washed with chlorine prior to further processing. However, there have been concerns regarding the decontamination effectiveness of chlorine, its impact on the environment and its potential harmful effect on human health. This study aims to develop a blueberry washing system using pulsed light (PL) alone or in combination with a limited amount of disinfectant.

Method:
Salmonella spp. was used in this study as a target to test the decontamination efficacy. Two types of wash water with different organic loads were tested to simulate different blueberry washing scenarios, one with 1% blueberry juice and 1% blueberry rinse and the other with 0.1% peptone. The effect of PL treatment (6.11 J/cm2 or 12.5 J/cm2 in total fluence) alone or in combination with hydrogen peroxide (0.5%, 1%, and 2%) or chlorine (10 ppm and 100 ppm) on the inactivation of *Salmonella* in the two types of wash water was determined.

Results:
For wash water with 1% blueberry juice and 1% blueberry rinse, low and high PL treatments reduced *Salmonella* by 3.4 and 3.8 log, respectively. The hydrogen peroxide (0.5%, 1% and 2%) treatments reduced *Salmonella* by 0.3-4.0 log. The combinations of low or high PL with hydrogen peroxide (0.5%, 1% and 2%) reduced *Salmonella* by 3.7-4.1 log and 4.0-4.8 log, respectively. Both chlorine (10 ppm and 100 ppm) treatments reduced *Salmonella* by 6.4 log. The combinations of low or high PL with chlorine (10 ppm and 100 ppm) slightly increased *Salmonella* inactivation to 6.6-7.1 log. For wash water with 0.1% peptone, water, low and high PL treatments reduced *Salmonella* by 5.0 and 6.6 log, respectively.

Significance:
Addition of hydrogen peroxide to the wash water only slightly enhanced the PL decontamination efficacy. In conclusion, for wash water with low organic load, PL treatment alone is adequate for *Salmonella* inactivation. In contrast, for wash water with high organic load, 10 ppm chlorine would achieve satisfactory *Salmonella* inactivation.

P04-084

Processing and Storage Stability of Nutrient Quality and Organoleptic Properties of Vitamins and Non-Animal Proteins

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Introduction:
The US Army’s Combat Feeding Directorate (CFD) is the leader in developing novel processed foods with unique shelf life requirements. Many novel processing technologies are non-thermal or low thermal in nature and purported to maintain nutrient content and acceptance of military rations; however a complete study of post-processing nutritional integrity is needed to validate overall nutritional quality and stability. Proteins, amino acids, and vitamins are vulnerable to chemical changes during processing and storage, which can adversely affect bioavailability and food quality. These chemical changes are primarily dependent on factors such as: processing method/temperature, storage temperature/time, pH, moisture content, water activity and sugar/protein interactions. Furthermore, Army ration proteins are historically animal sourced, so little is known about the behavior of non-animal sourced proteins in complex food matrices. In this study, we determined the effects of different processing methods on the individual ration components and the overall quality of the food.

Method:
Representative ration component items were processed via thermal and non/low-thermal methods and analyses performed on pre- and post-processed items to determine nutrient stability over 6 months. Analyses include degradation of antioxidants/phytonutrients, vitamins (C, B1, B9, and B12), omega-3 fats, Maillard browning, and color. Sensory studies were also conducted to examine correlations between measured stability and sensory acceptability over time.

Results:
The alternative protein sources varied in overall stability, but pea, rice and algal proteins were the most stable. Vitamin stability also varied, but correlated to the processing method and increased in instability over time. Novel microwave and osmotic processing proved most promising in maintaining quality.

Significance:
This study supports the value in utilizing novel processing technology. With the Army’s focus on supplying performance optimized, targeted nutrition to the warfighter, it is paramount to retain the nutritional effectiveness of rations after processing. This research ensures that CFD is supplying the warfighter with the most effective, nutritionally optimized rations.

P04-085

Combined Non-Thermal Processing with Chlorine Dioxide Gas, Fumaric Acid, and Ultraviolet-C Light to Inactivate *Escherichia Coli* O157:H7 and *Listeria Monocytogenes* Inoculated on Plums

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Introduction:
Recently, the incidence of foodborne disease outbreaks caused by pathogenic bacteria from fresh produce has increased. Fresh produces like plums are frequently used in salads without appropriate sanitization, and they can be easily exposed to pathogenic bacteria by cross-contamination from irrigation water, workers, and packing materials. To reduce these microbial hazards, disinfection of plums should be conducted. Therefore, hurdle technology combined with chlorine dioxide (ClO2) gas, fumaric acid, and ultraviolet (UV-C) light was conducted in this study as an effective alternative to enhance the microbiological safety of plums.

Method:
Plums harvested on the same day were used for experiments. Samples were treated with ClO2 gas (15 and 30 ppmv), fumaric acid (0.1, 0.3, and 0.5 %), and by UV-C irradiation (3, 5, and 10 kJ/m2). After each non-thermal processing, samples were cut into two pieces of top and bottom parts (20 ± 0.3 g) and used for microbial enumeration.

Results:
The single treatments with 15 or 30 ppm ClO2 gas, 0.5% fumaric acid, and 10 kJ/m2 UV-C decreased the population of *L. monocytogenes* and *E. coli* O157:H7 by 1.62-2.00 and 1.34-2.07 log CFU/g, respectively. In addition, combined treatments reduced the populations of the pathogenic bacteria more than each treatment alone. In particular, the combined treatment with ClO2 gas (30 ppmv) for 20 min, fumaric acid (0.5%), and UV-C (10 kJ/m2) decreased the populations of *L. monocytogenes* and *E. coli* O157:H7 by 6.26 and 5.48 log CFU/g, respectively.

Significance:
These results suggest that combined non-thermal processing with ClO2 gas, fumaric acid, and UV-C light can be a useful hurdle technology to enhance the microbiological safety of plums during storage.

P04-086

Chlorine Dioxide Gas Treatment Can Improve the Microbiological Safety and Quality of Paprika During Storage

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Introduction:
Paprika is a good source of Vitamin A, B1, C, and phytochemicals, such as carotenoids and phenolic compounds. However, paprika is easily perishable by microorganisms contaminated on the surface of paprika during storage and distribution. In particular, pre-existing microorganisms on paprika should be controlled for securing microbial safety after harvest. Chlorine dioxide (ClO2) gas treatment was suggested to improve the microbial safety of paprika, and new type of ClO2 gas generating stick (G-stick) was developed to maintain the quality and decrease the decay rate of paprika in this study. The objective of this study was to investigate the effects of two different types of ClO2 gas treatment on the inactivation of microorganisms and quality of paprika during storage.

Method:
The paprika (cultivar Scirocco) was harvested freshly and the samples with uniform size and color (level of maturity 70-80% red) were selected. The paprika was treated with 75 ppm ClO2 gas for 30 min first and additionally treated with 3 ppmv ClO2 gas G-stick during storage. The samples were then stored at 8°C and 90% relative humidity for 30 days.

Results:
After the combined treatment, the initial populations of total aerobic bacteria and yeast and molds in the paprika decreased by 3.04 and 2.70 log CFU/g, respectively, compared with those of the control, and the effect of microbial inactivation was maintained by ClO2 gas g-sticks during storage. In particular, decay rate for the samples with the combined treatment was significantly lower than that of the control after 30 days of storage. In addition, weight loss of the treated samples was less than that of the control, but other quality parameters (Vitamin C content, hardness, and color) of the samples were not affected.

Significance:
These results suggest that the combined treatment of two different types of ClO2 gas can be a useful method for improving microbial safety and maintaining the quality of paprika during storage.

P04-087

Controlling *Listeria monocytogenes* on Cheese Slices Packaged in Starch Films With Added Sodium Benzoate Using Pulsed Light Treatment

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Introduction:
Surface contamination of cheese with bacteria during slicing and handling can lead to food poisoning or food quality issues. Previous studies have shown that Pulsed Light (PL) has some potential for microbial decontamination of cheese surface, but the
effectiveness of the treatment is limited by light absorption by the cheese. Coupling PL treatment with another hurdle, such as antimicrobials, can offer a better solution for controlling microbial contaminants on cheese. The objective of this study was to evaluate the effect of PL on inactivation of Listeria innocua, a surrogate for Listeria monocytogenes, on the surface of cheddar cheese slices packaged in biodegradable starch-based films containing sodium benzoate (SB) as an antimicrobial agent. SB is also a photosensitizer which, upon exposure to PL, can induce crosslinking in the starch-based film and thus improve its mechanical properties.

**Method:**

The starch films were prepared by casting and their thickness, mechanical properties, and light absorption spectra were determined experimentally. Suspensions of L. innocua in stationary growth state were used to inoculate cheese slices 24 h before PL-treatment. The inoculated slices were exposed to fluence levels of 1.02 to 12.29 J/cm². Survivors were recovered and enumerated by standard plate counting after incubation for 24 h at 37°C. The study was replicated and data evaluated using statistical methods.

**Results:**

PL inactivated L. innocua on the cheese slices packaged in starch films, with and without SB, and a plate in the inactivation curve was reached after 6 pulses (6.14 J/cm²). The maximum inactivation level by PL was 2.0 log in samples packaged in films with SB and 1.8 log on samples packaged without SB, respectively. PL treatment of the SB containing starch films increased their tensile strength by up to 60%, but did not influence significantly (p> 0.05) the elongation at break and Young's modulus. The antimicrobial effect of the SB containing starch film was insignificant.

**Significance:**

This results of this study demonstrate that starch-based films with incorporated SB show strong potential for use as physical barriers/packaging for cheese, and allow the application of a terminal PL treatment for microbial control.

**P04-088**

**Flow Rate and Pattern Modifications of UVC Irradiation Equipment to Enhance Yeast Inactivation**

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**Introduction:**

Emerging technologies such as short-wave ultraviolet irradiation (UVC) are being investigated as an alternative for minimal processing of several fruit juices. It is known that using several lamps as well as modifying the flow rate and pattern could facilitate UVC penetration and thus its microbial inactivation efficacy. The aim of this study was to modify the flow pattern and rate of an UVC equipment to evaluate the inactivation of Saccharomyces cerevisiae inoculated in grape juice.

**Method:**

The juice was processed at three flow rates and paddles were placed within the annular section of the UVC equipment to generate a turbulent flow. A 30 cm UVC lamp (10 mW/cm²) was utilized for one liter of inoculated (1005 CFU/mL) juice at 15°C flowing at 5.2, 17.1, or 31 mL/s through the annular section during 60 min. To generate a turbulent flow, plastic holders (3x4 mm x 30 cm) were set in the stainless steel wall of the equipment and paddles (8x8x5 mm) were placed in them. 5 paddles were placed in each holder for a total of 20 paddles. During treatment, 0.1 mL juice samples were taken every 5 min for analysis. Samples were plated in potato dextrose agar, incubated, and survivors were counted. The Weibull distribution was used to model the yeast response.

**Results:**

In the modified UVC equipment and after 60 min of treatment, 4.47 ± 0.12 log reductions were obtained at 31 mL/s, while at 5.2 and 17.1 mL/s, 2.9 ± 0.15 and 3.8 ± 0.03 reductions were achieved, respectively. These reductions were increased twofold when compared with those obtained with the original equipment (without paddles). The Weibull distribution adequately (R²=0.90) described yeast inactivation under evaluated conditions. Tested paddles generated greater agitation; moreover, the maximum studied flow rate contributed to a higher number of juice recycles, thereby obtaining a greater contact of the UVC irradiation with the tested yeast. Generation of turbulence within the studied equipment had a significant (p<0.05) effect on S. cerevisiae inactivation.

**Significance:**

The results of this research indicate that generating turbulence within UVC-equipment promotes greater yeast inactivation in liquid foods while using a single lamp.

**P04-089**

**Cold Plasma Treatment for Microbiological Safety and Preservation of Satsuma Mandarin (Citrus Unshiu Marc.)**

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**Introduction:**

Satsuma Mandarin (Citrus unshiu Marc.) is one of the most popular fruits in Eastern Asia. P. italicium spp, the primary postharvest fungal pathogen of Satsuma Mandarin. Cold plasma treatment (CPT), which generates plasma by gas excitation without a marked temperature increase, has been investigated as a nonthermal food preservation method. The objective of this research was to study the effects of CPT on the growth of P. italicium inoculated into Satsuma mandarin and the microbiological safety and physiological properties of Satsuma mandarin during storage at 4°C.

**Method:**

Satsuma mandarin or its peel was treated by cold plasma at 667 Pa using a microwave-powered CPT system. The treatment variables were plasma-forming gases (nitrogen, oxygen), and power output (power: 400, 650, and 900 W), and treatment time (2, 5, and 10 min). The physicochemical properties of Satsuma mandarin treated by CPT were investigated during storage at 4°C for 28 d. The properties included weight loss, soluble solid content, titratable acidity, pH, ascorbic acid concentration, antioxidant activity, total phenolic content, and surface color.

**Results:**

CPT with nitrogen gas at 900 W for 10 min resulted in the highest reduction of P. italicium (percentage disease incidence: 16.03 ± 0.91%) (P < 0.05), without significantly affecting weight loss, content of soluble solids, titratable acidity, pH, ascorbic acid concentration, or total phenolic content of Satsuma mandarin peel were observed after CPT (P < 0.05).

**Significance:**

These results demonstrate the potential for application of CPT to reduce the growth of spoilage microorganisms of Satsuma mandarin and enhance the antioxidant activity and total phenolic content of Satsuma mandarin peel.

**P04-090**

**Extraction and Concentration of Bioactive Procyanidins From Cranberry Pomace Using Ultrasound-Assisted Water Extraction Coupled With Adsorption/Desorption on Macroporous Resins**

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**Introduction:**

Cranberry pomace is an underutilized by-product of cranberry juicing and it contains significant amount of bioactive procyanidins. Cranberry procyanidins are known to prevent the occurrence and recurrence of urinary tract infections. The objective of this study was to extract and concentrate procyanidins from cranberry pomace using ultrasound-assisted hot water extraction coupled with adsorption/desorption on macroporous resins.

**Method:**

Procyanidin and total phenolic contents were measured using 4-dimethylaminonanmaladhyde (DMAC) method and Folin-Ciocalteau assay, respectively. Impacts of temperature, time of ultrasound agitation, and pomace-to-water ratio on extraction yield were assessed. Static adsorption/desorption and kinetic adsorption of procyanidins and total phenolics were tested on five Amberlite resins (FPX-66, XAD-7HP, XAD-16N, XAD-1180, and XAD-761). Adsorption isotherm was tested at 25°C, 35°C, and 45°C on XAD7HP.

**Results:**

The highest yields of procyanidins (0.46 mg/g pomace) and total phenolics (3.37 mg/g pomace) were obtained when pomace was extracted in 90°C water using 15 min of ultrasound agitation and a pomace-to-water ratio of 1.6 (W/V). XAD-7HP and XAD-1180 showed significantly (p<0.05) higher procyanidins adsorption capacity compared to other resins. XAD-7HP had the highest desorption capacity of total phenolics. No significant difference was found on the procyanidins desorption capacity among five resins. Kinetic adsorption tests of the resins revealed that XAD-7HP had the highest adsorption efficiency and the adsorption of procyanidins followed a pseudo-second-order kinetics. Isotherm tests on XAD-7HP showed that adsorption of procyanidins complied with a Langmuir isotherm model.

**Significance:**

This study suggested that ultrasound-assisted water extraction coupled with resin adsorption/desorption is an efficient method to recover bioactive procyanidins from cranberry pomace.

**P04-092**

**Characterization of Food Thickeners Flow Behavior for Treatment of Dysphagia**

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**Introduction:**

Dysphagia is a term used for difficulty in swallowing. For individuals with this disorder, eating is no longer a pleasurable experience. Hence, food thickeners must be prepared in a range of viscosities to accommodate the needs of individuals with swallowing problems. These products are usually mixed with water, milk, or juices to help control swallowing. Understanding the behavior of the liquids should provide useful information to manufacture new and healthier options using principles of engineering and rheology. Currently available medical options are unattractive and with pureed textures. The psychological impact of eating something else than a paste cannot be overemphasized.

**Method:**

We evaluated the flow behavior of five different commercially available food thickeners at “nectar” and “honey-thick” consistencies. The samples were tested within 2-3 minutes of mixing at room (drinking) temperature. The viscosity of each sample was recorded using a Brookfield DV-II Viscometer with spindle #4 at 10-100 rpm, and results compared to other products of similar consistency (e.g., honey). Tests were conducted in duplicate. A mechanical esophagus was built to simulate the flow of the fluids through the
esophagus and obtain the value of rotational speed of the viscometer equivalent to a 5.0 1/s shear rate in the esophagus (50 RPM). Two mechanical rolls moved through the length of a 2.5-cm diameter latex tube to simulate the sinusaloid movement of the esophagus. The time for the fluid to flow through the tubing was also recorded.

**Results:**
All the samples showed non-Newtonian shear-thinning behavior. As the test speed increased, the viscosity decreased significantly. Samples also showed time-dependency (thixotropic). After 10 minutes of the first test, samples showed a significant decrease in viscosity. However, this change was reversible. Viscosity of samples at 50 RPM ranged from 2611 to 38,000 centipoise at room temperature. The ‘nectar-thick’ products did not show differences in viscosity (P > 0.05) between products and brands whereas the ‘honey-thick’ samples did.

**Significance:**
Overall, results suggest that the development of nutritional thickeners with better texture characteristics for treatment of dysphagia and other swallowing disorders needs an understanding of the required flow properties during materials with critical flow properties.

**P04-093**
**Formulation of a Highly Stable Functional Lutein Delivery Nanoemulsion**

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**Introduction:**
Age-related macular degeneration (AMD) is a progressive degenerative disease that affects the central portion of the retina (macula), resulting in loss of central vision. AMD is the main cause of blindness after 50 years old; it is estimated that around 30% of the population above 75 year old has the disease. Studies suggest that the daily intake of lutein can lead to the accumulation of this carotenoid in the retina, helping to protect the eyes against AMD. Since life expectancy of the general population is increasing, the use of lutein becomes an alternative, especially when added to dairy products, which are one of the main delivery systems for functional compounds. However, there is a technical difficulty incorporating lipophilic carotenoids to products in which the main component is water, for instance beverages and yogurts.

**Method:**
We developed a stable oil-in-water nanoemulsion for lutein delivery without added antioxidants and evaluated its chemical and physical stability during a four week refrigerated storage (1°C) in the dark. The lutein rich oil used in the nanoemulsion formulation was obtained by extracting the carotenoids from lyophilized marigold petals directly in soy oil by magnetic stirring at 50°C, followed by vortexing and over night magnetic stirring at room temperature under nitrogen atmosphere.

Nanoemulsions were prepared by microfluidization (3 cycles, 10000 psi) with three different carotenoid concentrations (4, 12, and 19 µg lutein/mL), 5% soy oil, and 1.5% Tween 20 aqueous solution.

**Results:**
No physical separation was observed in any formulation. In fact, all the nanoemulsions were highly stable during storage, size (250 nm), and zeta potential (-30.2 mV) values did not change regardless of their carotenoid contents. As expected, the higher the carotenoid content the higher the color parameters a* and b* values, due to an increase in orange color. Neither carotenoid degradation nor changes in color parameters were observed during storage in all formulations. Thus, there is no need for antioxidant addition to the nanoemulsion.

**Significance:**
These stable nanoemulsions were shown to be a good option for lutein delivery because they allow the incorporation of this compound to aqueous matrices without significant increases in the total lipid contents.

**P04-094**
**Retention of Bioactive Compounds and Antioxidant Capacity of Maqui Berry**

*Aristotelia Chilensis* [Moh] [Stuntz] as Influenced by Drying Methods

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**Introduction:**
This berry native to Chile and Argentina is categorized as a “superfruit” because of the large number of wholesome, antioxidant properties it has. Recently, the berry extract’s phytochemical profile and antioxidant capacity have been strongly correlated with total polyphenol contents. Dehydrated maqui and its eventual scaling up to an industrial level phytochemical profile and antioxidant capacity have been strongly correlated with total polyphenol contents. This berry native to Chile and Argentina is categorized as a “superfruit” because of the

**Results:**
Regarding to phenolic compound identification, ten compounds were found in the retention of Bioactive Compounds and Antioxidant Capacity of Maqui Berry. The highest free bioactive compounds with a total phenolic content of 175.25 mg/100 g d.m. were present in soybean products. However, comparing the ACE inhibition capability of products is difficult due to differences in raw material, processing, storage, and assay protocol. Our objectives were to establish a reliable method for the determination in vitro of ACE inhibitory activity in soybean products; and to evaluate the processing effect on antihypertensive activity of soy products made from the same soybean.

**Method:**
Prosoy, a high-protein variety, was processed into fermented and non-fermented products, including natto, tempeh, yogurt, soymilk (raw and cooked), soymilk slurry (raw and cooked), tofu (pressed and filled), and sprout (raw and cooked). All products were extracted with water and adjusted to the same concentration of 0.5 mg/mL for comparison. ACE inhibition assay was performed using hippuryl-L-histidyl-L-leucine as substrate and the reaction was stopped by heating at 85°C for 15 min. The hippoc acid produced was measured by ultrahigh performance liquid chromatography. Total phenolic and protein content of the extracts were measured.

**Results:**
Heating stopped the enzyme activity, and the reaction products (hippuric acid) remained stable for 24 h, and that is much more stable than the unstable products resulting from acid inactivation as reported in the literature. Heat inactivation followed by UHPLC was validated to be reliable. Tempeh presented the lowest ACE inhibition activity (8%), while natto, filled tofu and raw soymilk slurry showed similar inhibition as raw beans (between 15-26%). Raw sprout, cooked sprout and pressed tofu presented inhibition between 33 and 43%. Inhibition of 50% was observed in yogurt, and cooked soymilk, to which insoluble-residue was filtered out after cooking the slurry. Traditional cooked soymilk (filtered before cooking) presented the highest inhibition (69%). The protein content of the water extract was higher (p < 0.05) in raw soymilk (141 µg/mL) and raw sprout (163 µg/mL), while the TPC was higher in natto (3.8 µg GAE/mL) and raw soymilk (3.2 µg GAE/mL).

**Significance:**
Soybean processing can alter ACE inhibition of the soy products. The new information can be used by the food industry to improve products’ ACE inhibition ability.

**P04-096**
**Formulation of Nanoemulsion Processed by High-Pressure Homogenization to Protect a Bioactive Extract From Jackfruit Pulp**

*Artocarpus Heropillus Lam*

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**Introduction:**
Jackfruit (Artocarpus heterophyllus Lam) is a rich source of several high-value compounds with potential beneficial physiological activities. Particularly, it contains many carotenoids (De Faria et al., 2008), including all-trans β-carotene with an important antioxidant activity for human health (Cadenas &acker, 1996), these compounds are unstable in the presence of light, oxygen and heat (Gutiérrez, Albillos, Casas-Sanz, Cruz, García-Estrada, García-Guerra, et al., 2013), then, it is necessary to search for processes than increase its useful life. The present work investigates the development of nanoemulsions to maintain the bioactivity of a rich in carotenoids extract from jackfruit (Artocarpus heterophyllus Lam) pulp.

**Method:**
Firstly, the influence of the sucrose monostearate (SMS) (0.5-2%, w/w) and miglyl contents (5-20%, w/w), as well as homogenization pressure (400-800 bar), on the droplet size distribution and stability of emulsions processed by high-pressure homogenization

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was studied. Then, a jackfruit pulp extract was incorporated in the oily phase of the selected emulsion (5% miglyol plus 0.5% SMS processed twice in a high-pressure homogenizer at 800 bar).

Results: The results of this research show than except two formulations containing the highest SMS content and processed at the lowest pressure, stable fluid submicron emulsions were obtained. Therefore, the present study suggests that homogenization at moderate high-pressure (800 bar) can produce nanoemulsions stabilized with sucrose monostearate, with a high stability during storage at 4°C and 20°C. Finally, the bioactivity of a hydrophobic jackfruit pulp extract was successfully protected in the nanoemulsion.

Significance: In that way, this nanoemulsion could be useful to incorporate bioactive compounds in industrial food.

P04-097

In Vitro Starch Digestibility and In Vivo Glycemic Response of Foxtail Millet and Its Products

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Introduction: Foxtail millet, a leading variety in arid and semiarid areas of Asia and Africa, can provide broad potential benefits to human health. Starch, a major component of foxtail millet, may determine the nutritional qualities and physiological properties of millet products. However, its digestion properties are still not available.

Methods: The effects of lipids and proteins on starch digestibility of foxtail millet were investigated firstly in raw and cooked conditions. Then five pure foxtail millet products were produced and their in vitro starch digestion characteristics, degree of gelatinization (DG), and estimated glycemic index (eGI) were detected. Additionally, ten health volunteers were recruited and the effects of different processing methods on postprandial blood glucose and insulin responses were evaluated.

Results: The results showed that starch digestibility of foxtail millet flour is obviously lower than that of wheat flour. However, deproteinization and heating significantly increased rapidly available glucose and decreased slowly available glucose in foxtail millet. The markedly positive influence of different processing methods on the digestibility and glycemic responses was confirmed. The GIs of pure foxtail millet products were significantly positively correlated with the content of rapidly digested starch (r = 0.999), DG (r = 0.967) and eGI (r = 0.967), and in the following order: milllet porridge (93.6 ± 11.3), millet steamed bread (89.6 ± 8.8), No. 1 millet pancake (75% millet flour and 25% extrusion flour, 83 ± 9.6), No. 2 millet pancake (without extrusion flour, 76.2 ± 10.7), cooked millet (64.4 ± 8.5). Both in vitro and in vivo tests suggested that boiling, steaming and extrusion enhanced the formation of digestible starch and subsequently increased the GI values. Compared to other pure millet products, No. 1 millet pancake and cooked millet had a relatively gentle stimulation to β-cell.

Significance: People with (or without) hyperglycemia can use foxtail millet based foods to substitute for flour based foods to improve their blood glucose control in daily life. Therefore, foxtail millet, especially cooked millet, may serve as a potential source of nutriceutical and functional food that could delay the development of Type 2 diabetes.

P04-098

Is Grape Pomace an Effective Hypolipidemic Agent?

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Introduction: The objective of this study was to investigate the anti-obesity and hypolipidemic effects of grape pomace (GP) using a rat model by monitoring the effects of GP concentrations in diet on energy intake, weight change, blood lipid profiles, and fat deposition on the liver, kidney, and heart.

Method: Rat diets were prepared from ALN-93M supplemented per kg with 10g of cholesterol source. Diets containing GP were formulated by replacing the total carbohydrate in cholesterol containing ALN-93M by 10, 20, and 30% of GP. This resulted in diets containing 7.71, 15.41, and 23.12% of GP. Six of 24 male Sprague Dawley 15-week old rats were randomly assigned to one of the four treatment groups that were fed high cholesterol diet containing different percentages of GP for 8 weeks. The group in 0% GP diet was used as control. Feed consumption and body weight were measured every other day; blood sampling and analysis were performed biweekly; and organ weights were measured at the end of treatment period.

Results: As GP content increased, the feeding consumption increased but body weight of rats decreased. This suggests that the energy absorption of rats decreased and long term consumption of GP containing diet may have positive effect on the body weight. GP in the diet did not significantly affects blood total cholesterol (TC) and triglyceride (TG) levels in the first 4 weeks of treatment, but significantly reduced TC and TG from week 6. Significant increase of LDL and decrease of HDL were observed among rats fed diet containing 15.4 and 23.2% of GP (P<0.05). The average size and weight of rat heart and kidney were not significantly influenced by GP content of diet, but the average liver weights of rats fed GP diet were lower than that of the control. The amount of abdominal fat decreased with increasing amount of GP in the diet.

Significance: The findings of this study indicate that long term consumption of diets containing GP may prevent weight gain, but may not improve the blood cholesterol profile in the population consuming a high cholesterol diet. These findings have advanced the knowledge of anti-obesity and cholesterol lowering properties of GP.

P04-099

Development of an In Vitro DIAAS Protein Quality Method

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Introduction: In 2013, the Food and Agriculture Organization of United Nations (FAO) released a recommendation for the use of the Digestible Indispensable Amino Acid Score (DIAAS) for determining protein quality relevant to human nutrition. The DIAAS method determines amino acid digestibility, at the end of the small intestine, providing a more accurate measure of the amounts of amino acids absorbed by the body and the protein’s contribution to human amino acid requirements. However, the methodology for measuring DIAAS protein quality requires the use of ileostomized growing pigs and analysis costs the user approximately $51 to $200 per sample with results from testing reporting on average 4 to 6 months following the submission. As a result, DIAAS testing is cost and time prohibitive for most ingredient and food manufacturers. We have developed an in vitro digestion protocol that provides good correlation with the results for ileostomized pigs. Results are modeled using a chemometric translation of the colorimetric and amino acid results obtained with the in vitro digestion. This new in vitro digestion methodology significantly reduces the cost and time of analysis for the food industry leading to improved regulatory compliance while also enabling more rapid development and launch of high-quality protein food products.

Method: Methods for research utilized were ileostomized pigs, amino acid analysis, Dumas combustion, in vitro digestion simulating human gastrointestinal digest, ninhydrin reaction, TCA precipitation and centrifugation. Statistical analysis of data utilized linear regression, paired t-test, and ANOVA analysis.

Results: We have developed an in vitro digestion protocol that provides good correlation with the results for ileostomized pigs. Results are modeled using a chemometric translation of the colorimetric and amino acid results obtained with the in vitro digestion. This new in vitro digestion methodology significantly reduces the cost and time of analysis for the food industry leading to improved regulatory compliance while also enabling more rapid development and launch of high-quality protein food products.

Significance: This new in vitro digestion methodology significantly reduces the cost and time of analysis for the food industry leading to improved regulatory compliance while also enabling more rapid development and launch of high-quality protein food products.

P04-101

Assessment of Functional Properties of Different Lots of the Same SRW Wheat Flour Affecting Flour Water Batter Viscosity and Bulk Density

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Introduction: This study investigated the properties of Soft red Winter (SRW) wheat flour that affect flour-water food coating batter density and batter volume. A flour water batter periodically develops an undesirable batter viscosity resulting in a commercial coating operation to have light or heavy batter pick-up. The goal was to identify causative flour attribute and communicate it to the flour supplier for improved batter consistency.

Method: Straight grade SRW wheat flour was procured and evaluated from several millers for a batter flour with a defined specification (moisture <14.0%, protein 8.5-9.5%⁽¹⁾, ash 0.50-0.55% of 14%burn, and FN >350 sec). Each lot of flour was tested for moisture, protein, ash, falling number, SRC, PHi, alveograph, and cookie spread. A batter was prepared with 275g "as is mb" flour and 600 ml distilled water, mixed with a Kitchen Aid mixer with D-paddle in 3 stages (mix 1 minute at speed #1, rest for 1 minute and scraped down with spatula, then mix for 1 minute at speed #1). The batter was evaluated for Brookfield viscosity, Zahn cup viscosity, and bulk density. The Brookfield model LVF 5 was applied with four speeds (6, 12, 30, and 60 rpm), using the set of cylindrical spindles (#1, #2, #3, and #4). The Zahn cup #5 was fitted into the batter and time for batter volume to drain was recorded. The batter bulk density (g/cc) was determined using a graduated cylinder with batter recording volume and weight. The various flour attributes were paired with viscosity or density for regression analysis.

Results: We found that for wheat flour-water batter, there was a wide range in Brookfield viscosity (250 to 770 cps) and bulk density (73.8 cc/g to 109.4 g/cc). We observed in these lots of SRW wheat flour that higher viscosity batter to be correlated with higher arabinoxylan content and alveograph (total energy). We also observed that lower batter density was associated with greater batter volume.
**P04-102**

**Effect of Size Reduction on Hydration Properties of Wheat Bran and Its Rheological Properties in Wheat Dough**

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**Introduction:**
Wheat bran (WB) is a cheap and readily available source of dietary fiber that has been less utilized in food processing because of its low consumer acceptability which can be linked to the grittiness it imparts on food texture.

**Method:**
In this study, WB obtained from local supermarket in South Africa was milled and classified into coarse (2000 µm), medium (500 µm), and fine (230 µm) particle sizes. Hydration and rheological properties were determined using AACC method (2000).

**Results:**
All WB sizes varied significantly in water holding capacity (WHC), water retention capacity (WRC), and swelling capacity (SC). The coarse WB fraction showed highest values for WHC, WRC, and SC (6.49 g/g, 5.76 g/g, and 7.67 g/g) whilst lower values were recorded for fine WB due to low water binding property associated with size reduction of the WB fiber as a result of milling effect. Mixing and extensional properties of each WB particle size at 0.1, 1, 8, and 15 g in wheat dough were also determined using farinograph and extensograph tests. Increasing the amounts of WB in the dough resulted in high water absorption that ranged between 63 and 70.2%. The addition of WB negatively influenced the dough rheology as shown by less dough stability at 6.8 min during mixing compared to dough without WB at 12.5 min, while mixing tolerance index increased as the concentration of WB increased. In the extension test, dough with WB was less extensible than control dough. The relationship between mixing and extensional traits revealed that as water absorption of dough increased, the looser the dough became which led to a decrease in dough extensibility, maximum resistance and energy.

**Significance:**
These behavioral properties of WB in dough can be a useful tool in development of existing and new cereal products, and help increase consumer acceptability of WB-enriched foods. This study is relevant towards development of new products, especially in developing countries where malnutrition and high rate of obesity due to unhealthy diet choices.

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**P04-103**

**A Nutritionally Optimized Instant Beverage**

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**Introduction:**
The military has a need for nutrient-dense, low-volume, low-weight, high quality rations. Processing of foods to meet the stringent shelf-life requirements is often detrimental to a food’s nutritional value and quality. Furthermore, getting fresh whole foods to the field is unrealistic due to logistical constraints, which may consequently impair the Warfighter’s nutritional status. The objective of this effort was to first investigate and compare current and emerging drying technologies that dehydrate fresh fruits and vegetables into stabilized, nutrient-dense powders. Then, the powders were formulated into shelf-stable instant beverage bases that only require hydration prior to consumption.

**Method:**
Fruit and vegetable powders (spinach, carrot, beet, blueberry, apple, mango, pineapple, strawberry, and orange) produced by freeze drying, spray drying, radiant zone drying, vacuum drying, and microwave drying were obtained and used to formulate prototypes having optimal nutrient profiles. Targeted nutrients included potassium, Vitamin C, beta-carotene, folate, and phenolic compounds. Fruit and vegetable equivalencies per serving were calculated for each prototype based on potassium, Vitamin C, beta-carotene, folate, and phenolic compounds.

**Results:**
Six prototypes were compared. Prototypes underwent accelerated storage studies to determine overall stability.

**Significance:**
Results validated nutrient stability over time, indicated the best emerging drying technologies for heat-sensitive foods, and demonstrated the feasibility of a novel nutrient dense drink providing nutrition equivalent to that of fresh fruits and vegetables while reducing ration component weight and volume.

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**P04-104**

**Biofortified Sweet Potato Chips: Evaluation of the Blanching Method to Minimize Loss of β-Carotene**

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**Introduction:**
The micronutrient malnutrition affects billions of people worldwide, causing problems to growth, to immune and reproductive functions, to productivity and to mental development. Sweet potatoes with higher contents of provitamin A are one of the products being developed with the intent of supplementing the existing nutrition intoребелает for this population. The development of products such as chips expand distribution over long distances and the form of consumption since the product is widely accepted by teenagers, children and adults seeking for healthy and satiate products, and provides longer shelf life. The aim of this study was to develop biofortified baked sweet potato chips, thus minimizing loss of provitamin A carotenoids.

**Method:**
The potatoes were rinsed with water, then manually peeled, sliced (thickness = 1.5 - 2.0 mm) and blanched in two manners: (a) steam tunnel (4 ± 1 kgf / cm²) for 10 minutes, and (b) dipped in water at 98°C for 2 min. The blanching temperature was determined by inactivation of enzyme peroxidase. Next, the sweet potato slices were dehydrated in a forced-air oven (Proctor & Schwartz, model K13964) at 65°C for 4.5 hours. The contents of carotenoid (μg·g-1 dry wet), moisture, water activity and instrumental color were evaluated. The mean results were compared via T Test (Action, version 2015, June).

**Results:**
Sweet potatoes had 614 μg·g-1 of total carotenoids, 552 μg·g-1 of β-carotene and 76.86% moisture (dry basis). Chips A and chips B presented 0.41 and 0.38 of water activity and 7.66 and 6.95% of moisture (dry basis). The quantity of carotenoids was 614 μg·g-1 and 590 μg·g-1 of total carotenoids; 546 and 542 μg·g-1 of β-carotene, respectively, for chips A and B. Chips A displayed a darker and redder color and less yellowish than chips B, with a total delta E difference of 4.54. The results indicated that blanching in a steam tunnel was the system that best preserved carotenoids. Therefore, it should be the preferred method to process sweet potato chips with provitamin A carotenoid.

**Significance:**
Chips are already part of the diet of the children and teenagers, thereby providing ready access to more nutritional energy.

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**P04-105**

**Transport Characteristics of a Novel ACE Inhibitory Peptide Ala-His-Leu-Leu Across Human Intestinal Epithelial Caco-2 Cells**

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**Introduction:**
Loach (Misgurnus anguillicaudatus) is a popular freshwater fish in East Asia. It is a delicious and nutritious food and also has long been used as a traditional Chinese medicine for the treatment of hepatitis, osteomyelitis, carbuncles, inflammations, and cancers, as well as for recovery from debility. Ala-His-Leu-Leu (AHLL) is a novel angiotensin-I-converting enzyme (ACE) inhibitory peptide isolated from loach by controlled enzymatic hydrolysis of loach protein. The peptide exhibited strong ACE inhibitory activity in our previous studies. This study investigated how the AHLL was absorbed in the intestine tract and transported across the Caco-2 cells monolayer using cell culture model.

**Method:**
The across Caco-2 cell monolayer transport of AHLL at different concentrations (10, 30, 100 μg/ml) was assessed in two directions: from apical (AP) to basolateral (BL) and from BL to AP. The effect of temperature on AHLL transport was conducted at 4°C and 37°C. The pH effect was studied at pH 6.0, 7.0, 7.4, and 8.0 in donor compartments and pH 7.4 in the acceptor compartments. Inhibition of efflux transporters on AHLL transport was determined by verapamil (P-glycoprotein inhibitor) and MK-571 (MRPs inhibitor). Three transport pathways including transepithelial, paracellular transport and carrier-mediated transport were evaluated by adding carrier transport inhibitor of Gly-Pro, transepidermal transport inhibitor of phenylarsine oxide and paracellular transport promoter of sodium deoxy cholate, respectively.

**Results:**
The results showed that P-glycoprotein and MRPs were present during AHLL secretion, especially MRP2, which was fatal biochemical barrier in AHLL absorption. AHLL was transported through both trans- and paracellular pathways across Caco-2 cell monolayer.

**Significance:**
This is the first work that elaborates AHLL absorption mechanism across Caco-2 cells and provides the basis for future studied on bioavailability improvement of AHLL.

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**P04-106**

**In Vivo Antihypertensive and Antioxidant Properties of Enzymatic Chicken Skin Protein Hydrolysates in Spontaneously Hypertensive Rats**

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**Introduction:**
Chicken Skin Protein Hydrolysates in Spontaneously Hypertensive Rats provides the basis for future studied on bioavailability improvement of AHLL.
Introduction:
Enzymatic chicken skin protein hydrolysates (CSPHs) have previously been shown to
possess in vitro antihypertensive and antioxidant activities. However, it is not known
if CSPH can exhibit similar activities in vivo when administered orally. Therefore, this
study investigated the in vivo antihypertensive and antioxidant properties of CSPHs in
spontaneously hypertensive rats (SHRs).

Method:
Chicken skin proteins from the thigh and breast muscles were hydrolyzed with either
alcalase (3%) or a combination of pepsin/pancreatin (1%), lyophilized, and combined in
equal proportions to obtain CSPH. SHRs (n=29) and the normotensive Wistar Kyoto rats,
WKY (n=18) rats were randomized into seven groups to receive control, CSPH (0.5
and 1% w/w of diet) and undigested chicken skin meal (CSM 1% w/w of diet) diets for 6
weeks. Urine and blood samples were collected at baseline followed by weekly
body weight (BW) and systolic blood pressure (SBP) measurements. At the end of the study,
urine was collected, the rats terminated and blood and organ samples were collected,
weighed and stored at -80°C for analyses.

Results:
The results showed that the CSPH significantly (p<0.05) lowered SBP in SHRs (-36,
-31 and -26 mmHg for CSPH 1%, CSPH 0.5% and CSM 1% respectively) but had no
SBP-lowering effect in WKY rats. The SBP-reducing effect of CSPH in SHRs was
correlated with plasma ACE but not renin activity. Heart weight, cumulative BW gain,
and feed efficiency ratio (FER) of rats were not significantly (p>0.05) affected. CSPHs
significantly (p<0.05) reduced plasma antioxidant enzymes activities, suggesting that
the intervention diets did not ameliorate the oxidative stress in this animal model at this
time. Compared with the control group, heart weight increased in the CSM 1% group
(p<0.05) and feed efficiency ratio decreased in the CSPH 1% group (p<0.05). Heart
weight, cumulative BW gain, and feed efficiency ratio (FER) of rats were not
significantly (p>0.05) affected. CSPHs significantly (p<0.05) reduced plasma
antioxidant enzymes activities, suggesting that the intervention diets did not
ameliorate the oxidative stress in this animal model at this
time. Compared with the control group, heart weight increased in the CSM 1% group
(p<0.05) and feed efficiency ratio decreased in the CSPH 1% group (p<0.05).
Heart weight, cumulative BW gain, and feed efficiency ratio (FER) of rats were not
significantly (p>0.05) affected. CSPHs significantly (p<0.05) reduced plasma
antioxidant enzymes activities, suggesting that the intervention diets did not
ameliorate the oxidative stress in this animal model at this
time. Compared with the control group, heart weight increased in the CSM 1% group
(p<0.05) and feed efficiency ratio decreased in the CSPH 1% group (p<0.05).

Significance:
Our results confirm the potential of CSPHs to be used as ingredient in formulating
functional foods and nutraceuticals for the prevention and management of
hypertension or oxidative stress.

P04-107
Inhibition of Retrogradation of Gelatinized Rice Starch by Anti-Listerial
Grass Carp Protein Hydrolysate
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Introduction:
Retrogradation of gelatinized starch is a well-known phenomenon causing quality
deterioration of starch-containing foods during storage. Conversely, it is important
to ensure the microbiological safety of refrigerated food products. The objective of
this work was to study the effectiveness of anti-listerial grass carp protein hydrolysate
(GCPH) in reducing retrogradation of gelatinized rice starch (RS) during short-term and
long-term storage.

Method:
The GCPH was produced from grass carp protein using neurase to a hydrolysis degree
of 19% that was previously shown to have strong anti-listerial properties. Pastes with a
total solute content of 33.3 wt% were prepared with RS and GCPH at mass ratios of 100:
0, 97:3, 94:6, 91:9, and 88:12, and heated at 80°C for 20 min. Dynamic rheology was used
to study short-term retrogradation, while texture profile analysis, differential scanning calorimetry (DSC), X-ray diffraction spectroscopy (XRD), confocal laser scanning
microscopy (CLSM), and atomic force microscopy (AFM) were used to study long-term
microscopy (CLSM), and atomic force microscopy (AFM) were used to study long-term
microscopy (CLSM), and atomic force microscopy (AFM) were used to study long-term

Results:
The results showed that a greater amount of GCPH significantly reduced the storage
levels (hierarchical structure) to prepare for a new, updated coffee flavor wheel.

was to use rapid sensory sorting methods to reorganize the new coffee flavor lexicon
better understanding of what affects retronasal flavor concentration and perception can

Method:
Improving the New SCAA Coffee Flavor Wheel: Using Modified Rapid
Sensory Methods and Statistics to Design a New Coffee Flavor Wheel
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Introduction:
The original coffee flavor wheel developed by the Specialty Coffee Association of
America (SCAA) is outdated and lacks scientific validity. The purpose of this study
was to use rapid sensory sorting methods to reorganize the new coffee flavor lexicon
developed at Kansas State University and Texas A&M University into valid clusters and
levels (hierarchical structure) to prepare for a new, updated coffee flavor wheel.

Method:
Seven-two experts participated in a modified online Multiple Free Sorting activity
(no testing) to sort the new lexicon. The data was compiled into a similarity matrix
and Agglomeration Hierarchical Clustering (AHC) was used to determine the clusters and levels of the flavor attributes, while Multidimensional Scaling (MDS) was used to determine the positioning of the clusters around the flavor wheel. The outlined format resulting from this data analysis was then converted into a new SCAA coffee flavor wheel, unveiled at the Sensory Summit on January 16, 2016 in Davis, California.

Results: A new coffee wheel was designed with statistical validity.

Significance: This new wheel will help the coffee industry better describe the flavor of green beans, roasted beans, and brewed coffee, in order to identify problems or reproduce desirable results.

P04-111

Trained Sensory Panel Performance Monitoring Using Bias Matrix Estimation

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Introduction: In using trained panelists in sensory evaluation studies, monitoring of panel performance is performed to ensure repeatability and reproducibility of evaluations, thus increasing confidence in the results. Beyond the sample itself, the sensory verdict is influenced by both physiological and psychological differences among panelists. The goal of the panel leader is to use training to reduce the variability in the ratings of the panelists, which may be contributed by individual differences. Using trained panelists to rate wine, the objective of this study was to conceptualize panelists’ biases as a linear operator, correct panelists’ evaluations, predict attribute ratings of unknown wine samples and identify panelist confusion among attributes, resulting in a more efficient feedback calibration during training.

Method: Panelists (n=13) evaluated 12 commercial Merlot wines for 7 aromas and flavors, 3 tastes and 3 mouthfeel attributes. A bias matrix was computed for each panelist and filtered out of their evaluations, thus resulting in consistent sample evaluations. Differences between actual and filtered evaluations were evaluated using a t-test while predictive filtering was performed on a previously unrated sample using the known panelist bias.

Results: Results showed that the bias matrix could correct the individual ratings of the samples, leading to higher reproducibility among panelists. The t-test found no significant differences (p>0.05) between original and filtered means, indicating that filtering only reduces the dispersion of ratings around the mean without significantly affecting the mean. Predictive filtering showed that the panelists’ corrected means were closer to the predicted panel mean for the attributes than their predicted unfiltered means. From these analyses, a matrix was generated including each trained panelist along with each attribute and his/her bias related to that attribute. This matrix shows great promise in interpreting trained panel performance and providing meaningful feedback to panelists.

Significance: Overall, this study showed that trained panelists’ biases influenced their ratings during the wine evaluations, but agreement among their ratings were improved by using the bias matrix developed for each attribute. This method can be applied to trained panels for monitoring, corrective, and feedback purposes.

P04-112

Validity of Omission Testing as a Method for Identifying Important Odorants in a Mixture

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Introduction: Omission testing is used for identifying important odorants in a mixture. The premise of this method is that if a compound making an important contribution to an odor mixture is removed, doing so will produce a perceived difference in the mixture’s odor quality. This is easily observed if a removed compound provides a relatively intense and identifying character to the response. However, many compounds in the same perceived odor intensity are known to produce blending/fusing. Would assessors be able to perceive the omission of individual odorants in blended/fused mixtures? How much training would be required to accomplish this? Our objective was to determine whether participants could learn to discriminate between a five-compound odor mixture (with all compounds at the same perceived intensity) and the mixture with one or two of the five compounds removed.

Method: We selected panelists (N = 22) based on their ability to correctly order the perceived intensities of six concentrations of each of 5 compounds (butyric acid, furanone, methional, delta-decalactone, and acetylpropionyl). During preliminary test sessions we selected, for each panelist separately, concentrations of each of the first four of these compounds that were equivalent in intensity to acetylpropionyl. We then constructed, for each participant, a mixture of the five compounds that were matched in intensity. Panelists then participated in 20 sessions consisting of a series of A-not-A Tests using a replicated mixed design with corrective feedback. During each of these sessions panelists were presented with ten, complete 5-component mixtures, five, 4-component mixtures (each missing a different component), and five, 3-component mixtures (each missing 2 different components). For each session we tabulated the proportion of correct responses.

Results: At the first session panelists responded correctly 50% of the time. Over time panelists responded correctly closer to 60–70% of the time. This increase in performance was attributable to recognition of the 3-component mixtures. The 4-component mixtures were not correctly identified at a rate greater than chance.

Significance: Panelists’ failure to learn to discriminate the 4-component mixtures from the 5-component mixtures shows that omission tests are unreliable for indicating the importance of an odor to a mixture.

P04-113

Consumer Acceptance of Roasted and Steamed Purple Potatoes

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Introduction: Sales and consumption of fresh potatoes have decreased in the U.S. due to concerns about potato glyceremic index and starch content. However, potatoes are an inexpensive source of many nutrients, particularly potassium and dietary fiber. The Maine potato breeding program is evaluating new varieties with colored flesh for the fresh market, especially farmers’ markets. To help farmers and consumers, it is important to understand the factors that contribute to consumer acceptability of color-fleshed potatoes. Purple-fleshed potatoes are a source of anthocyanins, which are dietary antioxidants with benefits for cardiovascular and other aspects of health. The objective of this study was to identify new purple-fleshed potato varieties with increased yield and disease resistance that were acceptable to consumers.

Method: The commercially-available All Blue variety and 4 experimental varieties (AF5375-3, AF5414-1, AF5412-1, and AF5412-3) were cut into 22-g pieces and either roasted at 232°C with olive oil for 10 min, or steamed for 14 min. Two consumer panels (n=50) evaluated the different methods of preparation on different days. Affective testing results were collected by SIMS200 software, which balanced and randomized sample order presentation. The standard 9-point hedonic scale was used with a liking for color, appearance other than color, texture, flavor, and overall acceptability. We also collected demographic and purchase intent information. Analysis of variance was calculated using SYSTAT software.

Results: Consumers who participated were generally younger than 30 years old and female. Many participants had purchased purple potatoes previously, and these individuals cited health benefits, attractive color and adding interest to meals as reasons for selecting these tubers. Hedonic means for roasted potatoes fell between like slightly and like moderately (6.5–6.9). Steamed AF5412-1 was liked significantly more than All-Blue for color and appearance, but there were no other significant differences among varieties.

Significance: The findings of this pilot study suggest that new varieties of purple-fleshed potatoes have promise for fresh potato sales in Maine. Larger, more diverse consumer panels will have to be studied with these novel potatoes to better gauge acceptance for household and food service consumption. Segmentation of consumer preference for varying shades of purple potatoes is also needed.

P04-114

Structural Characterization of Vegetable Caviar From Spinach and Strawberry as Iron-Rich Food Products

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Introduction: Anemia is a big issue for infant populations all over the world. Taking into account the number of children and pregnant women affected by this problem it is necessary to create new products based on natural ingredients that could guaranty bio assimilation in this period of development. The aim of this work was to develop a macro encapsulated product from spinach, strawberries, and natural sources of iron, as a functional food.

Method: We evaluated the structural effect and time stability of soft jelly balls, similar to natural caviar, by varying the core alginate concentration (1%, 2%, and 3%) and the calcium chloride concentration (0.5%, 1%, and 1.5%). Samples were stored at 4°C immersed in lactate chloride for 8 days. Texture analysis for cores was done with TA.XTplus. Additionally, rheological behavior was evaluated by using a CRM-503 Anton Parr rheometer, with share rate between 0.01 and 100 s-1. Color changes were evaluated by CIELAB attributes.

Results: All treatments and control samples were adjusted to a power law model with a pseudoplastic behavior: higher concentration, higher consistency index ($r^2 = 0.99$) and an inverse relation with the behavior of the power law index. Color stability showed a
During idli fermentation immunoreactivity of BG, phaseolin remained stable. Blot results were internally consistent with ELISA results. Anti-whole BG pAbs exhibited BG phaseolin and anti-whole BG pAbs was respectively, 71-147% and 67-240%. Western

The thickness of the idli samples at the center and perimeter varied over the range 1.6–218, and 1.4–174 ng/g, respectively. The highest concentrations for cake samples were observed in Dodoma (218 ng/g), Singida (216 ng/g), and Mbeya (174 ng/g), and their concentration ranges were 2.8–663, 1.6–218, and 1.4–174 ng/g, respectively. The highest concentrations for cake samples were found in Morogoro (663 ng/g), Singida (216 ng/g), and Mbeya (174 ng/g), and their concentration ranges were 2.8–663, 1.6–218, and 1.4–174 ng/g, respectively. For seed samples collected between August-October 2015, the highest concentrations were found in Morogoro (663 ng/g), Singida (216 ng/g), and Mbeya (174 ng/g), and their concentration ranges were 2.8–663, 1.6–218, and 1.4–174 ng/g, respectively. The highest concentrations for cake samples were found in Morogoro (536 ng/g), Dodoma (598 ng/g), and Singida (53 ng/g), and their concentration ranges were 2.7–536, 1.4–598, and 3.2–53 ng/g, respectively.

Significance: Therefore, animals and humans are potentially at high risk of exposure to aflatoxins through sunflower seeds and cakes from micro-scale oil millers in Tanzania.

Effect of Fermentation on Idli Quality and Immunoreactivity of Black Gram (Vigna Mungo) Phaseolin

Method: Sunflower seed and cake samples (n=182) were collected in two consecutive years (2014 and 2015 sunflower harvest seasons) and were analyzed for aflatoxin concentrations using a competitive direct enzyme-linked immunosorbent assay (ELISA).

Results: For seed samples collected between June-August in 2014, the highest aflatoxin concentrations were observed in Dodoma (281 ng/g), Singida (262 ng/g), and Babati-Manyara (162 ng/g), and their concentration ranges were 1.7–281, 1.4–262, and 1.8–162 ng/g, respectively. The highest concentrations for cake samples were found in Dodoma (98 ng/g), Dodoma (88 ng/g), and Singida (34 ng/g), and their concentration ranges were 2.8–98, 1.9–88, and 2.0–34 ng/g, respectively. For seed samples collected between August-October 2015, the highest concentrations were found in Morogoro (663 ng/g), Singida (216 ng/g), and Mbeya (174 ng/g), and their concentration ranges were 2.8–663, 1.6–218, and 1.4–174 ng/g, respectively. The highest concentrations for cake samples were found in Morogoro (536 ng/g), Dodoma (598 ng/g), and Singida (53 ng/g), and their concentration ranges were 2.7–536, 1.4–598, and 3.2–53 ng/g, respectively.

Significance: Therefore, animals and humans are potentially at high risk of exposure to aflatoxins through sunflower seeds and cakes from micro-scale oil millers in Tanzania.
Introduction:
The objective of this study was to develop antimicrobial surfaces inhibitory to Staphylococcus aureus using biofilms formed by antagonistic microorganisms.

Method:
To screen antagonistic microorganisms, 1,648 and 417 colonies were isolated from various soil samples and fresh produces (leaf lettuce, iceberg lettuce, perilla leaf, chicory, etc.), and the antimicrobial activities of those colonies against S. aureus were evaluated using a double-layer assay.

Significance:
These results indicate that the biofilm formation of antagonistic microorganisms could confer the persistent antimicrobial properties on stainless steel surfaces. This study will be useful when developing antimicrobial surfaces to inhibit foodborne pathogens on abiotic surfaces in food processing environments.

Results:
As a result, 161 isolates showed inhibitory activities against S. aureus. Among those, three isolates were selected based on the size of inhibition zones and the growth abilities in Bennet’s broth or tryptic soy broth (TSB). Two isolates from soil samples were Bacillus spp. and Streptomyces spp., and one isolate from leaf lettuce was Pseudomonas spp. All three microorganisms were able to form biofilms on stainless steel coupons (SSCs) because, when ca. 3.0 log CFU/coupon of those isolates were attached on SSCs, the populations on SSCs were increased to 8.1-8.3 log CFU/coupon after incubation in Bennet’s broth or TSB at 25°C for 5 days. Finally, the lethal activities of biofilms formed by antagonistic microorganisms on SSCs against S. aureus were investigated. When S. aureus (4.0 log CFU/coupon) was spot-inoculated on SSCs containing biofilms of Bacillus spp., Streptomyces spp., or Pseudomonas spp., and incubated at 25°C and 43% relative humidity for 48 h, the populations of S. aureus were decreased to 1.8, 1.9, or 1.9 log CFU/coupon, respectively. However, the populations of Bacillus spp., Streptomyces spp., and Pseudomonas spp. on SSCs were not significantly decreased for 48 h.

P04-120
Changes of Protein and Peptide Compositions in Soy Foods as Affected by Fermentation and Non-Fermentation Processing Techniques
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Introduction:
Soy protein is a major alternative to animal proteins. The overall soy protein and peptide compositions of two major proteins, namely glycinin and β-conglycinin, which constitute 70% of the total seed protein are altered by processing methods. A systematic and comprehensive comparison of total protein content and the compositions of the major protein and subunit peptides in the end products as affected by different processing techniques including soymilk and tofu making, solid and liquid fermentation, and germination is lacking, and is the objective of this study.

Method:
A high protein food-grade cultivar Prossoy was processed into soymilk (heated before and after filtration), tofu (filled and pressed), sprouts (raw and cooked at 1, 2, 3, 5, and 7d), tempeh (2, 4, and 6 day stored at 4°C), natto (2, 4, and 6 day stored at 4°C) and soy-yogurt (0, 2, 4, 6, 8 day stored at 4°C), using reported methods. Protein content was analyzed by the Kjeldahl method, and protein/peptide profile was conducted by using sodium-dodecyl-sulfate gel electrophoresis (SDS-PAGE) and imaging analysis software.

Significance:
Soymilk processing alters the content, quality and structure of proteins. The products with hydrolyzed proteins would have better protein digestibility. The new information can help the food industry and the consumers enhance health by choosing products for improving protein digestibility.

Results:
Results showed tempeh and pressed tofu contained higher (p <0.05) crude protein (52-49%) compared to all other products (46-36%) indicating that the processes involved in making these two products could increase protein content. SDS-PAGE profile analysis of protein subunits indicated that each processed product contained different proportions of protein fractions. Tempeh and natto contained 90% of the extractable protein with molecular weight lower than 14 kD suggesting the bacterial and fungal hydrolysis of proteins during fermentation. Liquid fermentation in case of yogurt caused degradation of β-conglycinin (96%) and glycinin (24-54%) proteins compared with raw soybean. Protein profile pattern of soymilk and tofu making were similar to presence of β-conglycinin and glycinin subunits. Germination caused Ax and Bx protein subunits indicated that each processed product contained different proportions (49%) compared to all other products (46-36%) indicating that the processes involved in improving protein digestibility.

P04-121
Odor-Induced Taste Modifications in Teas
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Introduction:
Although odorants and tastants are perceived by two different sensory modalities, the perceived taste qualities of a solution may be modified with the addition of an odorant. While many studies have investigated odor-induced taste modifications in model solutions, there is a lack of conducted research examining odor-induce taste modifications in complex food systems. The objective of the study was to determine the effect of added vapor-phase stimuli on the perceived sweetness of a model solution and complex food system.

Method:
Eight vapor-phase stimuli (blueberry, caramel, ginger, honey, lemon, orange, peach, and strawberry) were selected for investigation. The study was conducted in two parts. For Part 1, a 0.3 M sucrose solution was used as the model solution. Untrained panelists (n=76) evaluated sucrose solutions with and without added vapor-phase stimuli regarding overall aroma intensity, sweetness, sourness, saltiness, and bitterness. For Part 2, green and black teas were selected as the complex food system. Untrained panelists (n=71) evaluated green and black teas with and without added vapor-phase stimuli regarding overall aroma intensity, sweetness, sourness, saltiness, and bitterness. Data were analyzed using Analysis of Variance with Tukey’s HSD test to determine differences in overall aroma intensities and perceived taste intensities.

Significance:
This data may be useful in food industry applications such as the modification of perceived taste qualities of beverages, specifically tea, without altering the nutritional composition.

Results:
Lemon had the highest sweetness intensity rating and was the only vapor-phase stimulus that enhanced the perceived sweetness intensity of the model solution (p<0.05). Caramel had the highest sweetness intensity rating for both green and black tea whereas the perceived sweetness enhancements were observed in the green and black teas (p<0.05). However, ginger suppressed the perceived sweetness of the green and black teas (p<0.05). Strawberry also suppressed the perceived sweetness of the black tea (p<0.05). Differences in perceived sweetness intensities among vapor-phase stimuli may be attributed to previous associations and co-occurrences of vapor-phase stimuli and tastants in food products, as well as interactions that may occur between the volatile and non-volatile components in the food systems used.

P04-122
Saltiness Enhancement of Roasted Peanuts Induced by Foam-Mat Salt and Soy Sauce Odor
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Introduction:
Over-consumption of salt remains a global health issue. Smaller salt particle size may enhance saltiness perception. Odor-induced-saltiness-enhancement (OISE) is another approach for salt reduction in foods. Our previous study showed that tasteless-soy-sauce-odor powder (TSSO) increased recognizable saltiness perception. No research has been performed to evaluate combined effects of OISE and foam-mat salt on saltiness perception in foods. This study was done to characterize some physico-chemical properties of foam-mat salt, and investigate combined effects of OISE via TSSO and foam-mat salt on saltiness perception and sensory acceptance of roasted peanuts.

Method:
The control (commercial salt; 100%), and CS50 (commercial salt:TSSO; 50:50) or FS50 (foam-mat salt:TSSO; 50:50) were evaluated for physicochemical properties. Each salt was mixed with roasted peanuts, which were evaluated by a descriptive trained panel (N=10) for saltiness intensity using a 150-mm line scale, and by consumers (N=210) for acceptance using a 9-point hedonic scale. Data were analyzed (alpha = 0.05).

Results:
The foam-mat salt had smaller particle size range (34.9-265.1 µm) compared to that of the commercial salt (170.8-529.6 µm). The CS50 peanut contained 50% less commercial salt than the control peanut, hence it should technically have had a saltiness intensity of approximately 25 (i.e., 50% of the saltiness intensity of 50.2 of the control). However, the saltiness intensity of CS50 peanut was 39.1. This perceived saltiness enhancement was due to OISE imparted by TSSO and post-exposure oil content of the latter had slightly higher perceived saltiness intensity (43.0 vs. 39.1), which was possibly due to smaller particle size of the foam-mat salt. The FS50 peanut, having 10 mg of sodium/100 g sample less than the CS50 peanut, was as acceptable as the control sample [overall liking (6.6-6.8), overall flavor (6.3-6.6) and salty taste (6.0-6.3) scores].

Significance:
This study demonstrated combined effects of OISE via TSSO and foam-mat salt particle size on saltiness enhancement of foods. This finding is useful in development of reduced-sodium food products.

P05-001
Characterization of Lecithin Extracted From Pacific Saury (Cololabis Saira) Viscera by Supercritical Carbon Dioxide
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Lecithin is a kind of sticky fatty substance mainly composed of phospholipid mixtures such as phosphatidylcholine (PC) and phosphatidylethanolamine (PE), small amount of neutral fat, and other suspended matter. Nowadays, marine lecithin (ML) has several valuable nutritional benefits. It is rich in important n-3 fatty acids, such as PUFA and DHA. Pacific saury is one of the most important marine commercial fishes in the world. The present study was to characterize the extracted lecithin from Pacific saury viscera. It was expected to provide basic foundation for further application of Pacific saury lecithin.

Method:
The lecithin was extracted by SC-CO2 combined with anhydrous ethanol as cosolvent. The phospholipid was extracted by SC-CO2 after the deoiled viscera. The phospholipid content of lecithin from Pacific saury viscera was measured by colorimetric method based on the formation of a complex
between phospholipids and ammonium ferrioxycanate. The lecithin from Pacific saury viscera was separated by thin layer chromatography (TLC) to determine the kinds of phospholipids. Major phospholipids of lecithin, including PC, PE, and PI, were separated and quantitatively analyzed by HPLC equipped with an evaporative light scattering detector (HPLC-ELSD). Oxidative stabilities of lecithin were checked by the thiocyanate (TC) and thiobarbituric acid (TBA) methods.

**Significance:**
Lecithin extracted from Pacific Saury (Cololabis Saira) was characterized. Lecithin alone could not inhibit the oil auto-oxidation. But still, lecithin showed high oxidative stability over a certain period. EPA and DHA were the major parts of unsaturated fatty acids which were the most susceptible to oxidation in lecithin.

**Results:**
In this study, 56.98g/100g (dry) oil and 23.90g/100g (dry) lecithin were extracted from Pacific saury viscera by SC-CO₂. Phospholipid content of the lecithin from Pacific saury viscera by SC-CO₂ was 63.28% (w/w). PC, PE, and PI were quantified as 0.028mg/g, 0.120mg/g and 0.032mg/g, respectively. The results of the oxidative stabilities of lecithin were shown in Figure 1. In this study, the oxidation trend of lecithin with linoleic acid or astaxanthin was compared. Lecithin with astaxanthin showed high oxidative stability maybe because astaxanthin has good properties for inhibiting the peroxide formation of the lipids over a certain period.

**PO5-002**

**Altering Batter Formulation to Reduce Fat Content of Fried Seafood**

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**Introduction:**
Fried seafood, although flavorful and enjoyed by consumers, contains a high quantity of residual fat from the frying process. Various coating components such as pre-dust, batter, and breading, are used during the frying process, which affect yield and fat uptake. Approximately 80% of seafood products consumed in the USA are processed with batter or battered/breaded before frying, which represents 4 billion pounds of product annually. Due to the high fat content and increased cholesterol, fried foods are often considered "unhealthy."

Our objectives were to evaluate the effectiveness of various fat blocking agents including rice bran powder and surimi fish protein when incorporated into the batter mix of batter/breaded fish portions.

**Method:**
Rice bran powders were replaced in the batter mix at 20, 30, and 40%. Surimi slurry solution was prepared (5 or 7% Alaska pollock surimi, 1.5% salt, and water, with pH adjustment to 7 or 11) and combined with batter mix. A control of only battered/ breaded fish portions was prepared. White fish fillets were cut into 2 inch square pieces. 10 fish fillet pieces were prepared for each treatment. Fillet pieces were treated by covering in pre-dust, dipping in batter solution, and covering with bread crumbs. Fillet pieces were weighed, treated, weighed again, and then cooked in hot oil (375°F) for 3 min. After cooking fillet pieces were cooled in a wire basket for 5 min and weighed. Batter/breading pick up (%) was calculated along with cook yield. Fat content and % moisture were also evaluated for each treatment.

**Significance:**
Fat content of fried seafood can be significantly reduced by altering the composition of the batter mix, either by replacing with rice bran powder or preparing with surimi slurry solution instead of plain water. Evaluating a combination of rice bran powder replacement of batter mix and combining with surimi slurry could further reduce the fat content of fried seafood products.

**Results:**
Replacing batter mix with rice bran powder proved effective in reducing fat content of fried fish fillet portions. Surimi slurry combined with batter mix also reduced the fat content while increasing the moisture content of fish fillet pieces.

**PO5-003**

**Characterization and Value-Added Utilization of Proteins Extracted From the By-Products From Catfish Fillet Processing Plants**

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**Introduction:**
Channel catfish farming is the most important warm water aquaculture in the United States as a health snack or condiment. Gim is sold as a dried thin sheet with/ without roasting with seasonings. The textural uniqueness or “crispiness” can often be damaged by its hysroscopic nature during storage. However, no scientific method has been developed to measure textural change from water adsorption under accurately controlled atmospheric conditions.

The objectives of this study were to: (1) describe the relationship between water activity and moisture content in gim with water sorption isotherm, (2) develop mathematical models to predict sorption characteristics, and (3) develop a method to measure the change of mechanical properties of gim with a no-stretch tensile test under control relative humidity.

**Method:**
Dried gim was prepared as a ring shaped specimen (inner diameter, 31 mm; width, 15 mm; thickness, 0.1 mm). Supersaturated salt solutions were used to obtain microclimates of 10 to 90% relative humidity environments at 25°C. After reaching equilibrium, moisture content and water activity were determined. Moisture content each step of extraction. The yield of extraction was determined. Fish proteins extracted by the two methods above were utilized for surimi gel making and then subjected to texture analysis, and comparison with commercial surimi products.

**Significance:**
Results showed it is possible to extract quality proteins from fish by-products for use as a functional ingredient for surimi-making. Successful utilization of catfish waste would increase the profit of the catfish industry and avoid environmental pollution.

**Results:**
Results indicated that yield of protein extracted from the catfish frames (pH Adjustment: 20.18% ± 1.78%; Salt Brine Solution: 17.09% ± 2.2%) was significantly (P < 0.05) higher than that from the catfish heads (pH Adjustment: 17.16% ± 2.11%; Salt Brine Solution: 14.25% ± 1.53%). Texture analysis showed gel strength of surimi made from catfish heads was not significantly different with that from catfish frames. Surimi gel made by salt extraction (catfish head: 0.45 ± 0.03 Kg/cm²; catfish frame: 0.43 ± 0.02 Kg/cm²) had significantly lower (P < 0.05) gel strength than gel made by pH adjustment (catfish head: 1.96 ± 0.13 Kg/cm²; catfish frame: 1.85 ± 0.11 Kg/cm²). SDS-PAGE results showed the protein composition of the extracted protein was similar to that from the fillet, indicating the integrity of myofibrillar proteins was maintained during the extraction process.

**PO5-004**

**Assessing Off-Flavor in Fish Tissue**
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**Introduction:**
Geosmin (GSM) and 2-methylisoboranol (2MIB) are two metabolites generated by microorganisms, such as cyanobacteria and actinomycetes. They possess dirt like odor and can be detected at very low concentrations (subparts per billion) by the human nose. Their presence in water creates a problem for municipal and potable water supplies as well as aquaculture. These compounds are hydrophobic and can be bioaccumulated in aquaculture products, such as catfish, trout, sturgeon, and even farm raised shrimp. Quality assessment of these products is generally accomplished by professional flavor checkers who sniff and/or taste representative samples. Due to the rather unremarkable chemical structure of these compounds, the analytical methods available are time consuming and costly, and consequently found only at research institutions and not within the industry.

**Method:**
This research investigates the location within a fish fillet of the deposits of the off-flavor compounds in order to locate the optimal location for the best sensory or analytical assessment. Previous research has shown variations in concentration when measured longitudinally from head and tail as well as from the top of the fillet to the bottom. In the present research 20 g of fillet tissue was removed form four selected sites: dorsal, belly, tail and along the lateral line. Subsequently the remainder of the fillet was blended and triplicate samples were analyzed for a total of 7 samples per fillet for 30 fillets. Samples were prepared by microwave desorption of the minced tissue and the steam distillate collected in a cold trap. The aqueous solution was analyzed by solid phase microextraction/gas chromatography/mass spectrometry.

**Significance:**
This research will aid processors of aquacultural products in maintaining quality control.

**Results:**
The blended fillets served as controls and showed little variation between the three repetitions but significant differences in concentrations for both 2MIB and GSM were observed between individual fillets. Concentrations of 2MIB and GSM were detected in all fish and varied significantly between sites within a single fillet. The site of maximum concentration for GSM and 2MIB was found to be inconsistent between fillets.

**PO5-005**

**Measuring the Mechanical Properties of Dried Gim (Korean Sea Veggie) as Affected by Relative Humidity Using a Ring Tensile Test**
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**Introduction:**
Dried gim (Han, Korean sea veggie “laver” (Porphyra tenera), has recently become popular in the United States as a health snack or condiment. Gim is sold as a dried thin sheet with/ without roasting with seasonings. The textural uniqueness or “crispiness” can often be damaged by its hysroscopic nature during storage. However, no scientific method has been developed to measure textural change from water adsorption under accurately controlled atmospheric conditions.

The objectives of this study were to: (1) describe the relationship between water activity and moisture content in gim with water sorption isotherm, (2) develop mathematical models to predict sorption characteristics, and (3) develop a method to measure the change of mechanical properties of gim with a no-stretch tensile test under control relative humidity.

**Method:**
Gim, Korean sea veggie “laver” (Porphyra tenera), has recently become popular in the United States as a health snack or condiment. Gim is sold as a dried thin sheet with/ without roasting with seasonings. The textural uniqueness or “crispiness” can often be damaged by its hysroscopic nature during storage. However, no scientific method has been developed to measure textural change from water adsorption under accurately controlled atmospheric conditions.

The objectives of this study were to: (1) describe the relationship between water activity and moisture content in gim with water sorption isotherm, (2) develop mathematical models to predict sorption characteristics, and (3) develop a method to measure the change of mechanical properties of gim with a no-stretch tensile test under control relative humidity.
Results: During the protein isolation, we were able to separate high molecular weight (HMW) glutenins and low molecular weight (LMW) glutenins. The protein identification results identified our isolated proteins as HMW glutenin (100, 85, and 70 kDa) and LMW glutenins (39 and 30 kDa) matching with our SDS-PAGE gels. As a result of comparative genomics, the sequences QQSQSYTPFSPQ and PVPQDQFFGSEQ were chosen as peptides for antigen design for anti-HMW glutenin and anti-LMW glutenin antibodies respectively. The antigens were injected into the rabbits and antibody collection was performed after several weeks.

P05-008
Next Generation Sequencing Using Multi-Marker DNA Barcoding as an Innovative Approach to Food Quality Control: Turkey Product Analysis
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Introduction: Food product mislabeling is a serious issue with consequences such as negative health impacts, economic fraud, and consumer distrust. Next Generation Sequencing (NGS) is a novel method for discovering the precise contents of one’s food. Because many products, such as animal products like turkey, cannot be visually analyzed to verify their contents, such technology is often required to screen food for its ingredients. The purpose of this study is to analyze the contents of turkey products from major American grocery stores and assess their label’s accuracy via NGS.

Method: We used a 96-well format to perform mass DNA extraction, PCR, and Next Generation Sequencing and analyze the contents of 170 turkey products. These products encompass 41 brands from 5 retailers, including 12 whole turkeys.

Results: We found problems with 13.5% of the 158 turkey products we tested (not including the 12 whole turkeys). 7% of these samples were found to be guilty of substitution with other ingredients, and 1% of them did not contain key ingredients that were listed on their labels. Additionally, 5.5% of samples had hygienic issues, such as human DNA.

Significance: Accurate labeling is paramount for various areas in our culture including health reasons, such as for those with allergies to major allergens. Studies to ensure transparency in the food industry will improve the accuracy of product labels and decrease the amount of economic, religious, social, and health-related issues that follow from mislabeling.

P05-010
Effect of Fermentation With Yeast (Saccharomyces spp.) and an Amyloytic Lactobacillus on Protein Content of Grain Sorghum
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Introduction: Grain sorghum is a staple crop in hot, arid climates. It is considered a vital source of protein for people and their livestock, despite being relatively low in protein content and deficient in some essential amino acids. Fermentation processes have been demonstrated to improve protein quality of grains; studies on grain sorghum have shown that lactic fermentation can increase digestibility of the protein in sorghum-based foods. Yeast fermentation has been used to increase protein content in high-carbohydrate substrates. The objective of this research is to determine how different types of fermentation affect the protein content of grain sorghum.

Method: In this study, non-tannin white sorghum grain was fermented using an amylolytic strain of Lactobacillus (L. amylovorous), a commercial baker’s yeast, and co-cultures of L. amylovorous and baker’s yeast with both lactobacillus and yeast. A 50% w/v grain slurry was fermented at 37°C, with and without nitrogen supplementation. The grain was subjected to different pre-treatments including thermal and enzymatic processing, as well as simple grading with no other pre-treatment, before inoculation with the fermentation organism. Nitrogen was added as ammonium sulfate or a blend of ammonium sulfate and yeast extract.

Significance: An optimized fermentation process using yeast and lactic bacteria together could yield improved nutrition from grain sorghum without expensive equipment or specialized techniques. Such a process could be more economically feasible than other protein enrichment methods, thus making it more accessible to those for whom it would provide the most benefit.

Results: Crude protein content did not increase significantly in grain fermented with L. amylovorous or baker’s yeast alone. Co-culture of L. amylovorous and baker’s yeast together resulted in an increase in crude protein when the grain substrate was also treated with amyloglucosidase. Co-culture fermentation raised the protein content from 14% to 16% (dry basis) after 48 hours of incubation.
**Introduction:**
Consumption of functional foods containing probiotics has been attributed to positive human health effects. Exposure to environmental and gastrointestinal conditions reduces viability of probiotic bacteria found in functional foods, but encapsulation can minimize this effect. The aim of this study was to investigate the effects of using encapsulated *Lactobacillus plantarum* NRII R8-496 (LP) to ferment grape juice (GJ).

**Method:**
LP was grown in MRS broth by incubating at 37°C for 16 h. LP pellets were harvested by centrifuging at 10000 x g and then free LP cells were washed thrice and suspended in sterile distilled water (FLP). Capsules containing LP (CLP) were produced by extruding a mixture containing 96% FLP and 2% each of pectin and rice bran into a 0.1 M CaCl2 solution (hardening agent). Afterwards, 1 mL of FLP or 1 g of CLP was inoculated into 49 mL of sterile GJ to produce FLP-GJ and CLP-GJ, respectively. LP-GJ and CLP-GJ were incubated at 37°C for 3 days and then stored at 4°C for 15 days. *Brix, viable cell counts, pH, and titratable acidity (TA) were analyzed during fermentation and storage. TriPLICATE experiments were conducted and data was statistically analyzed (α = 0.05).

**Significance:**
The study demonstrated that capsules loaded with LP could effectively ferment GJ and be potentially used as a delivery system for LP in functional foods.

**Results:**
After 3 days of fermentation, *brix significantly decreased for CLP-GJ (24.91 to 23.10) and FLP-GJ (24.91 to 24.25). Cell counts (log CFU/mL) increased from 4.93 to 7.56 in CLP-GJ and 8.06 to 8.98 in FLP-GJ, with FLP-GJ having significantly higher counts than CLP-GJ (P ≤ 0.05). The pH of both FLP-GJ and CLP-GJ decreased from 3.77 to 3.12 and TA of FLP-GJ (0.55%) and CLP-GJ (0.55%) increased to 1.13 and 1.06%, respectively (P ≤ 0.05). After 15 days of storage, *brix in CLP-GJ was significantly lower than FLP-GJ. FLP-GJ had significantly higher cell counts (log CFU/mL) (9.00) compared to CLP-GJ (7.75). The pH of FLP-GJ and CLP-GJ was unchanged and TA of FLP-GJ and CLP-GJ increased from 1.30 to 1.11%, respectively (P ≤ 0.05).

**P05-012**
**Effect of Fluidized Bed Drying on Physicochemical and Microbiological Properties of Mexican Fresh Cheese**
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**Introduction:**
Artisanal Mexican fresh cheese is the most recognized of the Latin American fresh cheeses and the most tested among consumers. These cheeses are traditionally made from raw milk, are often salted and consider a rich source of essential nutrients in particular; proteins, amino acids, fat, vitamins and minerals; for this reason, shelf life of this cheese is very short due to the chemical, biochemical and physical changes determined by enzymes and spoilage microorganisms, as a consequence of each change, several alterations in the product can occur at the sensory and nutritional level, deprecating its commercial value. The main purpose of this study was to evaluate the effect of a fluidized bed on physicochemical and microbiological properties drying of Mexican fresh cheese.

**Method:**
A 2^3 rotatable central composite design was used to establish the fluidized bed drying conditions. The independent variables investigated were drying time 60, 90, and 120 min, drying air temperature 50, 60, and 70°C, and particle size 0.6, 2, and 3.5 cm.

**Significance:**
This study suggests that dry cheese can be used as an additive in a lot of dishes with similar characteristics to a fresh cheese.

**Results:**
The results obtained for physicochemical and microbiological composition of fresh cheese were as follow: moisture content of 47.43%, water activity of 0.975, protein content of 19.89%, fat content of 2.93 %, sodium chloride content of 1.51% and pH of 6.3. The fresh cheese had an initial viability around of 15 x 10^3 CFU/g of cheese were as follow: moisture content of 47.43%, water activity of 0.975, protein content of 18.30% and 14 x 10^4 CFU/g of cheese.

**P05-013**
**Quantification of Benzoic Acid Production With Respect to Starter Culture and Incubation Temperature During Yogurt Fermentation**
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**Introduction:**
Benzoic acid is occasionally used either as additive to raw materials or sometimes produced during fermentation process by various microorganisms. Benzoic acid is a GRAS material, however, it has side effects to sensitive individuals. Additionally, the addition of benzoic acid is prohibited in some kinds of food. Therefore, the aim of this study was to evaluate naturally occurring preservatives during yogurt fermentation with respect to starter culture and incubation temperature.

**Method:**
We used Sep-Pak filtration and high performance liquid chromatography (HPLC) analysis methods described in Korean Food Standards Codex to determine the concentration of benzoic acid. *Streptococcus thermophilus, Lactobacillus acidophilus, Lactobacillus rhamnosus, Lactobacillus casei, Lactobacillus paracasei, Lactobacillus reuteri, Lactobacillus plantarum, Bifidobacterium lactam, Bifidobacterium lactis, Bifidobacterium bifidum, Bifidobacterium infantis, and Bifidobacterium breve were used as yogurt starter cultures. Among these strains, L. rhamnosus and L. paracasei showed higher production of benzoic acid than the other strains. The inoculum ratio (0–0.04%) of L. rhamnosus, L. paracasei, S. thermophilus, and incubation temperature (35–44°C) were performed as each factor for optimization of benzoic acid production. A response surface methodology based on the central composite design was used for optimize the benzoic acid production.

**Significance:**
Therefore, the results showed naturally occurring benzoic acid production during yogurt fermentation process, and these values are met the regulation for benzoic acid in dairy products in Korea.

**Results:**
The optimum condition was 0.04% L. rhamnosus, 0.01% L. paracasei, 0.02% S. thermophilus, and incubation temperature 35–44°C were performed as each factor for optimization of benzoic acid production. A response surface methodology based on the central composite design was used for optimize the benzoic acid production.

**P05-014**
**Effect of Probiotic Lactobacillus Plantarum Lb41 Isolated From Kimchi on Cottage Cheese**
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**Introduction:**
Kimchi, a traditional Korean fermented vegetable dish, has antioxidant, antimutagenic, antitumor, and immune-stimulating effects. *Lactobacillus plantarum*, which is abundant in Kimchi, is used as a starter for dairy products. Cottage cheese, an unripened and acidic cheese, is made from skim milk. Cheeses are excellent carriers of probiotic bacteria because of their high fat content, high pH, and excellent buffering capacity. This study evaluated the probiotic properties of *Lactobacillus plantarum* Lb41 isolated from Kimchi and cottage cheese produced using this probiotic strain.

**Method:**
*L. plantarum* Lb41 isolated from cabbage Kimchi persisted in a pH 2.5 and 0.3% peep condition for 3 h and survived for 24 h in 0.3% oxgall. Enzyme production was detected using API ZYM model. Adhesion activity of FLP and CLP was detected using HT-29 intestinal cell line. Cytotoxic activity of *L. plantarum* Lb41 on cancer cell lines was determined by MTT assay. Cottage cheese was manufactured by starter with *L. plantarum* Lb41, and viable cell number and physicochemical characteristics (pH, total solids, ash, fat, and protein) were determined during a 4-week storage period.

**Significance:**
Thus, *L. plantarum* Lb41 has various probiotic properties, and cottage cheese can be improved by adding *L. plantarum* Lb41.

**Results:**
Survival rate of *L. plantarum* Lb41 in a pH 2.5 and 0.3% peep condition for 3 h and for 24 h in 0.3% oxgall was 99.3 and 84.2%, respectively. An API ZYM kit indicated that *L. plantarum* Lb41 generated β-galactosidase and β-glucosidase but not β-glucuronidase, a carcinogenic enzyme. *L. plantarum* Lb41 showed strong adhesion (7.5%) to the HT-29 intestinal cell line. The cytotoxicity rates for a gastric cancer cell line (AGS) and human lung cancer cell line (SK-MES-1) were 99.04 and 99.29%, respectively, but that for the normal MRC-5 cell line was below 20%. For cottage cheese made using *L. plantarum* Lb41, viable cell numbers at 0 and 4 weeks were 8.49 and 9.04 Log CFU/mL, respectively, and those for control cheese without *L. plantarum* Lb41 were 8.27 and 8.53 Log CFU/mL, respectively. The physicochemical characteristics (pH, total solids, ash, fat, and protein) were within the range of commercial cottage cheeses.

**P05-015**
**The Effect of Delivery Vehicles of Bifidobacterium animalis subsp. lactis BB-12** on the Gut Microbiota of Young Healthy Adults
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**Introduction:**
Recent studies have demonstrated the involvement of some probiotic strains in promoting a healthy gut microbiota. As a widely used commercial probiotic strain, it is unknown whether *Bifidobacterium animalis* subsp. *lactis* BB-12 (BB-12) has any effect on the gut microbiota of young healthy adults. Furthermore, the matrix used to deliver probiotic bacteria may influence their performance and efficacy in vivo.

**Method:**
To address these questions, 36 healthy adults aged 18-40 years old with BMI 20-35 kg/m2 were recruited in a controlled, 4-period crossover, free-living study. Participants
were randomly assigned to one of 4 treatments, which were (1) yogurt smoothie alone; smoothie with BB-12 added (2) before or (3) after fermentation, or (4) BB-12 in capsule form. The dose level of BB-12 was log 10 ± 0.5 CFU/day if participants received any. Stool samples were collected at baseline and at the end of each 4-week treatment. Bacterial genome DNA was extracted using MOBIOS PowerSoil DNA isolation kit. DNA samples were sequenced for the V4 region of the 16S rDNA on an Illumina MiSeq sequencing platform. Sequence data from 29 participants who completed at least one treatment period were analyzed using QIIME.

Significance:
The results indicate that neither BB-12 nor the delivery matrix significantly altered the gut microbiota of young healthy adults.

Results:
In agreement with results found in the literature, the predominant phyla Firmicutes, Bacteroidetes, Actinobacteria, and Proteobacteria accounted for > 98% of the sequences. No difference at phylum or genus level was detected among treatment groups except that participants had a significantly higher percentage of Streptococcus in their fecal microbiota after consuming control yogurt smoothie when compared to the capsule (P = 0.01). All yogurt smoothies tended to result in a higher percentage of Streptococcus when compared to baseline, capsule, and final washout. This is likely due to the presence of the high level (log 11.4 CFU/day) of the culture S. thermophilus in the yogurt interventions.

P05-016
Effects of Natural and Synthetic Antioxidants on the Oxidative Stability of Njangsa Seed Oil
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Introduction:
Ricinodendron heudelotii (Njangsa) is a popular seed oil, which is largely consumed in Cameroon and some other African countries. To date, it has only been used for its culinary attributes; although its fatty acid profile suggests important health benefits due to the presence of alpha-oleoestric acid (α-EFA). These benefits include anticancer properties, reversal of oxidative stress and positive effects on some cardiovascular health markers. However, the high degree of unsaturation and conjugation of its predominant fatty acid, α-EFA, makes the oil susceptible to lipid oxidation, and thus hampers its application as a food or pharmaceutical product. In this study, we investigated the effect of natural and synthetic antioxidants on the overall oxidative stability of Njangsa seed oil (NSO).

Method:
We determined the oxidation induction time (OIT) of NSO spiked with tert-butylhydroquinone (TBHQ), butylated hydroxyanisole (BHA), Herbalox® seasoning type (HTB) and W (HTBW), as well as isothorinal differential scanning calorimetry (DSC) at 100°C. We also monitored the antioxidant capacity and secondary oxidation using the 2,2-diphenylpicrylhydrazyl (DPPH) assay and thiobarbituric acid (TBA) assay, respectively. Data obtained from all determinations were subjected to a one-way ANOVA followed by Fisher’s LSD test for comparison between any two means. Differences were considered significant at p < 0.05.

Significance:
Our findings demonstrate that TBHQ was a more suitable antioxidant for NSO. It does not only increase the oxidative stability of the oil substantially, but also improves upon its commercial viability.

Results:
Our results revealed that tert-butylhydroquinone (TBHQ) was the most effective antioxidant for the oil at 200 ppm. By increasing the concentration of the natural antioxidants (HTBO and HTBW) to 4000 ppm, OITs similar to that of oil spiked with TBHQ at 200 ppm were obtained. However, under simulated frying conditions at 160°C, NSO spiked with the rosemary extracts at 4000 ppm showed lower radical scavenging activity relative to TBHQ. Furthermore, secondary oxidation in terms of the TBA value of NSO spiked with the rosemary extracts at 4000 ppm showed lower radical scavenging activity relative to TBHQ. Furthermore, secondary oxidation in terms of the TBA value of NSO spiked with the rosemary extracts at 4000 ppm showed lower radical scavenging activity relative to TBHQ. Furthermore, secondary oxidation in terms of the TBA value of NSO spiked with the rosemary extracts at 4000 ppm showed lower radical scavenging activity relative to TBHQ.

P05-017
Easy-to-Use Visible Detection of Ara H1 as a Major Allergen Using a Novel Gold Nanoparticle Aggregation System
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Introduction:
Ara H1 is a major food allergen in peanuts causing serious allergic reactions including anaphylaxis. This being so, it is important to detect its presence in foods containing peanuts as undeclared ingredient statements. A conventional ELISA-based detection method might be hardly applied for a real time on-site detection due to its requirements of operator and, sophisticated equipment. In this study, we propose an easy-to-use visible detection method for Ara H1 based on the aggregation of gold nanoparticles.

Method:
In this system, the degree of aggregation of AuNPs is dependent on the quantitative relationship among streptavidin-coated AuNPs (stAuNPs), biotinylated anti-Ara H1 antibodies (linkers) and Ara H1 (target). When reacting various concentrations of linker with stAuNPs, large amount of aggregation enough to precipitate occurs only in certain quantitative relationship between the linkers and stAuNPs. This detection system is based on the change of the precipitation region resulting from the disturbance of the quantitative relationship due to the target. To demonstrate the detection of Ara H1, first, target solutions with or without Ara H1 were mixed with linker solutions at various concentrations. Then, stAuNPs solution was reacted to the mixture solutions under agitation for 2 h.

Significance:
Even 1 ppm of Ara H1 was successfully detected with the system without any specialized equipment. The working principle of the system could be applied to the detection of other allergens, chemicals and/or microorganisms in food.

Results:
In the absence of Ara H1 in the target solution (i.e., control), the precipitation region was shown in the range of 0.5–1.0 µg/mL of linkers. However, this region was shifted to 1.0–1.5 µg/mL of linkers, and to 1.5–2.5 µg/mL of linkers in cases of 0.1 µg/mL and 1.0 µg/mL of Ara H1, respectively. And these changes can be easily distinguished by the naked eye as shown in the figure. Further, the sensitivity of the system can be improved by controlling AuNP size and the amount of streptavidin.

P05-018
Arbutin Contents and Cellular Whitening Function of Unripe Asian Pear Cultivars
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Introduction:
Pear (Pyrus spp.) is one of the most widely consumed fruits in the world. Various phenolic compounds have been found in pear fruits, including arbutin, chlorogenic acid, rutin, and procyanidins. Large amounts of unripe pears are usually discarded due to natural disasters, poor cultivation techniques, or the thinning out of superfluous fruits. Therefore, is necessary to find out how these unripe fruits could be utilized to produce new food ingredients, such as functional food ingredients, instead of wasting them.

Method:
In this study, total phenolics and arbutin contents of the five unripe pear cultivars were measured, and further functional characterization was carried out with respect to the antioxidant activities, and inhibitory effects on tyrosinase as well as cellular melamin formation.

Significance:
These results indicate that unripe pears, especially the Manpungbae cultivar, could be useful for application as a possible natural whitening additive with high arbutin content and excellent whitening activity. This work was financially supported by Cooperative Research Program for Agriculture Science & Technology Development (Project No. PJ01134201).

Results:
Cultivars included Manpungbae, Gamcheonbae, Chuwangbae, Hanareum, and Niitaka, which were harvested 30 days after florescence. Total phenolic and flavonoid contents of the five pear cultivars ranged from 255–367 mg, and from 26.5–36.6 mg per 100 g fresh weight, respectively. Among the five cultivars tested, Gamcheonbae and Manpungbae had significantly higher total phenolics and flavonoid contents, while Niitaka had lower total phenolics and flavonoids. Quantification of the arbutin content by HPLC/DAD analysis revealed Manpungbae to have the highest levels (53.9 mg/100g FW), while Chuwangbae and Gamcheonbae had only half as much. With regard to the antioxidant capability by ABTS or DPPH radical scavenging, Nikita showed lower activity (65% or 77%), while Manpungbae was the highest (74% or 83%). The pear extracts showed relatively low cytotoxicity, with cell viability 79–96% of concentrations of 500 µg/mL. For 100 µg/mL pears ethanol extracts, Manpungbae showed the strongest tyrosinase inhibition, at 4.9%. Melanin formation by B16F10 mouse melanoma, was significantly inhibited by Manpungbae (16.9%), and Chuwhangbae (25.8%), resulting in 74% and 60% reduction compared to the level in non-treated cells (64.8%).

P05-019
Development and Validation of an Analytical Method for the Quantification of 4(5)-Methylimidazole in Bakery Products
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Introduction:
(5)-methylimidazole (4(5)-Mi) is a carcinogenic, nitrogen-containing compound, found mainly during the manufacturing of caramel colorings. Presence of 4(5)-Mi is common in any food with inclusion of caramel coloring for desirable sensory characteristics, such as biscuits and cookies. Limited work has been conducted to develop an analytical method suitable for quantification of 4(5)-Mi in bakery products. The current study aimed at developing and validating the analytical method for quantification of 4(5)-Mi in bakery products.

Method:
A sample preparation procedure specialized in bakery products was fully developed in this study and gas chromatography-mass spectrometry (GC-MS) was utilized for quantification and qualification of 4(5)-Mi.

Significance:
Findings from the current research can guide those specializing in bakery products on
identification and precise quantification of carcinogenic 4(5)-MI in a product. Further, the analytical method developed in this study can be utilized in future studies on reduction of 4(5)-MI in bakery products.

Results:
The linearity value (r) of a standard curve for quantitative analysis was 0.9995. The limit of detection (LOD) was 18 μg/kg and the limit of quantitation (LQD) was 56 μg/kg. The concentration of 4(5)-MI in 15 commercial cookies and biscuits ranged from 72 to 1253 μg/kg.

P05-020
Chemical and Taste Pattern Analyses of Soybean Paste (Doenjang)
During Fermentation Using HPLC and LC-MS and Electronic Tongue
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Introduction:
Doenjang is a Korean traditional soybean paste fermented with Aspergillus sp. and Bacillus subtilis. Two types of commercial Doenjang were prepared for this research; conventional Doenjang contains grain ingredient in early stage of fermentation, while soybean Doenjang consists solely of soybean. The aim was to compare the chemical and taste pattern analysis between two different types of Doenjang using HPLC and LC-tandem MS and an electronic tongue.

Method:
Free sugars, free amino acids, and organic acids of Doenjang according to fermentation were analyzed by HPLC and LC-tandem MS. Also, tastes of the Doenjang, such as bitterness, saltiness, sourness, sweetness, and umami taste, and their correlation interaction were determined by an electronic tongue (Alpha M.O.S., Toulouse, France).

Significance:
Doenjang has been consumed as a source of protein and a flavor agent in Korea. This study suggests the changes of favorable taste compounds and taste patterns analyzed by HPLC and LC-MS system and E-tongue according to fermentation.

Results:
In this study, four sugars, seventeen amino acids, and nine organic acids were analyzed. As the fermentation period increases, the contents of alanine, glutamic acid, isoleucine, lysine, phenylalanine, proline, serine, and valine increased, while four kinds of sugar decreased in conventional Doenjang. During fermentation, aspartic acid in soybean Doenjang increased from 0.80 to 2.90 mg/g and all types of sugar content increased, ranging from 1.86 to 8.02 mg/g. In addition, lactic acid and succinic acid contents increased in both types of Doenjang, 27.25–34.73, 6.64–8.25 and 17.12–35.33, 4.97–7.18 mg/g, respectively. On the other hand, the taste pattern results showed that sourness, saltiness, and umami increased along with fermentation period, while sweetness and bitterness decreased.

 Organic acids, especially lactic acid, increased in both Doenjang samples during the fermentation period, and could be a main contributor. In addition, an increase of glutamic acid content could be responsible for the umami taste of two Doenjang samples.

P05-021
Analysis of Furan in Coffee With Consideration of the Common Consumption Scenario at the Individual Consumer Level
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Introduction:
Furan is a colorless, highly volatile, heterocyclic aromatic compound. The presence of furan in heat processed foods, including coffee, received much attention from public health authorities due to its carcinogenicity. Most widely accepted form of coffee consumption is home-brewing, instant coffee mixture (dried powder), and ready-to-drink coffee in a can, and a common consumption scenario for coffee at individual consumer level is using disposable cups with/without lids. The aim of this study was to investigate the levels of furan in coffee with consideration to the common coffee consumption scenario.

Method:
The analytical method used to analyze furan levels in foods was optimized based on solid-phase microextraction followed by gas chromatography-mass spectrometry (SPME-GC-MS).

Significance:
Findings from the current study can aid public health authorities to set practical guidelines on furan levels in coffee for individual consumers.

Results:
The level of furan in brewed coffee was the highest among the coffee types studied, followed by instant and canned coffee. Furans levels decreased significantly after 5 min. of cupping, and the degree of reduction was greater when coffee sat in a cup without a lid, regardless of coffee type (p<0.05). As for the canned coffee, the degree of furan reduction in a coffee was greater on coffee served in a warm temperature (60°C) than that of coffee served at a cold temperature (4°C, p<0.05). The flavor profile of each coffee type during 5 min. of storage was not different, but the intensity of each flavor was different (p<0.05).

P05-022
Change in Volatile Compounds of Korean Soybean Paste (Deonjang) During Fermentation by GC-MS
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Introduction:
Various fermented soybean products (e.g., Korean soybean pastes, Japanese miso and natto, soy sauce, and tempeh), having their own characteristic flavor and taste, have been used for hundreds of years in Asia. In this study, we investigated changes in the volatile compounds of Korean soybean paste (Doenjang) during fermentation using GC-MS. In general, it is made by soaking, steaming, molding, and fermenting grain ingredient and soybeans (called as ‘meju’) and soybeans with Aspergillus oryzae and/or Bacillus subtilis in a humid space maintained at a warm temperature. On the other hand, Doenjang used in this study was compared to Korean traditional soybean paste. It was made with only soybean (I will show this scheme at the poster in detail).

Method:
In this study, the SDE extraction techniques were combined with GC-MS to establish comprehensive volatile profiles of Doenjang.

Significance:
Previous research has shown that 3-methyl butanoic acid, ethyl 2-methylbutanoate, 2,3-butanediol, 4-methylacetamide, and pyrazine were important contributors of commercial Deonjang. However, this study reports that ethyl linoleate, 2,5-dimethylpyrazine, maltol, nonanal, and benzaldehyde were predominant volatile compounds in Doenjang.

Results:
A total of 57 volatiles, containing 4 acids, 1 alcohol, 4 benzene derivatives, 10 carbonyls, 16 ester, 5 furan derivatives, 4 phenols, 7 pyrazines, and 6 miscellaneous, were identified in this study. Maltol (3-hydroxy-2methyl-4H-pyran-4-one) and 2,3,5-trimethyl-6-ethyl pyrazine, enhancers of sweet flavor, increased according to the fermentation time. On the other hand, 2,5-dimethylpyrazine, which is responsible for strong beany notes, decreased according to the fermentation time. The ethyl linoleate in the soybean paste had the highest content among all of the compounds identified in the samples. The ester and aldehydes in the samples seemed to be characteristic soybean Deonjang flavor and showed much higher quantities than those of the other flavor groups.

P05-023
Evaluating the Flavor Authenticity of Thermal and High Pressure Processed Single-Cultivar Apple Juice: The Potential of an Integrated and Multivariate Approach
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Introduction:
Today, consumers demand for high quality, minimally processed fruit juices with natural appearance and fresh flavor. Most commercially available juices are pasteurized by thermal processing (TP), causing a loss of sensorial and nutritional attributes. Due to these limitations, in the past few years a lot of research attention has been given to non-thermal technologies, such as high pressure processing (HPP). In that context, it is important to evaluate the capacity of HPP to maintain fresh juice qualities in comparison to TP. Most previous studies followed a targeted approach, where only a particular (set of) quality response(s) is (are) monitored. Focusing on known quality aspects from the start entails that possible unknown effects are overlooked.

Method:
The present work approaches food quality assessment as a multivariate problem. However, in open food science and technology literature, this challenge is rarely exploited. This work applies cutting-edge analytical and data analysis approaches to allow monitoring multiple food quality characteristics at once. As a case study, 3 commercially-relevant apple varieties were selected: Granny Smith, Pink Lady, and Jonagold. The apple juices were pasteurized with HPP and TP targeting an equivalent microbial inactivation. To obtain an increased insight into flavor changing reaction pathways, a wide range of relevant quality parameters were studied combining targeted and untargeted approaches. Targeted approaches were used to analyze a priori selected attributes including sugars, acids and enzymes. As an untargeted approach, a headspace-SPME-GC-MS procedure was used to fingerprint the volatile fractions. Next, multivariate data analyses were used for extracting important information out of these large data sets.

Significance:
This work demonstrated the potential of the multivariate approach for food quality assessment, with a potential to be used as routine/rapid method for food quality control in food industries and research institutes, to provide high quality juices to the consumers.

Results:
In all processed apple juices, the most significant changes of volatiles were detected in classes of esters, aldehydes, terpenes, alcohols, ketones, and sulphur compounds compared to a fresh juice. Some Maillard and lipid degradation reaction products were highly detected after TP. From the taste analysis, sugars and acids were less affected by processing.
**P05-024**

**The Effect of Extracting Conditions on Obtaining Isorhamnetin-3-O-Rutinoside and Its Aglycone in Opuntia Ficus Indica Fruit Extracts**

**S. Paik, Sejong University, Y. Kim, B. Kim, S. Ko, Email: serim0506@naver.com**

**Introduction:** The objective of this study was to analyze the physicochemical properties and cytotoxicity of iron oxide nanoparticles (IONPs) to the developmental and morphological properties of bone marrow cells. The objective of this study was to analyze the physicochemical properties and cytotoxicity of IONPs in bone marrow cells.

**Method:** We compared three different types of iron samples (surface-modified iron oxide nanoparticles (SMNPs), IONPs, and iron citrate) and analyzed their physicochemical properties such as particle size, zeta potential, iron levels, and subcellular localization in bone marrow cells. In addition, the cytotoxicity of IONPs in various kinds of bone marrow cells, iron levels, and subcellular localization of the iron samples in bone marrow cells.

**Results:** The average particle size of IONPs and SMNPs was 207.89 and 219.7 nm, respectively. The size distribution of SMNPs was narrower than that of IONPs, which is an important factor in determining the cellular uptake of nanoparticles. In addition, we examined the cytotoxicity of IONPs in various kinds of bone marrow cells. We analyzed particle size distribution, zeta potential, iron levels, and subcellular localization of the iron samples in bone marrow cells.

**Significance:** Our results may be used to investigate the interactions between nanoparticles and cells and tissues and the developmental toxicity of nanoparticles. Moreover, iron nanoparticles can be used safely in various functional foods.

**P05-026**

**Physicochemical and Sensory Qualities of Irradiated Satsuma Mandarin and Its Identification by ESR Spectroscopy**

**H. Nam, Kyungpook National University, Y. Jo, H. Kyung, Y. Park, S. Lim, D. Ahn, J. Kwon, Email: skagusdk@104@naver.com**

**Introduction:** Satsuma mandarin (Citrus unshiu Marc.) produced in Korea is being exported to many countries due to its attractive taste. A phytosanitary quarantine treatment is essential for the trade of fresh fruits to control the spread of invasive pests now. Irradiation treatment for quarantine purposes has been approved by APHIS/USDA for most fresh fruits at 0.4 kGy, and it was also permitted by the US FDA at up to 1 kGy for insect disinfection. This work was intended to determine the effect of electron-beam irradiation on the quality properties and study the electron spin resonance (ESR) application to detect the irradiation status of Satsuma mandarin.

**Method:** Satsuma mandarin was irradiated using an electron accelerator (3 MeV) at different doses (0, 0.4, 1 kGy) and their microbiological, physicochemical and sensory qualities were measured during storage (0, 5, 10, 15 days) at 4°C. Electron spin resonance (ESR) spectral behavior of fruit peel and flesh were also studied to determine free radicals induced by irradiation.

**Significance:** A phytosanitary irradiation dose at 0.4 kGy could reduce the microbial loads with maintaining qualities of Satsuma mandarin during two weeks of storage at a refrigerated condition. The identification of irradiated mandarin was possible using ESR spectroscopy during storage.

**Results:** The aerobic bacteria were reduced by 1-2 logs by irradiation at 0.4 and 1 kGy. There was no significant difference between nonirradiated and irradiated samples in their physicochemical properties in terms of total acidity, Vitamin C, and total flavonoid content at 0 day of irradiation. Irradiation did not cause a detrimental change in sensory qualities like color, aroma, and texture, while the taste of irradiated samples showed a lower score than the control. Irradiation at 1 kGy caused a decrease in hardness, total phenolic contents, and radical scavenging abilities. The quality properties of samples decreased throughout the entire storage time, however 0.4 kGy as a phytosanitary dose induced negligible changes throughout the entire storage time. Detection of radiation-induced cellulose radicals using ESR spectroscopy was possible exhibiting a clear triplet spectrum with a pair of peaks on the left and right side of the central peak up to the post-irradiation period of 15 days.

**P05-027**

**Preparation of Iron Oxide Nanoparticles and Their Toxicity to Bone Marrow Cells**

**S. Paik, Sejong University, Y. Kim, S. Seo, S. Shin, S. Ko, Email: serim0506@naver.com**

**Introduction:** Iron oxide nanoparticles (IONPs) have been used to develop iron supplements for improving the bioavailability of iron in patients with iron deficiency, which is one of the most serious nutritional deficiencies in the world. Accurate information about the characteristics, concentration, and cytotoxicity of IONPs to the developmental and reproductive cells enables safe use of IONPs in the supplement industry. The objective of this study was to analyze the physicochemical properties and cytotoxicity of IONPs in bone marrow cells.

**Method:** We compared three different types of iron samples (surface-modified iron oxide nanoparticles (SMNPs), IONPs, and iron citrate) and analyzed their physicochemical properties such as particle size, zeta potential, and morphology. In addition, we examined the cytotoxicity of the IONPs in various kinds of bone marrow cells. We analyzed particle size distribution, zeta potential, iron levels, and subcellular localization of the iron samples in bone marrow cells.

**Significance:** Our results may be used to investigate the interactions between nanoparticles and cells and tissues and the developmental toxicity of nanoparticles. Moreover, iron nanoparticles can be used safely in various functional foods.

**Results:** The average particle size of IONPs and SMNPs was 207.89 and 219.7 nm, respectively. The size distribution of SMNPs is narrower than that of IONPs and the dispersion of SMNPs was more stable than that of IONPs. The TEM images indicated that cells and tissues and the developmental toxicity of nanoparticles. Moreover, iron nanoparticles can be used safely in various functional foods.

**P05-028**

**Lipophilic Phytochemicals in Milled Fractions of Barley and the Effect of Baking on These Phytochemicals**

**N. Gangopadhyay, Teagasc Food Research Centre, N. O’Shea, N. Brunton, D. Rai, E. Gallagher, S. Harrison, Email: nirupama.gangopadhyay@teagasc.ie**

**Introduction:** Health beneficial phytochemicals in barley are non-uniformly distributed in the whole grain, and milling results in their redistribution in the milled fractions. Roller-milling has been widely used to fractionate barley, however the lipophilic profile of the fractions...
Phenolic Composition and Antioxidant Activities of Teff (Eragrostis Tef) Flour and Bread
A. Lemma, Alabama A & M University, L. Walker, S. Ogutu, M. Verghese, Email: aberhanu@bulldogs.aamu.edu

Introduction:
Teff, the smallest known cereal grain, is native to Ethiopia. It is a staple in the diet of more than 70% of Ethiopians. Most studies on teff revolve around its agronomic features, potential as an ingredient in baking, and their potential use as ingredients in baking, to improve the overall nutritional constitution of these products.

Results:
Results indicated that lipophilic phytochemicals are concentrated in the bran and semolina fractions of barley. Bran and semolina contained 47% of each total fatty acids in barley, while flour contained a meager 6%. Of the total sterols, bran and semolina harbored 46% and 44% respectively, while flour contained 10%. Bran was also the richest source of tocols with 68%, while semolina and flour contained 23% and 9% respectively of total tocols in barley. In terms of composition, polysaturated fatty acids (PUFA) represented 75% of the total fatty acids in barley fractions, wherein linoleic acid (18:2) was the principal PUFA. β-sitosterol, amongst the sterols, and α-tocotrienol, amongst the tocols, were the dominant compounds. Owing to the rich lipophilic profile of bran and semolina, they are incorporated in baked crackers. The total content of lipophilic phytochemicals in these crackers was higher than the control crackers, and minimal to low losses of these phytochemicals following baking was observed.

Method:
The Folin-Ciocalteau method, the aluminum chloride colorimetric assay, and FRAP and DPPH radical scavenging assays were employed to determine the total phenolics, flavonoids content and the AOC, respectively. Data were presented as mean ± standard deviation of triplicate measurements, and a one-way analysis of variance (ANOVA) with post-hoc Tukey HSD (Honestly Significant Differences) test was used to determine significant differences among treatments.

Significance:
Results obtained from this study suggest that teff flour and bread are good sources of phenolics and flavonoids, and that fermentation enhanced the AOC of teff bread. In summary, teff products in general, and especially its fermented products, have potential to be consumed by a larger population of health conscious consumers and provide health benefits.

Results:
Results showed that injera had a significantly (P<0.01) higher total phenolic content of 580.06±63.72 mg GAE 100 g-1 DM compared to teff flour (503.55±45.51 mg GAE 100 g-1 DM) and unfermented bread (242.55±62.27 mg GAE 100 g-1 DM). Injera had the highest (P<0.01) total flavonoids content and the AOC, respectively. Data were presented as mean ± standard deviation of triplicate measurements, and a one-way analysis of variance (ANOVA) with post-hoc Tukey HSD (Honestly Significant Differences) test was used to determine significant differences among treatments.

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Significance:
Results obtained from this study suggest that teff flour and bread are good sources of phenolics and flavonoids, and that fermentation enhanced the AOC of teff bread. In summary, teff products in general, and especially its fermented products, have potential to be consumed by a larger population of health conscious consumers and provide health benefits.
Introduction:
Currently, the anthocyanin-rich purple fleshed potato peels (PFPPs) are underutilized and wasted. In order to maximize the efficiency of the anthocyanin extraction system, extraction rate of anthocyanin which depends on particle size should be achieved. The pretreatment processes such as drying and grinding can improve the extraction rate and reduce total processing time. The objectives of this study were to (1) estimate the drying characteristics such as the effective diffusion coefficient of PFPPs at a low drying temperature, (2) evaluate the grinding kinetics of PFPPs, and (3) investigate the effect of particle size on the extraction rate of anthocyanin in PFPPs using a stagnant single stage extraction system.

Method:
The peels of the PFPPs were collected from the washed purple fleshed potato and used for experiments. The hot air drying experiments were conducted at 40°C in a horizontal tray dryer. The moisture content and drying rate were calculated from the change of sample weight. Batch grinding was carried out on 30 g of PFPP for 10, 20, 30, 60, and 90 s. The work constants and work index were estimated from the experimental data. Drying and grinding kinetic models were investigated for both pretreatment processes. Anthocyanin content of various size of PFPP particles (0.15, 0.25, 0.43, 0.6, and 1.00 mm) was carried out using pH differential method.

Significance:
Our study demonstrated that the grinding kinetics model is useful to estimate the grinding time to produce an optimum particle size for anthocyanin extraction from PFPP.

Results:
The drying behavior of PFPP was successfully described using thin layer models (Page model and Midilli-Kucuk model). The effective diffusion coefficient of drying temperature at 40°C was determined to be 1.67x -10 -12 m2/s. Grindling time to obtain particles of a specific size was accurately estimated using the grinding kinetics model (R2=0.97). The extraction rate of anthocyanin increased as the particle size decreased, but when the particle size was 0.15 mm, the anthocyanin content decreased. Our study demonstrated that the grinding kinetics model is useful to estimate the grinding time to produce an optimum particle size for anthocyanin extraction from PFPP.

P05-033
Analysis of the Effect of Air Movement in a Hot Air Dryer on the Drying Characteristics of Colored Potato (Solanum Tuberosum L.) Using Computational Fluid Dynamics
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Introduction:
Colored potatoes are a rich source of anthocyanins and powdered forms of dehydrated potatoes are in high demand due to their convenience and versatility of use. Conventional air drying is the most frequently used dehydration method in the food industry. However, no reports have been made to simulate the effect of air movement during the drying process of colored potato. An enhanced understanding of heat and mass transfer would enable to predict the drying process of colored potato.

Method:
The hot air drying experiments were conducted in a commercial lab scale tray dryer at 50, 60 and 70°C. Three different sample sizes (diameter=50mm, thickness=10, 15, and 20 mm) and 3m/s air velocity were used. Samples were placed at 5 different positions during the drying process. The finite element analysis was used to develop a simulation of the drying process. Thermal properties are taken as variable properties with respect to the moisture content and temperature, and heat and mass transfer coefficients are also taken as variable properties with respect to the flow field.

Significance:
Our results can be concluded that the simulation model accurately describes the moisture evaporation and the temperature profiles with variable thermal and physical properties.

Results:
The local air velocity decreased as the distance from the flow inlet increased. The heat and mass transfer coefficients and the effective moisture diffusivity significantly increased as the air velocity increased from 0.150 to 0.795m/s. The drying simulation model using the mass transfer model with an effective moisture diffusivity made accurate predictions. The thermal properties of colored potato, such as the specific heat and thermal conductivity, decreased significantly from 3906.45 to 2198.52J/kg-K and 0.440 to 0.034W/m-1ºC-1, respectively, as the moisture content decreased from 78% to 5%. With the variable thermal and physical properties, the heat transfer simulation model made accurate predictions, and the RMSE values for all cases were 1.85 (±0.27).

P05-034
Hybrid Mixture Theory Based Modeling of Unsatuated Transport Mechanisms Coupled With Poroviscoelastic Deformation in Expanding Starch
P. Takhar, University of Illinois, S. Ditudompaa, Email: ptakhar@illinois.edu

Introduction:
An understanding of the expansion phenomenon during extrusion is necessary to improve the functionality of expanded products. The objective of this research was to formulate a predictive model, which can be used to identify the effect of extrusion conditions on properties of extrudate; investigate the underlying mechanisms using simulations; and predict transport processes and mechanical changes in the extrudates.

Method:
The model consisted of the two-scale unsaturated transport equations coupled with the poroviscoelasticity equations. The transport equations based on Hybrid Mixture Theory were transformed from the Eulerian coordinates to the Lagrangian coordinates. At microscale, the solid and fluid phases of the extrudate were assumed to be viscoelastic and viscous, respectively. The interaction between the viscoelastic solid and the viscous fluids (liquid water, vapor, and air mixture) contained in its pores resulted in a poroviscoelastic matrix at macroscale.

Significance:
The developed modeling approach integrated with relevant experimentation can be used to design, optimize and/or control the extrusion process conditions, and improve the functional characteristics of expanded biopolymers.

P05-035
Aflatoxins in Traditionally Processed Peanuts and Peanut Products From Selected Communities in Ghana
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Introduction:
Peanuts are consumed in Ghana in various products. About 98% of Ghanaians eat peanuts in one form or the other. The quality of peanuts in Ghana has however become a great concern due to incidence of aflatoxins, with levels exceeding those regarded as safe for human consumption. In traditional peanut oil processing, raw peanuts are roasted, ground into paste and mixed with water to extract the oil. The cake obtained after oil extraction is deep fat fried into kulikuli, which is eaten as a snack or ground into a spice mix. Defective peanuts may be diverted to produce the peanut oil. These are suspected to have unacceptable aflatoxin levels.

Method:
This study sought to determine the aflatoxin levels in peanut oil and its by-products. Six samples each of raw peanuts, peanut paste, peanut cake, and peanut oil were collected along the traditional peanut oil processing chain from selected communities in the Northern, Ashanti and Greater Accra regions of Ghana. Samples were analyzed for aflatoxin (types B1, B2, G1, and G2) using the CEN (European Committee for Standardization) method with High Performance Liquid Chromatography (HPLC) procedures.

Results:
The aflatoxin levels detected in the peanut products by far exceeded the set maximum limit of 4μg/kg by the European Union and 20 μg/kg maximum limit by the Codex Alimentarius Commission. Across the regions, the highest total aflatoxin levels detected for raw peanuts, peanut paste, peanut cake, kulikuli and peanut oil were 563.33μg/kg, 76.8μg/kg, 160.69μg/kg and 78.57μg/kg respectively. Aflatoxin B1 and B2 were highest in the raw peanut (522.1 and 41.2μg/kg) peanut cake (100.9 and 16.6μg/kg) and kulikuli (133.8 and 25.0μg/kg) samples, respectively.

Significance:
High aflatoxin levels could be due to improper sorting of raw peanuts posing health risk to consumers. Processors must be trained to implement food safety tools like good manufacturing practices and HACCP (Hazard Analysis and Critical Control Points) including improved sorting methods to remove defective kernels. The results from this study provides baseline data for planning appropriate methods to reduce aflatoxin in peanuts and peanut products in Ghana and results can be transferred to other African Countries having similar peanut products.

P05-036
Hybrid Mixture Theory Based Modeling of Water, Vapor, and Oil Transport in Swelling/Shrinking Foods Subjected to Frying
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Introduction:
Deep fat frying is a popular cooking technique which involves immersing of foods at high temperatures in edible oil for short time durations. Excess fat consumption has been linked to health diseases and hypertension. Optimizing the frying parameters to obtain foods with desirable textural, color and taste attributes with lower fat content is...
a tedious task due to involvement of complex transport mechanisms and un saturated nature of fluid transport (presence of compressible vapor phase in a deformable poroviscoelastic matrix).

**Method:**
Hybrid Mixture Theory based two-scale mathematical model was employed to simulate transport phenomena in foods (French fries and chicken nuggets) during frying. The foods were treated as heterogeneous products. Transport equations were solved using finite element method to obtain spatial and temporal profiles for moisture, fat, pressures, evaporation and temperature.

**Significance:**
A mathematical model helped to understand the mechanisms of fat uptake during frying of foods. In food industry, controlling the frying parameters and negative gage pressure can result in healthier fried foods.

**Results:**
An average absolute deviation (AAD) was calculated for model validation. Existence of high capillary pressure, and negative pore pressures gradients inside the food appeared to be the reason for oil uptake. Most of the oil penetrated only in the coating. Temperature was below 100°C in the most part of food. Temperature values greater than 100°C were witnessed in the outer layers toward the end of frying process. Kinetic equation for color change in chicken nuggets was also obtained as a quality parameter. The poroviscoelasticity equations were derived and solved to model swelling/shrinking behavior of foods during frying. The model also predicted porosity across the cross-section of foods by numerical simulations.

**P05-037**
Investigating the Relationship between Food Properties and Buffering Capacity Using a Standardized Method
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**Introduction:**
During gastric digestion, foods are mixed with acid, lowering the pH and promoting acidic and enzymatic hydrolysis. However, the specific pH in the gastric environment varies based on food resistance to changes in pH, or buffering capacity. Therefore, food buffering capacity is a crucial parameter needed to understand the gastric pH distribution. The objective of this study was to develop a standard method to quantify food buffering capacity, and to characterize the buffering capacity of foods in relationship to particle size and moisture content.

**Methods:**
Twenty foods were selected of varying physical (liquid, semi-solid, solid) and chemical (macronutrient content) properties, such as applesauce, carrot juice, pineapple juice, milk, tomato, and a pre-made protein shake. Solid foods were blended for 15-60 sec. For buffering capacity measurements, pH of 20 g of blended solid or semi-solid food or 20 mL of liquid was measured. 0.2 M HCl was added in quantities of 0.25 to 1.00 mL. The pH was measured after each addition of HCl until it reached 1.5. Particle size was measured using laser diffraction. Six to nine replicates were completed for each food.

**Significance:**
These results form the foundation to characterize the relationship between food properties and buffering capacity. Food buffering capacity will influence gastric pH distribution, which may modify the amount of gastric secretions, resulting in altered food breakdown. This information is crucial in development of food products with pH-dependent properties, or food products for target populations that have modified gastric acid secretions due to disease or other factors.

**Results:**
Food type significantly influenced buffering capacity, quantified as the mL HCl necessary to reduce the sample pH by one pH unit (< 0.0001). Buffing capacity ranged from 2.82 ± 0.30 (applesauce) to 4.67 ± 0.08 (tomatoes) mL HCl per pH unit reduction. Initial pH and median particle diameter did not influence buffering capacity. For example, tomato and the protein shake had statistically equivalent buffering capacities (average 4.63 mL HCl per unit pH reduction), although tomato had a lower initial pH compared to the protein shake (4.34 vs. 6.73, respectively) and a higher median particle diameter (473 vs. 34 μm, respectively).

**P05-039**
Encapsulation of Probiotic Lactobacillus Acidophilus Using Phytic Acid and Chitosan via Electrostatic Extrusion for Enhanced Survival Under Harsh Processing and Distribution Conditions With Special Reference to Yogurt
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**Introduction:**
Probiotics are widely applied to different food products for health benefits. Modern consumers are increasingly interested in products fortified with probiotics. There is a great need to protect probiotic bacteria from harsh conditions during food processing and distribution. In addition, post-acidification during storage results in development of undesirable taste and decrease in live cultures of acid sensitive bacteria due to strong acid. The aim of this work was to develop a new encapsulation method using biocompatible and biodegradable wall material to effectively protect lacticobacillus against harsh conditions of processing and post-acidification.

**Method:**
Probiotic capsules were prepared by dropping chitosan-probiotic solution into diluted phytic acid (PA) solution. The probiotic capsules were then exposed to various simulated conditions of industrial food processing. For determining protective ability against the thermal process, free L. acidophilus and encapsulated L. acidophilus were incubated at 63°C for 30 min. The effect of osmotic stress using sugar solution and accelerated oxidation using UV light against bacterial survival was also studied. The probiotic capsules were applied to yogurt for storage study.

**Significance:**
Overall results showed that chitosan-PA capsules protected L. acidophilus effectively from simulated harsh conditions of processing and during storage.

**Results:**
Scanning electron microscopy images showed that capsules were of spherical and porous structure with particle size ranging from 1.2 to 1.4 mm. L. acidophilus was entrapped in porous matrix and loading capacity was 8.13 log CFU/g. Encapsulated L. acidophilus showed 1.56, 0.55 and 0.39 log reduction, while free L. acidophilus showed 6.17, 2.49, 1.93 log reduction after heat, osmotic stress, and oxidation treatments, respectively. Encapsulated L. acidophilus showed 1.90 log reduction; whereas free cells showed 4.36 log reduction after 4 weeks of storage period at 10°C. The pH of yogurt containing encapsulated cells was 4.41; whereas the pH of yogurt containing free cells was 4.02 after 10 weeks storage.

**P05-040**
Validation of a TTI Based Seafood Safety Management System for Monitoring Vibrio Parahaemolyticus Risk in Oysters
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**Introduction:**
Time Temperature Integrators (TTI) are simple, inexpensive devices that indicate an easily measurable, time-temperature change, directly dependent on the temperature history of the food product they are attached to. Implementing a TTI based system may be used for a realistic control of the chill chain and efficient management of either shelf life, quality changes, risk assessment, and/or bacterial growth prediction. The current TTI technology and a scientific approach with regards to quantitative study of safety risk in foods allow the undertaking of the next important step i.e. the application of TTIs to manage safety risks of foods. It has been reported that infections caused by pathogens commonly transmitted through food have declined, or are approaching targeted national levels, with the exception of Vibrio infections. Growth of Vibrio spp. in shellfish after harvest is a typical time-temperature relationship which can be used as a predictive model for growth. Vtsab has initiated a development program for suitable enzymatic Vibrio TTI formulations. The aim of the study was to validate existing predictive models for Vp growth in oysters and to evaluate the applicability of the Vtsab enzymatic TTI smart labels for monitoring Vibrio parahaemolyticus risk in oysters during distribution and storage.

**Method:**
Oysters (Crassostrea gigas) were inoculated with Vibrio parahaemolyticus, placed in plastic trays with attached Vp-TTI labels and stored isothermally at 0-30°C and at variable conditions. Temperature was constantly monitored with electronic data loggers. Vp load at predetermined times was estimated based on the response of the TTI and was compared to actual measured Vp enumeration.

**Significance:**
The results of the study indicate that the developed Vp-TTIs can be a powerful and a cost effective tool in validating improved handling and cooling procedures and monitoring the distribution of oysters locally as well as for longer transports.

**Results:**
The comparison between the experimental (actual) and predicted by the TTI microbial condition. Temperature was constantly monitored with electronic data loggers. Vp load at predetermined times was estimated based on the response of the TTI and was compared to actual measured Vp enumeration.

**Significance:**
The results of the study indicate that the developed Vp-TTIs can be a powerful and a cost effective tool in validating improved handling and cooling procedures and monitoring the distribution of oysters locally as well as for longer transports.

**Results:**
The comparison between the experimental (actual) and predicted by the TTI microbial load was based on the accuracy and bias factors. Vb spp. risk in oysters, using validated kinetic models, can be estimated at any point of the chill chain if the temperature history is known.

**P05-041**
Assessing the Influence of a Chitosan Layer on Curcumin Nanoemulsions Bioavailability and Apparent Permeability Coefficient
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**Introduction:**
Driven by consumers’ awareness towards a healthier life style, food industry is seeking edible nanosystems able to encapsulate, protect, and release bioactive compounds, and that should offer the possibility to create new, healthier, and safer food products while improving their quality. Nanoemulsion-based technology offers the methodologies to encapsulate, protect, and control release, while improving the solubility and bioavailability of these compounds. The main purposes of this study were to evaluate the behavior of lipid-based nanosystems under in vitro digestion and to assess the cytotoxicity, cellular antioxidant activity, apparent permeability coefficient, and cellular uptake using Caco-2 cells line of undigested nanosystems.

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**Method:** Curcumin-loaded nanoemulsions and multilayer nanoemulsions were successfully developed using high-pressure homogenization and high-pressure homogenization followed by layer-by-layer (LbL) electrostatic technique.

**Significance:** This study suggests that lipid-based nanosystems can be designed as delivery systems offering the opportunity to create functional foods able to maximize curcumin antioxidant capacity.

**Results:** The size stability and zeta potential studies showed that both lipid nanosystems were stable during storage (35 days), obtaining hydrodynamic diameters values of 185.6 ± 3.9 nm and 189.1 ± 3.4 nm and zeta potential values of -51.9 ± 2.4 mV and 40.1 ± 1.2 mV for nanoemulsions and multilayer nanoemulsions, respectively. Results showed that both nanosystems were stable at stomach conditions, whereas creaming and phase separation occurred at intestine conditions. The deposition of a chitosan layer onto the nanoemulsions did not significantly increased (p>0.05) the curcumin bioaccessibility of 41.6 ± 6.2 % when compared to the nanoemulsions bioaccessibility of 31.6 ± 4.9 %.

**Significance:** This study revealed that both water and ethanol extracts of Cephalania syriaca grains were efficient for obtaining better dough properties. The results were also important because the extracts were found to have potential benefits for dough strengthening and increasing the use of weak wheat flours for breadmaking.

**Results:** Determination coefficient of the established model was found to be 0.97 for both water absorption and stability of the dough respectively, which indicates the independent factors satisfactorily described the change in dependent factors. Both mixture and response factors significantly affected dough properties. Water absorption capacity was mainly influenced by water extract addition, while increasing ethanol extract concentration in the W/E ratio provided an increase in stability of the dough. The optimum extract concentration and W/E ratio for desirable farinograph properties of the dough were 0.59% and 20/80, respectively.

**Method:** In this study, extracts were obtained from defatted Cephalania syriaca grains using water and ethanol as solvent for 12 hours at 50°C. A combined design that was composed of mixture and response design was performed to optimize both extract amount and water/ethanol (W/E) extract ratio considering farinograph properties of the dough. Extracts obtained from water and ethanol were selected as mixture factors and each of their concentrations varied between 0 and 100%. Regarding response design, the extract amount incorporated into the dough ranged from 0.1% to 0.6%.

**Significance:** Farinograph Study Strengthening of Weak Wheat Flour Dough for Breadmaking: A

**Introduction:** The microalgae Haematococcus pluvialis is considered a good candidate for producing natural astaxanthin (3,3’-dihydroxy-b,b’-carotene-4,4’-dione, ASX), and ASX is a high-value carotenoid with strong antioxidant properties which has many applications in the food, nutraceutical, cosmetic, and feed industries. ASX has strong antioxidant properties due to a highly unsaturated molecule. Therefore, ASX can easily be degraded by heat, light, and oxygen during processing and storage. Encapsulation of ASX by β-cyclodextrin has developed to increase the stability of ASX. However, quantitative information on ASX encapsulation on storage stability is still very limited; therefore, the objective of this study was to establish the kinetics model of ASX retention by encapsulation and storage temperature.

**Method:** In this study, the stabilities of ASX and β-cyclodextrin encapsulated astaxanthin (CD-ASX) were analyzed under various storage conditions, namely, storage temperature (25, 40, 45, and 50°C), and storage atmosphere (in a sealed tube and an uncovered tube) to evaluate kinetic parameters of astaxanthin degradation.

**Results:** The results showed that the kinetic model of ASX and CD-ASX retentions were the zeroth reaction order. In addition, the reaction rate constant k values increased at higher storage temperature, and there were significant difference between uncovered and sealed conditions. Therefore, temperature and air significantly affected the stability of ASX. ASX retention rates were plotted with the inverse of different absolute storage temperatures, and then the activation energy (Ea) was obtained according to Arrhenius’ equation. The results showed that the Ea of ASX after encapsulation in the sealed condition increased from 56.82 kJ/mol to 113.08 kJ/mol. The Ea of ASX after encapsulation in the uncovered condition increased from 51.72 kJ/mol to 106.02 kJ/mol.
Western blot. These monoclonal antibodies specific to flagellar antigens were applied to immunochromatographic fingerprint analysis (IFA) for identification and subtyping of *Salmonella*.

**Significance:**
The developed IFA method is both specific and sensitive and thus could be valuable as a diagnostic assay to identify and differentiate *Salmonella* at subspecies levels.

**Results:**
The IFA method developed consists of three major steps including limited proteolysis, 2-D/SDS-polyacrylamide gel electrophoresis, and Western blot. In brief, the flagellar antigens were extracted from cultures using glycine-hydrochloride and treated with various proteasens (Trypsin, Lys-C, Glu C, Asp-N, and Arg-C). The resulting protolytic fragments were separated by 2-D/SDS gels and transferred to nitrocellulose membranes. Western blots were performed using a cocktail of flagella-specific monoclonal antibodies. The antigenic fragment patterns were captured by a digital imaging system and subsequently analyzed with image-analysis software. The resulting protolytic fragments yielded more than 15 detectable peptides with molecular mass ranging from 52 kD to 16 kD and isoelectric point ranging from 4.6 to 5.1. Comparisons of the fingerprint heterogeneity generated from limited proteolysis enable the differentiation of *Salmonella* serotypes.

**P05-046**
Integrated Treatment of UV Light and GRAS Organic Acid for Inactivation of *E. coli* O157:H7 and *Salmonella Enterica* on Spinach Leaves
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**Introduction:**
Current chlorine-based washing practice for decontamination of produce surface have limited efficacy and may produce potentially harmful toxic compounds that raise safety concerns. There is a need to develop a safe and effective alternative strategy to chlorine-based sanitizers wash. The purpose of this study was to evaluate the effect of integrated treatment of low dose UV-C light and organic acids on the reduction of *Escherichia coli* O157:H7, *Salmonella enterica* inoculated on spinach leaves.

**Method:**
A bacterial cocktail containing a three serotype mixture of *S. enterica* (S. Montevideo G4639, S. Newport H1275, and S. Stanley H0558) and a three strain mixture of *E. coli* O157:H7 (C9490, E02128, and F00475) were used for this study based on their prevalence with produce related outbreaks. Spinach leaf surfaces were spot inoculated with approximately 10⁶ to 10⁷ CFU/mL. Inoculated leaves were subjected to UV-C dose (0.6 kJ/sq. m) followed by organic acid washing with three different concentration of lactic and citric acid mixtures. Influence of treatment protocol on spinach color, texture, and background microflora was also determined.

**Significance:**
Results from this work suggest that integrated treatment of UV-C and GRAS organic acid wash could be a promising alternative to chlorine based washing practice.

**Results:**
Results indicated that combination of UV-C irradiation and organic acid based washing can significantly reduce the population of common foodborne pathogens. Inactivation efficacy was dependent of both acid concentration and treatment time. Effectiveness of UV-C and organic acid sanitizer wash was dependent of treatment intensity and target pathogen. *Salmonella enterica* was more sensitive to treatment strategy than *E. coli* O157:H7. Mixed acid (lactic plus citric), at 1% for 2 min exposure provided 3.9±0.6 log CFU/mL with excellent sensitivity and practicability.

**P05-048**
Isolation of Bacteriophage Phda10 and Combined Effect of Phda10 and Calcium Acetate for Growth Inhibition of Histamine-Producing *Photobacterium Damselfae* Subsp. Damselfae
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**Introduction:**
Scombroid or histamine poisoning is a major seafood-borne disease. *Bacteriophages (phage)* of the histamine-producing marine bacteria and can be a causative agent of histamine poisonings due to its strong ability of histamine production. Bacteriophages (phage) are bacterial viruses, and their antimicrobial potential is attractive for controlling *V. parahaemolyticus* during storage at different temperature (4, 7, 15, 20, 25, and 30°C). The bacterial concentration was determined by using real-time PCR combined with propidium monoxide treatment. The Baranyi model, square root model and non-linear Arrhenius model was employed to fit the behavior of *V. parahaemolyticus*. And the developed model was validated by using the independent data obtained from shrimp harvested from the same region stored at 18, 23, and 28°C.

**Significance:**
This study will fill in the gap of traditional predictive microbiology and improve significantly the accuracy of microbial risk assessment.

**Results:**
Naturally-occurring *V. parahaemolyticus* inactivated at 4 and 7°C with average rates of -0.019 and -0.025 Log CFU/g/h, and grew at 15, 20, 25, and 30°C with average umax of 0.044, 0.105, 0.179 and 0.336 Log CFU/g/h and the average λ of 15.45I, 7.259, 4.427 and 3.741 h respectively. The bias and accuracy factors were 0.963 and 1.066 for square
root model and 1.054 and 0.974 for non-linear Arhenius model, which indicated that the models could reliably predict the behavior of \textit{V. parahaemolyticus} in shrimp. Furthermore, the behavior of naturally-occurring \textit{V. parahaemolyticus} in post-harvest shrimp was significantly different from artificially contaminated \textit{V. parahaemolyticus} in sterilized shrimp. That indicated the traditional predictive model based on artificially contaminated \textit{V. parahaemolyticus} might incorrectly estimate the risk of this pathogen.

**P05-051**

**Inactivation of Salmonella Typhimurium on Red Chili Peppers by Treatments of Gaseous Chlorine Dioxide and Heated-Air Drying**

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**Introduction:**
Red chili peppers are frequently used to produce various powdered spices in worldwide. The peppers have been contaminated with microorganisms during cultivation, distribution, or drying process. In addition, food poisoning outbreaks including Salmonella spp. were detected from chili peppers or powdered spices. We determined inactivation of \textit{Salmonella Typhimurium} on red chili peppers by treatments of gaseous ClO2 and heated-air drying.

**Method:**
Pepper samples inoculated with \textit{S. Typhimurium} (ca. 5.0 log cfu/sample) were exposed to gaseous ClO2 generated from 0.33 or 0.77 ml of aqueous ClO2 at 35°C for 6 h (RH 100 %) and heated-air dried at 55°C for up to 24 h. Populations of \textit{S. Typhimurium} and total aerobic bacteria (TAB) on pepper samples treated with ClO2 gas and heated-air-dried were determined. Color and aw values of the samples were also monitored.

**Significance:**
These results show that treatment of gaseous ClO2 prior to heated-air drying effectively enhances microbiological safety of dried chili peppers or powdered pepper spices.

**Results:**
Populations of \textit{S. Typhimurium} on the samples significantly decreased by 2.3-2.5 log cfu/sample, regardless of ClO2 concentrations, after 15 min of exposure to gaseous ClO2 and the bacterium was completely eliminated on samples treated with ClO2 gas evaporated from 0.33 ml (peak ClO2 gas concentration: ca. 213 ppm) or 0.77 ml (peak ClO2 gas concentration: ca. 410 ppm) of aqueous ClO2 within 4 or 2 h, respectively. Regardless of ClO2 gas concentrations, TAB counts (7.1 log cfu/sample) also significantly reduced to 4.8-4.9 log cfu/sample and below detection limit (1.7 log cfu/sample) after 15 min and 2 h, respectively, of ClO2 gas treatment. Color (L, a, b) values of the samples did not change during treatment of gaseous ClO2 but significantly decreased after 12 h of heated-air drying. The aw value (0.94) of the samples began to significantly decrease to 0.83 and 0.18 after 6 and 12 h, respectively, of heated-air drying.

**P05-052**

**Listeria Monocytogenes Strain WaX12 Isolated From China Contained Five Prophages Revealed by Comparative Genomic Analysis**

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**Introduction:**
Listeria monocytogenes, a food-borne pathogen, can cause listeriosis via contaminated food products. Listeriosis caused by \textit{L. monocytogenes} manifests as gastroenteritis, meningitis, mother-to-fetus infections and septicemia. \textit{L. monocytogenes} WaX12, which isolated from chilled pork, belonged to serotype 1/2a. Because about 95% of human listeriosis cases are caused by serotypes 4b, 1/2a, and 1/2b, researching \textit{WaX12} strain is valuable for its character.

**Method:**
For Illumina pair-end sequencing of \textit{WaX12}, at least 3μg genomic DNA was used for sequencing library construction. Paired-end libraries with insert sizes of ~300bp were prepared following Illumina's standard genomic DNA library preparation procedure. The 	extit{WaX12} genome sequencing was performed using Illumina MiSeq sequencing technology with approximate genome size of 23-27 kb. One-step growth curve showed that the latent concentration was determined to be 5.36 × 10^{11} PFU/mL. TEM images showed that the 	extit{WaX12} bacteriophage was confirmed by using TEM. The DNA of 	extit{WaX12} bacteriophage was extracted using by PEG precipitation and CsCl density gradient ultra-centrifugation. The morphological characteristic of the 	extit{KFS-A9} bacteriophage was examined using the plaque assay. These results show that treatment of gaseous ClO2 prior to heated-air drying effectively enhances microbiological safety of dried chili peppers or powdered pepper spices.

**Significance:**
These results show that treatment of gaseous ClO2 prior to heated-air drying effectively enhances microbiological safety of dried chili peppers or powdered pepper spices.

**Results:**
Populations of \textit{S. Typhimurium} on the samples significantly decreased by 2.3-2.5 log cfu/sample, regardless of ClO2 concentrations, after 15 min of exposure to gaseous ClO2 and the bacterium was completely eliminated on samples treated with ClO2 gas evaporated from 0.33 ml (peak ClO2 gas concentration: ca. 213 ppm) or 0.77 ml (peak ClO2 gas concentration: ca. 410 ppm) of aqueous ClO2 within 4 or 2 h, respectively. Regardless of ClO2 gas concentrations, TAB counts (7.1 log cfu/sample) also significantly reduced to 4.8-4.9 log cfu/sample and below detection limit (1.7 log cfu/sample) after 15 min and 2 h, respectively, of ClO2 gas treatment. Color (L, a, b) values of the samples did not change during treatment of gaseous ClO2 but significantly decreased after 12 h of heated-air drying. The aw value (0.94) of the samples began to significantly decrease to 0.83 and 0.18 after 6 and 12 h, respectively, of heated-air drying.

**P05-054**

**Isolation and Characterization of New Aeromonas Hydrophila SNUFFPC A9: Specific Bacteriophage for the Development of Rapid Detection**

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**Introduction:**
Aeromonas has recently gained more attention due to the increasing outbreaks in food and multiple-drug resistance. Recent increasing outbreaks of \textit{A. hydrophila} have raised concerns about the lack of rapid, reliable, and on-site applicable detection method. Therefore, a bacteriophage as a bio-recognition element is essentially required for the development of rapid and practical biosensor method.

**Method:**
An \textit{A. hydrophila} SNUFFPC A9-specific bacteriophage (referred to as \textit{KFS-A9}) was isolated and purified from waste water of chicken plants using by PEG precipitation and CsCl density gradient ultra-centrifugation. The morphological characteristic of the \textit{KFS-A9} bacteriophage was confirmed by using TEM. The DNA of \textit{KFS-A9} bacteriophage was extracted using by DNA extraction kit and analyzed by gel electrophoresis for the determination of its DNA size. One-step growth curve, pH stability, thermal stability, and calcium ions effect of the \textit{KFS-A9} were examined using the plaque assay.

**Significance:**
These results show that treatment of gaseous ClO2 prior to heated-air drying effectively enhances microbiological safety of dried chili peppers or powdered pepper spices.

**Results:**
The \textit{KFS-A9} bacteriophage against \textit{A. hydrophila} SNUFFPC A9 showed sufficient possibility for the development of biosensor method as a new bio-recognition element. The optimum range of pH and temperature of the \textit{KFS-A9} bacteriophage was pH 7.0-11.0 and 4-37°C. The addition of 1 M CaCl2 was significantly increased the adsorption rate of the \textit{KFS-A9} bacteriophage against \textit{A. hydrophila} SNUFFPC A9 (P < 0.05).

**P05-056**

**Development of an Accelerated Migration Test to Predict Migration for Long Term Storage in Food Cans**

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**Introduction:**
Consumer demand has caused food companies to start replacing epoxy lined food cans in favor of Bisphenol A (BPA) free coatings. Because of this coating switch, several studies were undertaken by the Food and Drug Administration (FDA) to verify whether current FDA migration testing protocols, predict migration from can coatings into food or food simulants during long term storage. The study, performed using several types of can linings, suggested that protocols may need to be modified in order to estimate migration for extended storage time. The aim of this experiment was to develop an accelerated migration test that could be used to modify the current FDA Chemistry Guidance Document for Food Contact Notifications.
Chitosan/Food Dye(s) Conjugate-Based Indicator for Irreversible Coloration of Fermented Foods

Method:
Fifty percent ethanol food simulant was placed in contact with three different types of can coatings including epoxy-resins, polyesters and acrylic-phenolics at 60°C. Migration times were from 4 hours to 30 days. Previously identified oligomers and monomers were monitored during the migration by using HPLC coupled to three different detectors (DAD, MS/MS and HRMS). Data was compared with results obtained in previous studies where a long term migration experiments at 40°C were conducted.

Significance:
These results suggest that the accelerated migration test at 60°C in 50% ethanol could simulate real migration from food cans into food or food simulants for long term storage.

Results:
Equilibrium/depletion was reached for BPA and BPA derivatives in the epoxy coating at 10 days, 60°C. Concentrations for BPA and cyclo-di-BADGE at equilibrium/depletion were 71 ng/mL and 2 µg/mL respectively. These results are similar to those previously obtained at 40°C when steady state was reached after 30 days of migration testing. For the other coatings, an increase in concentration for most of monomers and oligomers occurred during the migration experiment. For most of analyzed compounds, migration testing at 60°C appeared to provide a closer estimation of migration during long term storage. For example, the concentration of benzoguanamine migrating from an acrylic-phenolic coatings at 30 days was 87 ng/mL, while in the test at 40°C, 72 ng/mL was measured when equilibrium was achieved at 180 days.

P05-057
Development of Antimicrobial Food Packaging by Incorporating Antimicrobial Molecule-Nanoparticles System in Bio-Based Polymers

Method:
The effects of the concentration of modified nanoparticles with benzoate in bio-based polymer poly (hydroxybutyrate-co-valerate) (PHBV) on mechanical properties and release kinetics of benzoate was studied. The effect of temperature on release kinetics of benzoate was also studied. All statistical analysis was done using Minitab 15.1. One-way analysis of variance (ANOVA) and Tukey's multiple comparison tests at 95% confidence level were applied.

Significance:
A new method to develop antimicrobial food packaging was presented by incorporating antimonal-nanoparticle system into polymeric matrix. This study suggested the potential use of these new hybrid materials with antimicrobial agents as antimicrobial food packaging.

Results:
The concentration of modified nanoparticles showed significant effects on mechanical properties of PHBV films and release kinetics of benzoate from the films. Tensile strength increased with the increase of concentration of modified nanoparticles reaching a maximum at 2% loading and then started to decrease. The release of benzoate into DI water from PHBV composite films followed pseudo-Fickian behavior fitted with power law model and was also fitted into Weibull model, indicating Fickian behavior.

P05-058
Chitosan/ Food Dye(s) Conjugate-Based Indicator for Irreversible Indication of Carbon Dioxide Level in Packaged Fermented Foods

Method:
3 g of chitosan powder was added to 100 mL of 0.1 M aqueous HCl solution and stirred for 2 h after adjusting pH to 5.5, yielding a 0.3% (w/v) chitosan solution. Then food color dyes (Yellow 4 and 5) were added into the chitosan aqueous solution to prepare chitosan/edible dye conjugate (CEDC). The CO2 indicator was tested every 1 hour to confirm its responsiveness to the CO2 concentration. The pH changes were determined using a pH meter. Changes in the transparency were measured at 680 nm using a UV-spectrophotometer.

Significance:
Novel food grade indicators were developed for monitoring of food quality and can readily be applicable to packaged fermented foods.

Results:
Transparencies of the indicators at different pHs (7.0, 5.3, and 7.0 by re-neutralization) showed the property of chitosan that it cannot reunite with color dye and the indicator was not returned to its original state. Compared with BB dye incorporated indicator, significant increments of transparencies from 10-18% to 61-74% were observed in the CEDC as pH decrease from 7.0 to about 5.3. In the storage test, the CEDC suspension was placed in a 100% CO2 atmosphere for 12 hours. With the suspension pH decreased (from 7.0±0.2 to 5.3±0.2), its transparency increased from 15%±5% to 70%±5%. A good CO2 indicating performance was observed, which evidenced CEDC could be a better candidate for the development of CO2 indicators than BB dye-based chitosan conjugate.

P05-059
Hydroxypropylated High-Amylese Cornstarch Films Produced by Extrusion

Method:
The effects of extrusion processing conditions, such as starch/plasticizer ratio, temperature profile, and screw speed were investigated. Starch pellets were prepared by feeding the raw materials (starch, glycerol, and water) into a single-screw extruder (C.W. Brabender, Germany) at up to 130°C of temperature. Pellets were sheet-extruded using a 100 mm wide film die in a single-screw extruder that melted it first up to 140°C and cooled to 100°C. Duncan's multiple range test (p<0.05) was used to determine the statistical differences among the mean values.

Significance:
Study on thermoplastic properties of starch is important in understanding application potential for abundant biomass. Physical and chemical modifications of starch are essential in creating films with desirable properties. Starch-based films produced in this study can have a variety of industrial uses, such as disposable bags, containers, forks and knives, and garbage bags. Starch-based films reduce the use of petroleum feedstock and enhance biodegradability of food/non-food packaging materials.

Results:
Based on the experimental results, optimum extrusion processing parameters could be: weight ratio of starch/glycerol/water (g), 90:20:56:47:97; temperature profiles (along the extrusion direction), 75-130-140°C for pelletization, and 75-160-90-90°C for sheeting, and screw speed 75 rpm for the extruder used. Under these conditions, HPHACS was fully gelatinized (this was confirmed by both polarized microscopy and differential scanning calorimetry) and consequently, strong but flexible film (tensile strength: 8.98 MPa; elongation at break: 17.65%) could be obtained.

P05-060
Evaluating the Effectiveness of Cooling Techniques for Chili Con Carne

Method:
Large recipes are commonly used in child nutrition programs. Improper cooling of food is a major contributing factor to foodborne illnesses. Requirements in the FDA's Food Code 2013 state food should cool from 135°F to 70°F (57.2°C to 21.1°C) within two hours and from 135°F to 41°F (57.2°C to 5°C) within a total of six hours. Cooling foods within these time and temperature parameters is essential to prevent foodborne illness outbreaks, especially for vulnerable populations like children. Identifying cooling methods that are effective and feasible is an important component to reduce public health risks.

This research is a continuation of previous studies to determine the effectiveness of cooling methods used in school nutrition programs by identifying which procedures best meet cooling requirements in the Food Code.

Method:
Chili was cooked to 165°F, portioned to 5.1 cm (2-inch) or 7.6 cm (3-inch) depths in stainless steel counter pans, and cooled to 140-135°F. Pans were covered with a single
layer of foil, two layers of foil, or left uncovered; and cooled in a walk-in freezer (−4°F, −20°C) or on an ice bath placed in a walk-in refrigerator (39°F, 4°C). Temperatures were monitored every 60 seconds for 8 hours. One way ANOVA was used to analyze differences between cooling methods.

Significance: This study provides information about best practices for cooling large quantities of food following the Food Code 2013 guidelines using commercial kitchen equipment. Using the methods presented to cool food can strengthen food safety practices in schools by preventing the growth of potential pathogens and, therefore, protecting students from foodborne illnesses.

Results: At 2 hours, a significant difference was found between the freezer and ice bath (p < .0001); the depths of the pans (p = 0.0082), and the pan covering method (p = 0.0001). Three cooling methods reached the 70°F (21.1°C) as recommended by FDA. At 6 hours, a significant difference was found between the depths of the pans (p = 0.0083) and the pan covering method (p = 0.0020). Five cooling methods reached 41°F (5°C). Three cooling methods met Food Code requirements: uncovered 2-inch and 3-inch pans in the ice bath and uncovered 2-inch pan in the freezer.

P05-061 Effect of Pre-Cooking and Addition of Phosphate on the Quality of Catfish Fillets Cooked in Pouches in Boiling Water C. Li, USDA, P. BecTHEL, J. Bland, Email: spratrich@gmail.com

Introduction: Cooking or reheating food in a vacuum-sealed bag has been a common method of preparing vegetables, meat and poultry products. There are very few examples of vacuum-sealed bags designed for cooking or reheating catfish fillets. The objective of the present study was to examine the properties of raw frozen and precooked frozen catfish fillets in that were cooked in vacuum-sealed pouches in boiling water. The effects a commercial phosphate blend on properties of boiled raw frozen and precooked frozen catfish fillets was also evaluated.

Method: Both fresh and frozen (containing a commercial phosphate blend) fillets were purchased from a commercial Mississippi catfish processor and stored frozen. Fillets (5-7 oz) were trimmed and cut into three pieces each weighing approximately 50 g. For the experiment, 6 fillet pieces were used for each treatment. Treatments included plus and minus oven precook and plus and minus phosphate. After boiling in pouch, sample analysis included weight loss, moisture content, color (L*a*b*) using a Minolta colorimeter, pH, and texture (hardness) using a TA.XT Plus Texture Analyzer. Precooked pieces of fish were prepared by cooking the fish in a 121°C oven until an internal temperature of 60°C was obtained, followed by storing frozen until analyzed or cooked to 93-98°C in a pouch in boiling water.

Significance: This study will be used to develop precooked catfish products that can be reheated in a vacuum-sealed bag placed in boiling water.

Results: Preliminary studies indicated boiling in water for 15 minutes was the best for frozen catfish fillet pieces of −50 g to reach a uniform temperature of −95°C. Both raw frozen and precooked frozen fillets containing phosphate showed significantly lower moisture loss after cooking (less than 2.1%) relative to the fillets without phosphate, which had a 4.7-5.6% moisture loss. Color analysis showed a notable increase in yellow color after cooking, with a higher b* value for fillets without phosphate. Similar texture properties were observed between treatments, however, an overall harder texture (~1.4 times, determined by average peak force per thickness) was determined for fillets without phosphate.

P05-062 The Effect of Reusing Syrup on the Stability of Dried Guava Obtained by Osmotic Dehydration S. Germer, Institute of Food Technology, M. Silva, F. Ibrahim, E. Guerreiro Souza, Email: silviagermer@gmail.com

Introduction: The osmotic dehydration (OD) is an alternative process, whose economical feasibility depends on the reuse of the solution. However, the reconditioning/reuse process may result in physical-chemical changes that may influence the quality and stability of the products. In this context, the aim of this study was to evaluate the effect of the sucrose syrup reuse in the stability of dried guava during storage.

Method: A trial of 15 OD cycles (Pulama variety/65ºBrix sucrose syrup/45°C/4 hours) was carried out beginning with new syrup at the first cycle and employing reconditioned syrup (vacuum concentration) at subsequent ones. The products obtained at the 1st (C1) and 15th (C15) cycles were hot air dried (65°C/4 hours), packaged (PET/Al/PEBD) and stored at 25°C and 35°C (RH=65%) for 200 days. Periodical analyses were carried out: Vitamin C, lycopene and color. The degradation kinetic models and the respective reaction rate constants (k) and Q10 values were determined.

Results: A 1st order model fitted the vitamin C loss (R2=0.91), and k for C1 and C15 at 25°C were respectively 0.0022 ± 0.0042 (day-1). The average Q10 of 2.6 indicates a high temperature sensibility reaction. The lycopene degradation were fitted by a first order model, and the k values for C1 and C15 (25°C) were respectively 0.0043 ± 0.0052 (day-1). The average Q10 of 1.0 shows a temperature independent reaction. The Chroma and Difference of Color variations (ΔE) were fitted by a zero order model (R2=0.97 and 0.98). The k values for C1 and C15 (25°C) were respectively 0.0343 and 0.0498 (day-1) (Chroma); 0.0457 and 0.0499 (day-1)(ΔE). The average Q10 of 2.60 and 2.51 indicates a high temperature sensibility reaction.

Significance: The results point out to a likely effect of reusing syrup on the stability of the products regarding the assessed properties, mainly concerning the Vitamin C content.

P05-063 Chemical, Microbial, and Sensory Properties of Low-Sodium Kimchi With Fermented Soybean Curd Residue J. Eun, A. Jeong, Email: jibuen@konnam.ac.kr

Introduction: Fermented fish sauce (aekjeot), one of the ingredients for kimchi, could be perceived negatively due to its high level of sodium content and biogenic amines. Also, its excessive salty taste and strong fishy smell cause low preferences of kimchi among foreigners. To overcome these issues, fermented soybean curd residue (SCR) can be used after natural fermentation, producing high levels of free amino acid (FAA). Therefore, the objective of this study is to investigate the availability of fermented SCR to replace aekjeot as a flavor-enhancer for manufacturing low-sodium kimchi.

Method: Kimchi with SCR fermented at 55°C for 0, 24, 48, and 72 h was fermented at 10°C for 10 days. SCR fermented for 72 h could not be used further study, because of the off-flavor.

Results: Change of pH, titratable acidity, and reduced sugar content was similar in all samples during fermentation, except for kimchi with added SCR without fermentation (SO). Salinity of kimchi with added aekjeot (control) was higher than the others, but the numbers of lactic acid bacteria of kimchi with added SCR were higher than control and maintained the level of 8 log cfu/g after 2 days of fermentation time. Total FAA content of kimchi with added SCR fermented for 48 h (S48) was highest following control, kimchi with added SCR fermented for 24 h (S24) and SO. In sensory evaluation, there were no significant different, except for redness (lowest in SO) and saltiness (highest in control).

Significance: Chemical characteristics in S24 and S48, kimchi with added SCR fermented for more than 24 h, did not change significantly during fermentation compared to control, and SCR fermented for 48 h has the highest FAA content. In conclusion, SCR fermented for 48 h could be a good substitute for aekjeot due to its higher FAA and lower salinity.

P05-064 Consumer Evaluation of Persimmon (Diospyros Kaki) Varieties for a Chip-Style Product R. Woods, USDA-ARS, S. LaFond, R. Milczarek, J. Preece, A. Breksa, Email: rachelle.woods@ars.usda.gov

Introduction: Asian persimmons (Diospyros kaki) are grown across the state of California, but the availability of this fruit outside the growing area and harvest season is limited. A dried, chip-style product would extend the geographic area and timeframe in which persimmon growers could sell their fruit. Persimmons come in 3 astringency types (astringent, nonastringent, and pollination-variant) and dozens of varieties, and the suitability of the various astringency types and varieties for a chip-style product has not been explored. The objectives of this work were to identify the best persimmon varieties for making this dried product and determine if other fruit characteristics (including astringency type) are predictive of consumer liking of the dried product.

Method: Dried chip-style products, prepared from 23 varieties of persimmons, were evaluated by a consumer panel. A balanced incomplete block design was devised to enable ranking of 5 samples by each of 150 consumers. Using the Durbin test, the significant differences (p < 0.05) among the average ranks of the samples were determined.

Results: This approach resulted in 10 samples (representing 9 varieties) being the most preferred and 7 samples (representing 7 varieties) being the least preferred, with the balance of the samples falling in the middle of the set. Via a chi-squared test with simulated p-values (p < 0.05), chips made from nonastringent persimmons were less likely to be evaluated as the lowest ranked sample (5th place) and more likely to be ranked in 2nd place, compared to chips made from astringent and pollination-variant persimmons. However, a consumer’s most liked persimmon chip was not more likely to be from any specific astringency type.

Significance: This work will enable persimmon growers to focus on only the best varieties for drying. The top varieties identified by this study were Chocolate, Fuyu, Izu, Jiro, Lampadina, Lycopersicon, Maekawa Jiro, Nishimura Wase, and Yotsumizo. This set includes astringent, nonastringent, and pollination-variant varieties. While nonastringent

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Persimmons were less likely to be lowest ranked and more likely to be higher ranked, indicating type was not found to be a predictor of a variety's inherent suitability for drying into a chip-style product.

**P05-065**

**Effect of Electrical Treatments (Pulsed Electric Fields) in the Enzymatic Activity of Polyphenol Oxidase Extracted From Apple (Malus Domestica)**

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**Introduction:**
Enzymatic browning in a chemical decay responsible for many losses in fruit and vegetables products during their storage.

**Method:**
A laboratory scale pulsed electric field machine with the capacity of 450 mL was designed, built and validated (Phase I) to assure the creation of electric fields during application in liquid foods. Polyphenol oxidase (PPO) extracted from apple (Red Delicious) was treated with different combinations of electric field strengths and times, ranging from 15.6-33.6 kV/cm and 110-448 ms, respectively. The experiment was analyzed by a surface response experimental design. The pulse frequency was set at 12.5 kHz and pulse width at 0.04 ms applied in a positive monopolar square waveform pulse (Phase II). The best electric treatment was compared to a thermal treatment (70°C × 1 min), chemical treatment (5 mg/L ascorbic acid) and a control without enzyme inactivation (Phase III) under a completely randomized design. Data was analyzed using SAS 9.3.

**Results:**
The voltage generated by the machine was validated showing the accuracy of the electric pulse generated (Phase I). PPO activity was reduced up to 68% of residual activity when applying field strengths of 24.6 kV/cm×250 ms. On the other hand, activity of PPO was increased up to 15% when treated at 18.2 kV/cm×110 ms (Phase II). In Phase III the electricical treatment had a residual activity of PPO of about 41% followed by the thermal treatment with a residual activity of 48%, and last, the electric treatment where the residual activity was 64%. The designed machine was effective in the inhibition of PPO and when compared to traditional industrial treatments did not show the best results.

**Significance:**
This experiment illustrated the opportunity to have alternative processing which could replace traditional chemical or thermal processing or work synergistically. It is recommended to change the specificities of the polarity of the wave of the pulsed electric field to a bipolar wave to achieve best enzymatic inhibition.

**P05-066**

**Effect of Aqueous Ozone Treatment on Fungal Decay and Mechanical Properties of Strawberry**

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**Introduction:**
Storage life of strawberries is limited by fungal attack. The traditional use of fungicides to reduce postharvest losses has been questioned and the development of new preservation strategies is necessary. This work investigated the effect of aqueous ozone treatment on fungal spoilage, mechanical properties and structure of strawberries stored at subfreezing temperatures.

**Method:**
Strawberries (Fragaria x Ananassa Duch cv. Albion) were immersed in ozonated water (3.7 ppm O3) in a bubble column (1.25 L) and treated at different times (5, 10 and 15 min) at 20±1°C. Ozone-treated fruits were compared to controls (fruits without washing and fruits dipped in water bubbled with oxygen instead of ozone) throughout 12 days of storage at 5±1°C. The presence of macroscopic fungal growth was daily visually inspected and the results were expressed as percentage of decayed fruit. Puncture tests and light microscopy observations were made after processing and at selected intervals of the storage period. From the force-displacement curves, the maximal force in the skin rupture point, the mechanical work up to the rupture point and the probe position at the rupture point (D) were analyzed. 40 replicates were performed for each condition. Mechanical data were analyzed by MANOVA.

**Results:**
Strawberries exposed to ozone 5 min showed a decrease in fungal incidence during storage. After 12 days of storage, the percentage of infected fruits was about 25% lower compared to stored control fruits without washing or dipped in non-ozonated water. Higher treatment times did not allow reducing the number of infected fruits. Ozone-treated fruits and controls did not show significant differences in the mechanical behavior throughout storage, but D parameter values of stored fruits were greater than at day 0. This change could be attributed to the disruption of cuticular membrane, degradation of polysaccharides of the inner and outer cellular walls of the epidermis, contraction of epidermal cells, and rupture of membranes of mesocarp cells in stored tissues.

**Significance:**
Exposure of strawberries to 3.7 ppm ozone for 5 min could help in reducing fungal decay during refrigerated storage without affecting mechanical properties. The application of higher treatment times did not improve the microbiological quality.
Food insecurity in households living in El Ejido Colima is low to moderate and less severe mostly by occasionally asking for credit at stores, reducing the numbers of meals per day, and sometimes, not eating at all.

Significance:
Food insecurity in households living in El Ejido Colima is low to moderate and occasional. The production and value addition of malanga in this community contributes to lower food insecurity by becoming a source of energy and extra income during seasons of food scarcity.

P05-070

Exploring the Milk-Clotting and Proteolytic Properties of Plant Proteases From Wild Bromelia pinguin Fruit
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Introduction:
Proteases are the most important enzymes in the market. Plants represent an attractive source for their isolation, pH and temperature effect on proteolytic (PA), and milk-clotting activity (MCA) of Bromelia pinguin fruits' crude extracts (FCE) and its potential use in cheese-making process was evaluated.

Method:
MCA was determined by incubating 1 mL of FCE with 10 mL of reconstituted nonfat dry milk (10% w/v) in the temperature range of 25-90°C and the period elapsed from the time when the coagulant was added and when milk clotting occurred was registered as the clotting time. Proteolytic activity was determined at different pHs (range 2-10) by the method of Kunitz (1947) using casein as the substrate and proteolysis of casein monitored by SDS-PAGE analysis.

Results:
FCE showed MCA in a broad temperature range (25-90°C) with a maximum of 3.99 U/mL in the range of 70-80°C. This value indicated that one mL of FCE was capable to clot 400 mL of milk in 40 min at the specified condition. However, milk coagulation at standard conditions (30-35°C temperature range) for cheese-making process FCE presented a relative MCA of 25%, indicating that four times the volume of FCE is needed to clot the same volume of milk. FCE proteolytic activity showed a pH dependence with two peaks of maximum activity. Maximum activity at acid pH range of 2.0-3.0 and at neutral-alkaline range of 7-8.5 indicated that more than one type of protease was present in FCE. Proteases diversity in FCE was confirmed by the partial inhibition with serine and aspartic proteases inhibitors (80% and 50% of inhibition with TPCK and pepstatin A, respectively). The milk-clotting/proteolytic activity ratio of 2.31 obtained for this FCE was similar to those reported for other plant proteases being considered good candidates as rennet substitute. SDS-PAGE analysis of casein hydrolysis indicated that proteases in FCE were slightly more proteolytic than chymosin.

Significance:
Bromelia pinguin fruits contain milk-clotting proteases in high concentration and open up possibilities for its use in cheese-making or other biotechnological processes. In order to understand the biochemical properties of milk-clotting enzymes in B. pinguin, studies on purification and characterization of its proteases are in progress.

P05-071

Characterization of Food Insecurity Among Malanga Growers in Tabasco, Mexico
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Introduction:
Food insecurity is a global issue, and in the case of Mexico, it affects more than a third of its 37 million citizens. The use of traditional crops and their value addition by social enterprises is one of the strategies promoted by local governments and development organizations against food insecurity. In Tabasco, Mexico, malanga (Colocasia esculenta Schott) is a root representative of the zone and high in calories and insoluble fiber. The objective of this work was to characterize the food insecurity of the population living from production and value-addition of malanga.

Method:
Households (=15) living in El Ejido Colima working with a local social enterprise promoting malanga processing were characterized using validated scales measuring food insecurity (ELCSA), dietary diversity (HDDS), and coping strategies against food insecurity (CSI) as well as a demographic questionnaire. Instruments were administered via interviews. Qualitative perceptions among malanga growers on food, nutrition, crop production, and processing were obtained using the most significant change technique.

Results:
Women answered most of the questionnaires (80%). The average household consisted of five members. Most families earned less than 30,000 MXP per year (<$2,000).

 Although variable, food insecurity was low to moderate among households (3.5±4.1) and associated with CSI (r=0.7; p<0.05) and HDDS (r=0.7; p<0.05). On average, households had access to 7 out of 12 food groups. All households consumed cereals (tortillas), 93% consumed legumes (beans) and sweets, and 83% consumed condiments (salt). In contrast, consumption of vegetables, roots, vitamin A rich produce, and green leaves was low (2 out of 15 households). CSI showed food insecurity was low (18.1±19.5) low among households. Families were resilient and able to address food insecurity in less severe manners mostly by occasionally asking for credit at stores, reducing the numbers of meals per day, and sometimes, not eating at all.

Significance:
Food insecurity in households living in El Ejido Colima is low to moderate and occasional. The production and value addition of malanga in this community contributes to lower food insecurity by becoming a source of energy and extra income during seasons of food scarcity.
evaluated at different pHs (3-7), NaCl concentration (4-6%) and storage temperature. Decarboxylase activity was determined on agar plates added with amino acid precursors (lysine, histidine, tyrosine, and ornithine). Antibiotic susceptibility was tested by the disk diffusion method using BBL-Sensi-Disc. Total strain DNA was used in polymerase chain reactions to detect virulence genes. E. faecium NCIMB-700585 and E. faecium SF68 were used as positive and negative controls.

**Results:**

The strain showed high anti-Listeria activity and it did not produce BA under the tested conditions. The strain growth was not influenced by the NaCl, and the best growing was at pH 5. The recovery rate of survival stains after 45 days of storage were 63, 70, and 45% at -80, -40, and 4°C, respectively. The strain was resistant to penicillin, erythromycin, gentamicin and chloramphenicol, and showed a positive amplification for sex phenotypes (cpd gene).

**Significance:**

P. acidilactici did not show virulence genes that determined their pathogenicity or production of BA, the resistance to antibiotics might be a limiting factor for its possible use as starter. Nevertheless, it could be use as a producer of antimicrobial compounds such as bacteriocins; even though, more studies need to be performed in order to confirm this statement.

**P05-074**

**Dielectric Barrier Discharge Helium Cold Plasma Treatments for Microbiological Safety and Preservation of Onion Powder**

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**Introduction:**

Powdered onion is widely used as a spice in the majority of countries. Foodborne pathogens have been found in powdered food with low water activity. A new method of decontaminating powdered products, which minimizes effects on their inherent sensory and nutritional properties, has been sought. Cold plasma treatment (CPT) has been investigated as a novel nonthermal food preservation method. Although several studies have demonstrated the antimicrobial effects of CPT, little is known about their effect on microorganisms in powder food products. The objective of this study was to study the effects of dielectric barrier discharge cold plasma treatment (DBD-CPT) on the inactivation of Escherichia coli O157:H7, Salmonella Enteritidis, and Micrococcus lysodeikticus on onion powder, as well as the concentration and color of onion powder.

**Method:**

Onion powder, inoculated either E. coli O157:H7, S. Enteritidis, or M. lysodeikticus, was treated by DBD-CP using helium as a plasma-forming gas. Treatment variables included treatment time (5, 10, 12, 15, and 20 min) and voltage (4, 5, 6, 7, 8, and 9 kV) and sample variables include water activity (aw) (0.40, 0.64, and 0.80) and particle size (0.22, 0.49, and 1.00 cm).

**Results:**

DBD-CPT at 9 kV for 20 min reduced the numbers of E. coli O157:H7, S. Enteritidis, and M. lysodeikticus by 1.4±0.2, 2.3±0.1, and 0.7±1.2 log CFU/cm2, respectively. The aw in the ranges tested did not influence the inactivation of the pathogens. However, as the particle size increased from 0.23 to 1.00 cm2, the inactivation rates of E. coli O157:H7, S. Enteritidis and M. monocytes by 2.32±0.21, 2.11±0.35 and 2.07±0.35 log CFU/cm2 (P < 0.05), respectively. DBD-CPT for 20 min did not significantly affect ascorbic acid concentration of onion powder and color (P > 0.05).

**Significance:**

The results demonstrate the potential for application of DBD-CPT for improving microbiological safety of onion powder without altering ascorbic acid concentration and color properties.

**P05-075**

**In Vitro Bile Acid Binding and Short-Chain Fatty Acid Profile of Microfluidized Wheat Bran**

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**Introduction:**

Consumption of dietary fiber lowers serum cholesterol levels and promotes colonic health, probably through the binding of the fiber to bile acids and the production of SCFAs (short chain fatty acids) in the large intestine where undigested fibers are fermented by colonic microflora. Wheat bran (WB) is an excellent source of the dietary fiber and has been shown to bind bile acids and improve overall colon health. Our previous study has indicated that microfluidization process can significantly improve physicochemical properties of WB due to particle size reduction and microstructure. The objective of this study was to evaluate the effects of microfluidization parameters on the in vitro bile-acid binding and fermentability of WB using a Response Surface Methodology.

**Method:**

Aqueous suspensions of ground wheat bran (<500 µm) were processed through a 200 µm interaction chamber of an M-110P Microfluidizer under conditions from a central composite design with two independent variables: processing pressure (17,000-23,000 psi) and number of passes (1-5) at five levels. The treated bran was lyophilized and pulvORIZED before analysis. Bile-acid binding of microfluidized WB was measured for sodium cholate, sodium deoxycholate, sodium glycocholate, and sodium taurocholate individually using a direct method at a concentration of 5 mM. In vitro fermentability was assessed using human fecal microflora by comparing the individual as well as total SCFAs (including acetic, propionic, butyric, valeric, and hexanoic acid) determined by gas chromatography.

**Results:**

An increase in processing pressure and number of passes increased the binding capacity of WB to sodium deoxycholate (p<0.0001), but not to other examined bile acids. For SCFAs, processing pressure had a positive quadratic effect on the production of propionic acids by excluding the values at 23,000 psi and 3 passes. We suspected that high pressure substantially disrupted microstructure of the bran materials, leading to non-continuous changes in the fermentability of WB.

**Significance:**

The physiological properties of wheat bran were affected differently by microfluidization conditions. Further research is needed to elucidate the mechanisms.

**P05-076**

**Application of Hydrodynamic Cavitation to Release Bound Phenolics in Sorghum Flour and Apple Pomace**

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**Introduction:**

As a non-thermal process, ultrasonication has been recently used to release bioactive compounds from different food commodities. But energy inefficiency and scale-up incapability are the main drawbacks of ultrasonication process. To overcome this problem, hydrodynamic cavitation was approached to release the bound phenolics in sorghum flour (SF) and apple pomace (AP) to enhance their antioxidant activity eventually.

**Method:**

In this study, SF and AP, naturally fermented at optimized conditions, were hydrodynamically cavitated at different solid ratios of 10, 27.5, 45% (w/v) and 5, 8.75, 12.5% (w/v), respectively. As another variable, three types of cavitators with 2, 3, and 4 holes rotor were used to cavitate both the samples for the time range of 2-4 min and 2-6 min, respectively. Both the treated samples were analyzed for total phenolic content (TPC), antioxidant activity (AA) and phenolic characterization. In-vitro starch digestibility (WSD) and total dietary fiber (TDF) were also determined for SF and AP respectively.

**Results:**

For SF and AP, optimized conditions were determined as 10% and 8.75% (w/v) solid ratio, 3 and 4 holes rotor cavitator, and 3 and 4 min cavitation time, respectively. At these conditions, TPC and AA of SF were 50% and 40%, respectively higher than the control SF, while for AP, these numbers were observed as 60% and 51%, respectively. IVSD in SF showed 15% increase, whereas AP exhibited 9% increase in TDF as compared to that of control samples. Phenolic acids derived from protocatechuic, chlorogenic, p-coumaric, and salicylic acids were found in higher concentrations in cavitated AP, while treated SF showed the higher concentration of p-hydroxybenzoic, p-coumaric, ferulic, and salicylic acids.

**Significance:**

The study suggests that these SF and AP may be very useful for the preparation of processed foods with increased levels of phenolic antioxidants.

**P05-077**

**Effect of UV-C and Pulsed-UV Treatments on Reduction of Penicillium Expansum Spores and E. Coli K12 in a Model Apple Juice**

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**Introduction:**

Pasteurization of fruit juices is essential for ensuring product safety and shelf stability. Penicillium expansum can cause significant health problems for consumers of apple juice due its potential to produce the mycotoxin patulin. Ultraviolet (UV) light technology has been proposed as a non-thermal alternative to pasteurization; however, its application might be limited due to low energy delivery and the properties of food being treated. Pulsed UV treatment has been developed to improve this technology. This study compares the effectiveness of UV-C and pulsed UV light processing for the inactivation of P. expansum spores and E. coli K12 in model apple juices.

**Method:**

Model apple juice containing ascorbic acid and malic acid with or without added fructose was treated with UV-C for up to 100 min or with pulsed UV for up to 70 s. Results were compared for statistical significance by two sample t-test.

**Results:**

Log reductions of P. expansum and E. coli K12 increased with time. Moreover, the log reductions in pulsed UV treatment for both microorganisms were significantly higher in samples without fructose than with fructose (p<0.05). Pulsed UV resulted in 3.80 and 4.67 log CFU/ml reduction of E. coli K12 with and without fructose, respectively, for a 40 s treatment, whereas the population of P. expansum was reduced by 3.16 and 3.85 log CFU/ml with and without fructose, respectively, for a 60 s treatment. The difference between log reductions in UV-C treated samples with and without fructose was not statistically significant. UV-C treatment for 100 min resulted in 2.99 and 3.05 log CFU/ml reduction of E. coli K12 with and without fructose, respectively. P. expansum was reduced...
by 1.97 and 2.04 log CFU/ml for 100 min of UV-C treatment with and without fructose, respectively. These results contrast recent studies showing accelerated UV destruction of ascobic acid in the presence of added fructose. The results clearly show, however, that pulsed UV can be more effective than UV-C in reducing microbial populations in apple juices.

Significance:
This research is valuable to the beverage industry as UV light processing can increase the safety, stability, and integrity of fruit juices.

P05-078
Ozone-Induced Changes in Structure and Mechanical Properties of Blueberry Fruits
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Introduction:
One of the important usages of ozone is the post-harvest treatment of harvested crops for surface decontamination. Applying ozone at doses necessary for effective decontamination may change the quality of these products. This study aimed to evaluate the impact of aqueous ozone at different doses over the structure and the mechanical properties of blueberry (Vaccinium corymbosum, O’Neal variety) fruits during refrigerated storage.

Method:
Blueberries were treated with aqueous ozone (1.4 or 3.7 ppm O3 in water, 20 ± 1°C) at different exposure times (0 (control), 15, 20, and 30 min). Fruits were packed in closed plastic boxes permeable to air and stored at 3 ± 1°C for 15 days. Puncture test was performed on 30 whole fruits for each condition (Instron Universal Testing Machine model 1011, 4 mm in diameter flat-end cylindrical probe, deformation speed: 50 mm/ min) after treatments and during storage. From the force-displacement curve, force required puncturing the fruit epidermis (FR), probe position at FR (DR), and mechanical work (W) were computed. For light microscopy (LM), samples were prepared according to conventional techniques and examined with a Zeiss Axioskop 2 plus microscope. Mechanical data were analyzed by multivariate analysis of variance.

Results:
The blueberry (treated or untreated) skin had the major effect on the mechanical properties, contributing more than 90% of the firmness of the fruit before the rupture point. There were not significant differences in mechanical properties among control and fruits exposed to different O3 doses after treatments nor in storage. LM images indicated compression of the cuticular membrane and the epidermal cells in stored untreated fruits and in treated fruits, more accentuated as O3 dose increased. At the greatest O3 dose, cuticle proper, cutinized cellulose layer, pectic layer, and cellulose layer appeared in some regions with disruptions. Treatments did not affect the fruit mesocarp. Although O3 exposure and/or storage induced different skin structure changes, they appeared not to be enough to modify the mechanical behavior.

Significance:
The low impact of this sanitizing agent on the mechanical properties would support its application, at least at the doses assayed, for blueberries surface decontamination in terms of texture characteristics.

P05-079
Pilot Plant-Scale Pulsed Electric Field Processing for Improving Microbial Stability of Tangerine and Carrot Juices
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Introduction:
Pulsed electric field (PEF) processing is a promising nonthermal intervention technology that has received considerable attention for microbial inactivation in foods. However, more data obtained using a large system, demonstrating its effectiveness in improving microbial stability and product quality of food products, need to be accumulated for commercial application of the technology. The objective of this research was to study the inhibitory effects of pilot plant-scale PEF processing on the inhibition of indigenous aerobic microorganisms of tangerine and carrot juices and their physicochemical properties.

Method:
Tangerine and carrot juice were processed by a continuous pilot plant-scale PEF system at 11-23 kV/cm for 85-226 µs and 12-14 kV/cm for 170-198 µs, respectively. Microbial inactivation, Vitamin C, color, nonenzymatic browning, “Brix, and pH were determined before and after PEF processing.

Results:
The 23 and 14 kV/cm were determined as the optimum electric field strength for the treatments of tangerine and carrot juices, respectively, without causing dielectric breakdown in the juices with the set conditions employed (20 µs pulse width-55 pps frequency, and 30 µs pulse width-70 pps frequency, respectively). As total treatment time of the PEF processing at optimum conditions increases from 85 to 104 µs and from 170 to 198 µs in tangerine and carrot juice treatments, respectively, the inactivation rates of total aerobes and yeasts/molds increased from 4.6 to 6.3 log CFU/mL and from 2.8 to 4.4 log CFU/mL, respectively, in tangerine juice and from 3.9 to 5.3 log CFU/mL and from 3.8 to 5.4 log CFU/mL, respectively, in carrot juice, with maximum temperature increase of 59 and 64°C in tangerine and carrot juices, respectively. Vitamin C concentration of tangerine juice did not change, but that of carrot juice decreased from 2.8 mg/g to 2.5 mg/g (P < 0.05) after optimized PEF processing. None of color, nonenzymatic browning index, “Brix, and pH of tangerine and carrot juices were affected by PEF processing (P > 0.05).

Significance:
Pilot plant-scale PEF processing was effective in pasteurizing both tangerine and carrot juices, minimizing changes in their quality properties.

P05-080
Bioactive Compounds Content and Antioxidant Capacity of Strawberry Fruit (Fragaria x Ananassa cv. Camarosa) Treated by Pulsed Light
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Introduction:
Pulsed light (PL) treatment has emerged in recent years as an alternative method for surface decontamination of foods. In previous studies it was demonstrated that the application of specific PL fluencies could be able to extend the shelf life of strawberry fruit, reducing the incidence of postharvest molds and deleting the softening along cold storage. The aim of this work was to analyze the impact of pulsed light treatments on functional quality of strawberry fruits. To this end, the effect of PL fluence and refrigerated storage on total anthocyanin and phenolic contents and antioxidant capacity was investigated.

Method:
PL treatments were performed with a Xenon RS-3000B Steripulse-XL system, which generated high intensity pulsed light (200 to 1100 nm). Strawberries (Fragaria x Ananassa cv. Camarosa) were exposed to irradiation for 10 and 20 s at 10 cm from the lamp, corresponding to fluencies of 11.9 and 23.9 J/cm2, respectively. PL treated fruits were compared to a control (non-irradiated fruit) throughout 8 d storage at 6±1°C. At selected intervals of the storage period the total anthocyanin content (pH Differential Method), phenolic content (TPC) (Folin-Ciocalteau Assay) and the hydrophilic antioxidant capacity (measured as Oxygen Radical Absorbance Capacity, ORACFL) were determined. In the analyses, 10 strawberries for each treatment and storage time were evaluated.

Results:
Non-treated strawberries showed a significant increase in anthocyanin content along storage time. Strawberries PL-treated 10 s did not show significant changes in anthocyanin accumulation compare to the control, while the content of this pigment in samples treated 20 s was significantly lower. The variations observed in anthocyanin content did not correlate with changes in total phenolic content, since TPC in all the samples did not vary significantly throughout the storage. On the contrary, both in treated and untreated fruits a slight increase in ORAC activity at 8 d storage were observed.

Significance:
Results showed that the hydrophilic antioxidant capacity and the total phenolic content of strawberries were not affected by PL treatments. However, a treatment of 23.9 J/cm2 reduced the anthocyanin accumulation during refrigerated storage, which would be associated with a delay in ripening induced by pulsed light.

P05-081
Modeling of Virgin Olive Oil Extraction Yield Increase From Pulsed Electric Fields Treated Olive Paste Combined With Different Malaxation Conditions
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Introduction:
Pulsed Electric Fields (PEF) can promote olive oil extraction during malaxation by altering cell permeability, resulting in higher yields. Critical process parameters are the elevated temperature having a negative effect on the extracted oil and treatment duration. A balance between oil yield and quality must be achieved. The objective of this work was to evaluate and model the potential benefit of the application of PEF on olive paste for virgin olive oil extraction yield increase.

Method:
Olive paste (Vaccinium corymbosum cv. Camarosa) treated by Pulsed Light (from 0.5 to 1.4K/cm, 1.6k/kg) process conditions and constant malaxation conditions (30 min at 30°C) and the oil extraction was measured. PEF treated olive pastes at selected conditions combining high oil yield and optimal quality (0.9K/cm and 1.6k/kg) and non-treated samples were subjected to different malaxation times (0:60min) and temperatures (15-40°C). The yield and quality characteristics such as acidity, peroxide value, K232, K270, total phenolic compounds, and sensory evaluation were determined for each sample. Appropriate mathematical models were developed to describe the yield increase of olive oil from PEF treated pastes at all conditions studied.

Significance:
The results obtained show that PEF technology at selected conditions could be applied for the production of virgin olive oil with increased yield. PEF could permit a reduction in the current malaxation temperature without impairing the oil extraction while improving olive oil quality and sensorial characteristics.

Results:
An increase in olive oil yield was observed after PEF treatment at all conditions studied.
The highest yield calculated was 3.8% higher compared to untreated paste after PEF processing at 0.9kV/cm, while quality and sensory characteristics were not significantly affected. When no malaxation was used, PEF treated (0.9kV/cm) olive paste resulted in a 280% extraction yield increase compared to control. Malaxation at 15°C for 30 min of PEF treated (0.9 kV/cm) olive paste, resulted to oil yield similar to the one from untreated paste malaxed at the control only used conditions (30 min at 30°C). The combination of PEF and low temperature malaxation resulted in significantly higher quality oil.

**P05-082**

Lactobacillus Plantarum Viability in Ice Cream Formulated With Different Levels of Soluble Fiber During Storage at Selected Temperatures

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**Introduction:**

There has been a growing interest in using probiotic bacteria and prebiotics as dietary adjuncts in the dairy industry, being symbiotic ice creams which are becoming increasingly popular. The objective of this work was to evaluate the viability of Lactobacillus plantarum 229v incorporated into ice cream formulated with different concentrations of inulin (0, 8, or 16 g/100g) during storage at different temperatures (-4, -20, or -80°C).

**Method:**

A standard ice cream formulation was made from milk, egg, 30% cream, refined and invert sugar, and strawberry color/flavor. The ice cream was divided into four sets, one of which was separated as control and the others were added with L. plantarum (10E12 CFU/g) and 0, 8, or 16 g/100g of inulin. Samples of each ice cream set were stored at -4, -20, or -80°C during 60 days. Every 15 days ice creams were analyzed for probiotic viability (plate count on MRS agar after 48 h of incubation at 35°C under anaerobiosis), pH, texture (hardness), overrun, color (L, a, and b color parameters), as well as a sensory evaluation (appearance, texture, flavor, sweetness, and overall acceptability).

**Results:**

No significant changes (p>0.05) in pH and color were observed among studied formulations or tested storage temperatures. Texture and overrun were significantly different (p<0.05) among formulations, being the ice cream formulation with 8 g inulin/100g softer and with higher overrun values (56%). L. plantarum viability was maintained (counts >10E8 CFU/g) after 60 days of storage at -20 or -80°C in ice creams with 8 or 16 g inulin/100g while storage at -4°C decreased its viability to counts <10E6 CFU/g. Studied ice cream formulations were well accepted (scores >7) in the evaluated sensory attributes, being the formulation with 8 g inulin/100g the best accepted one. Survival of studied probiotic bacteria was higher in the ice creams added with inulin, most likely due to the prebiotic effect of this fructan.

**Significance:**

Our results suggest that addition of inulin to ice cream stimulated the survival of L. plantarum, which resulted in improved viability of this organism during frozen storage.

**P05-083**

Formation and Physicochemical Properties of Casein-Derivative Delivery System Using pH-Induced Gelation

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**Introduction:**

The objectives of this research were to produce casein-derivative delivery systems (CDSs) and to investigate the impacts of manufacturing variables, such as the charged amount of linoelic acid (LA) and manufacturing pH, on the morphological and physicochemical properties of CDSs.

**Method:**

CDSs were prepared using the covalent conjugations of sodium caseinate with various charged amounts of LA (10, 20, and 30%). The degree of modification and surface hydrophobicity of CDSs were determined by using an o-phthalaldehyde method and fluorescence probe method, respectively. Atomic force microscopy (AFM) and particle size analyzer were used to assess the morphological and physicochemical properties, such as particle size, polydispersity index, and zeta-potential value of CDSs.

**Results:**

An increase in the charged amount of LA from 0 to 30% resulted in a significant (p<0.05) increase in the degree of modification and surface hydrophobicity of CDSs, which indicates that the number of hydrophobic LA moieties conjugated on the surface of sodium caseinate was increased with an increase in the degree of modification of CDSs. In AFM images, globular-shaped particles with size of approximately 5 μm were observed indicating that CDSs were successfully manufactured. As the charged amounts of LA were increased, the size of CDSs was significantly (p<0.05) increased while there were no significant (p>0.05) differences in the polydispersity index and zeta-potential values of CDSs. An increase in manufacturing pH of CDS from 4.8 to 5.0 resulted in a significant (p<0.05) decrease in the size and zeta-potential values of CDSs.

**Significance:**

In conclusion, the charged amount of LA and manufacturing pH of CDSs are the key parameters affecting the physicochemical properties of CDSs.

**P05-085**

Anti-Inflammatory Activity of Cacao Byproducts (Theobroma Cacao) in Human Colon Cancer Cells (HT-29)

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**Introduction:**

Colon cancer is the third most common cancer worldwide and it has been treated with cacao dried beans due to the important amount of polyphenols found in this matrix. However, the rest of the fruit has not been evaluated. The objective of this study was to identify and quantify polyphenols of 5 parts of the cacao fruit and evaluate their anti-inflammatory activities.

**Method:**

Polyphenol content was assessed on each fruit part in triplicates. Completely randomized designs were used for: colon cancer (HT-29) cell proliferation (5 extracts x 5 concentrations); intestinal myoblast (CDD-18) cell proliferation (2 extracts x 5 concentrations) to evaluate their effect on healthy cells; reactive oxygen species (ROS) and gene expression for inflammation and apoptosis (2 extracts and 2 concentrations). Data collected was analyzed using SAS 9.3.

**Results:**

Dried Beans (DB) and Fruit Husk (FH) extracts presented the highest amounts of polyphenols and significantly reduced HT-29 cell proliferation. Therefore, these extracts were selected for the next step of the experiment. Both extracts increased the number of hydrophobic LA moieties conjugated on the surface of sodium caseinate which was separated as control and the others were added with L. plantarum (10E12 CFU/g) and 0, 8, or 16 g/100g of inulin. Samples of each ice cream set were stored at -4, -20, or -80°C during 60 days. Every 15 days ice creams were analyzed for probiotic viability (plate count on MRS agar after 48 h of incubation at 35°C under anaerobiosis), pH, texture (hardness), overrun, color (L, a, and b color parameters), as well as a sensory evaluation (appearance, texture, flavor, sweetness, and overall acceptability).

**Significance:**

This study illustrated the importance of by-products in chronic disease prevention. Furthermore, more than 75% of the cacao fruit is discarded, as only the nub (cotyledons), are used for chocolate production. These results illustrated the potential these biomass could have for the industry beyond normal use as fertilizer or animal feed. It is recommended to continue this investigation and the use of cacao fruit extracts in vivo studies.

**P05-086**

Starch Digestibility and Rheological Behaviors of Black Rice Extracts During In Vitro Simulated Digestion

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**Introduction:**

It is well-known that the essential phytochemicals in pigmented rice cultivars are greatly linked with reduced risk of developing chronic diseases based on their strong antioxidant activity. Special emphasis has been given to the inhibitory effects of black rice extracts (black rice flour, BF; dietary fiber-enriched extract, DE; phenolic-enriched extract, PE) on in vitro starch digestibility by inhibiting digestive enzyme, however, PE exhibited the IC50 of 24.12 mg/mL and 0.03 mg/mL against α-amylase and α-glucosidase, respectively. Also, their effects on in vitro starch digestibility (glucose release behavior and predicted glycemic index; pGI) and rheological behavior were investigated in a wheat flour gel model.

**Results:**

The chemical compositions in BF, DE, and PE were 63.21%, 0.43%, 0.65% for starch, 16.13%, 64.13%, 5.46% for total dietary fiber, and 4.89 mg GAE/g flour, 0.00 mg GAE/g flour 23.26 mg GAE/g flour for total phenolics, respectively. BF and DE did not inhibit digestive enzyme, however, PE exhibited the IC50 of 24.12 mg/mL and 0.03 mg/mL against α-amylase and α-glucosidase, respectively. Also, the pGI values of the gels with BF, DE, and PE at 20% replacement for wheat flour were as follows: control (wheat flour) = BF > DE > PE. Moreover, a significant decrease in the viscosities of gels during the intestinal digestion was obviously observed in the order of BF, DE, and PE.

**Significance:**

As a result, PE showed the highest suppression effect on starch hydrolysis by inhibiting digestive enzyme. It was supported that phenolic compounds may be a critical factor than dietary fiber for retarding in vitro starch digestibility of starch-based foods prepared with black rice.

**P05-087**

Evaluation of Texture and Viscosity of the Banana Peel-Based Yogurt Enriched With Mung Beans

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**Introduction:**

Indonesia contributes about 10.9% of Asia’s total banana production. The potential of using banana peel (BP) as one of the food sources in yogures has been previously studied. In this research, the addition of mung bean (Vigna radiate) to the yogurt was expected to increase nutritional content. Moreover, it was anticipated to improve...
refined structure, mouthfeel, and texture of the yogurt. The purpose of this research is to investigate the utilization of BP (Musa acuminata) as a whole, and banana flesh (BF) extracts, with added mung beans (Vigna radiate).

Method:
Four mixtures (100 ml each) of BP (BP1, BP2, BP3, and BP4) and BF (BF1, BF2) were varied in milk composition with: BP1 no milk addition; BP2 30 ml; BP3 60 ml; BP 90 ml; BF1 no milk addition; and BF 50 ml. Additions of Lactobacillus bulgaricus, Streptococcus thermophilus, and Bifidobacterium were followed with incubation at 35°C for 24 hr. Assessment on pH before and after the incubation was observed followed by sensory evaluation by untrained panelist (n=60) in color, aroma, taste, mouthfeel, and texture of yogurt.

Results:
The results of pH before and after the incubation are as followed respectively: BP1, 7.02-6.7; BP2, 7.05-6.27; BP3, 6.44-6.19; BP4, 7.05-6.25; BF1, 6.30-4.80; and BF2, 6.32-4.87. The decrease of pH showed that fermentation process occurred BF. The sensory evaluation results showed that BP3 has higher liking towards aroma (p<0.05), flavor (p<0.05), and mouthfeel (p<0.05). Off flavor from bitterness of banana peel was detected significantly on BP1 (p<0.05). Panelists preferred BP4 due to its rich flavor.

Significance:
In conclusion, BP could undergo as one of basic ingredients in yogurt making. But panelist showed low preference towards BF due to off-flavor. Investigations of how to eliminate the off-flavor from the yogurt-based BP, as well as the usage of varied starter cultures, are promising topics for further research.

P05-088

6-C-(E-Phenylenethly)-Naringenin, Identified From Tomato and Beef Soup, Induces Cell Growth Inhibition in Colon Cancer Cells

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Introduction:
6-C-(E-Phenylenethly)Naringenin (6-CEPN), found in the popular tomato and beef soup, possesses potent tumor cell-selective cytotoxicity. In this study, the mechanism of action (AOA) of 6-CEPN was investigated in four colon cancer cell lines (SW620, SW480, HCT116, and HT29).

Method:
Genome-wide transcriptome expression profiling by RNA-seq was conducted after the cells exposed to 10 µM of 6-CEPN for 24 hours. Subread and Limma was used to perform read mapping, count, normalization and differential expression analysis. Gene set enrichment analysis (GSEA) was conducted among the 14,336 expressed genes with the gene expression signatures of chemical and genetic perturbations in the Molecular Signatures Database to identify the probable targets of 6-CEPN.

Results:
Surprisingly, the gene expression pattern induced by 6-CEPN was extremely similar to the transcriptome response caused by a KRAS inhibitor salarisf (FDR q-value=0). It is hypothesized that tumors cells addicted to KRAS gain-of-function (GOF) mutation is more sensitive to KRAS inhibition compared with cells carrying wild-type KRAS but mutated BRAF (V500E GOF) mutation downstream of RAS signaling pathway, e.g. downstream BRAF V600E. Perfectly in align with this hypothesis, HT29, a cell line with wild type KRAS but mutated downstream BRAF (V600E), showed much lower sensitivity to 6-CEPN compared with three other cells with mutated KRAS GOF but wild type BRAF. Moreover, RNA-seq data mining showed that 6-CEPN treatment downregulated signatures of cell cycle arrest (repression of E2F-regulated genes) and stress response (induction of ATF-regulated and Bach2-regulated genes), where E2F was related to G1 phase arrest of the cell cycle. ATF was a critical transcription factor to induce autophagy to allow cells to manage stress conditions and contribute to cancer cell survival, and Bach2 was associated with cell death. In the following studies, we are planning to conduct genome editing and biochemistry experiments to further confirm whether KRAS is the bona fide target of 6-CEPN, cell cycle profile, and cell death pathways.

Significance:
This research helps to identify novel agents with anti-cancer properties from food processing products by providing preliminary data on their mechanism of actions.

P05-089

Characterization of Soybean Protein-Based Monodispersed Nanoemulsions Using Ultra-High Pressure Homogenization

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Introduction:
Nanoemulsions are non-equilibrium, heterogeneous systems, consisting of two immiscible phases, in which one phase is dispersed and the other phase as discontinuous droplets with diameters of 100 to 500 nanometers. The relatively small droplet size of a nanoemulsion requires stable physicochemical properties for potential applications in the food and medicine industry. It is beneficial to develop stable nanoemulsions using alternative natural proteins as surfactants that are safer than synthetic surfactants. The objective was to investigate the characteristics of nanoemulsions prepared using peanut oil and soybean protein isolate, β-conglycinin, and glycinin as stabilizers.

Method:
Soybean protein isolate, β-conglycinin, and glycinin were isolated from soybean, and suspended in 0.05 M phosphate buffer (pH 7.0). A coarse emulsion was prepared by homogenizing various concentrations of freshly prepared soybean protein isolate, β-conglycinin, and glycinin (1-5%, w/v) with peanut oil (2%, v/v), using a blender for two minutes. The coarse emulsions were immediately homogenized by passing through an ultra-high pressure homogenizer at various pressures (control 0, and treatments at 70, 140, and 210 MPa). Data were analyzed using statistics for variance, and mean significant differences using p<0.05.

Results:
Results indicated that soybean protein isolate, β-conglycinin, and glycinin were able to generate nanoemulsions within a desired nano-size range (<200 nm). Under 140 MPa pressure, average particle size of nanoemulsions was significantly (p<0.05) reduced (from 739 nm to 129 nm) with the increase of soybean protein isolate concentration (from 1 to 4%). Under 210 MPa, average particle size of nanoemulsion was significantly (p<0.05) reduced (from 290 to 153 nm) with the increase of glycinin concentrations (from 1 to 4%). However, 5% glycinin concentration led to an increase of particle size. With respect to β-conglycinin, under 140 MPa, 2% protein resulted in the smallest particle size of 182 nm; and from 3 to 5%, the particle size remained constant at 250 nm. In general, particle size and stability of nanoemulsions were dependent on the pressure applied and protein type used.

Significance:
The study provided useful information for potential industrial applications of different types of soy proteins for making stable nanoemulsions.
interactions between JF and other ingredients in dough and cookies, to determine an optimum formula based on quality measurements, and to develop a baking kinetics model for a cookie mixture with JF.

**Method:** The dough and cookie characteristics were evaluated using the stress relaxation test and texture profile analysis method with a texture analyzer. Degree of browning and antioxidant activities by baking time were described using kinetic modeling.

**Results:** JF was the most influential component on the dough and cookies, possibly due to its high content in PME activity. In all the formulas, the best fit was the Herschel-Bulkley model for describing the flow behavior of the samples.

**Significance:** The rheological and textural properties of the samples were important for resistance of the sample against deformation, and machinability of the compound chocolate, selection of oil type, and concentration were demonstrated to be very significant for quality of the product. Optimization of process conditions, such as refining which may affect textural and rheological behaviors, these quality attributes may be accorded with conventional formulations.

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**P05-094**

**Kunitz Trypsin Inhibitor, Bowman–Birk Inhibitor, and Lunasin in Selected High-Protein Soybean Varieties**

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**Introduction:** Soybean is an important source of dietary protein and has been widely used for making traditional soy foods, and also used to extract protein isolate ingredients for increasing protein nutritive value or functional properties of processed food products. Soybean contains lunasin, which can inhibit cancer cell growth in vitro and in animals. However, soybean contains protease inhibitors, such as KTI (Kunitz trypsin inhibitor) and BBI (Bowman-Birk inhibitor), which are anti-nutrients because if not inactivated by heat, they could reduce body growth and pancreatic hypertrophy. On the other hand, protease inhibitors can be extracted and used as an aid to reduce protein degradation during food processing. Therefore, understanding the contents and activities of these bioactive components is important for the utilization of soybean. The objective of this study is to investigate the content of protease inhibitors (KTI and BBI) and lunasin in 40 high-protein varieties and to study thermal processing effects on these components.

**Method:** Based on the data of the USDA germplasm collection, 40 varieties of soybean varieties high in protein content were selected for this study. Soybean was ground by a mill into fine powder. Protein was extracted using literature methods. The relative content of KTI, BBI, and lunasin in the varieties were analyzed, quantified, and compared using sodium-dodecyl-sulfate gel electrophoresis (SDS-PAGE) and imaging analysis software. Authentic protein standards of KTI, BBI, and lunasin were obtained from commercial sources for qualitative and quantitative analyses.

**Results:** Results showed that KTI, BBI, and lunasin differed significantly (p < 0.05) among soybean varieties. Among soybean varieties with high KTI, BBI, and lunasin contents, the highest content of KTI, BBI, and lunasin were 6.25%, 11.1%, and 11.15%, respectively. Among the soybean varieties with low KTI, BBI, and lunasin contents, the lowest content of KTI, BBI, and lunasin were 2.9%, 3.1%, and 1.3%, respectively. After heat processing, the protease activities decreased to various activities, depending upon processing methods.

**Significance:** The results provide useful information for the food industry to select soybean varieties for making foods for human consumption, or for use as a processing aid to control protein degradation during food processing.

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**P05-095**

**The Effect of Nixtamalization on the Reduction of Tannins in Flours of Three Varieties of Grain Sorghum**

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**Introduction:** Grain sorghum is utilized primarily as an energy source and as peripheral protein contributor to the diet in many parts of the world. One disadvantage is that the presence of tannins inhibits the absorption of protein. However, this can be mitigated by reducing polyphenol content in the sorghum flours. This research was aimed to assess the effect of lime treatment, or nixtamalization, in the "detannification" of grain sorghum flour. Polyphenol content in the sorghum flours. This research was aimed to assess the effect of tannins inhibits the absorption of protein. However, this can be mitigated by reducing polyphenol content in the sorghum flours.

**Method:** Three varieties of sorghum (low, intermediate, and high tannins) were treated with three lime treatments, or nixtamalization, in the "detannification" of grain sorghum flour.

**Significance:** The results are described using kinetic modeling.
Results: Statistical analysis of the effect of the lime-treatment on the extractable phenols of the sorghum varieties performed using STATA® showed that sorghum variety and lime concentration were highly significant factors, whereas the impact of steeping time was not statistically significant. The results also indicate that the most efficient treatment to reduce phenols was the highest lime concentration (1.5% of the sorghum weight) and 8 h steeping time, which was able to remove polyphenols from the high, intermediate, and low tanning sorghum varieties, reducing them by 90%, 82%, and 58% respectively.

Significance: This research demonstrates that tannins can be removed effectively by lime treatment. The significance is that this method is simple enough to be used at the household level in part of the world where sorghum is an important contributor of protein to the diet, thus improving its digestibility.

P05-098
Effects of RF Heating on Rapid Freezing Depending on Thickness of Beef
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Introduction: Electromagnetic fields have been used in the freezing to upgrade frozen food quality like CAS (Cell Alive System). Electromagnetic fields can perturb water molecules in order in not to form big ice crystals. In this study, we focused on the passing time of the maximum ice crystal formation zone by monitoring the temperature of food.

Method: During freezing, the surface of beef can be rapidly cooled by an outside coolant, but the inner parts of the beef cool slowly owing to the latent heat from the phase change. RF waves can directly heat the inner parts to prevent them from freezing until the outer parts finish their phase change and are cooled rapidly. The beef samples were cut by three thicknesses, 1, 2, and 3 cm. Power from 5 to 30 W of 27.12 MHz RF was used to heat the beef, and the center temperatures of beef with different thickness were probed with optical thermo sensors while rapid freezing. The frozen samples were thawed by 400W of 27.12 MHz until the center temperature became 0°C and compared by color, weight loss, and texture profile.

Results: When RF heating was applied, the center cooling times of the beef samples from freezing until -10°C were shorter than those without RF heating. Color, weight loss, and texture profiles attained from thawed beef samples demonstrated that RF heating during rapid freezing seemed to improve the characteristics of frozen beef.

Significance: The RF heating during rapid freezing can make short the freezing time from 0 to -10°C at the center of beef.

P05-099
Heating Limit Temperature of Frozen Food Under Radio Frequency Thawing
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Introduction: The thawing processes play an important role in the preservation of the quality of frozen foods. This study investigated the effects of 27.12-MHz radio frequency (RF) heating on heat transfer phenomena during the thawing process of frozen food.

Method: To determine the heating limit temperature of RF thawing; equal sizes radish, pork sirloin, rump, chicken breast, and tuna samples were frozen in a -80°C chest freezer and subjected to different RF power thawing treatments: 50, 100, 200, and 400 W. The internal temperature behavior changes of the frozen samples were monitored using optical thermal sensor during thawing.

Results: As a result, the phase change (-5 to 0°C) times of frozen radish were 30, 26, 13, and 8 min; those of pork sirloin were 38, 25, 11, and 5 min; those of rump were 23, 17, 11, and 6 min; chicken breast were 42, 29, 13, and 9 min; and those of tuna were 25, 23, 10, and 5 min at the RF powers of 50, 100, 200, and 400 W, respectively. The phase change time generally reflected the effectiveness of the thawing process, and it was significantly accelerated by the high power of the RF treatment. The heating limit temperatures of the radish, pork sirloin, rump, chicken breast, and tuna samples were 19.5, 9.2, 21.8, 8.8, and 16.8°C at 50 W; 23.5, 15.5, 27.3, 12.3, and 19°C at 100 W; 42, 26.9, 45.7, 22.1, and 39.4°C at 200 W; and 48.5, 54.7, 63.6, 57.3, and 44.9°C at 400 W, respectively. The differences in the maximum temperatures of the tested samples could be related to the food-specific energy absorption rate; however, the heating limit temperatures were not affected by the size of the foods. As the size increased, the samples needed a longer heat transfer time during the test.

Significance: These results suggest that a high power of RF thawing should improve the thawing velocity and quality of frozen foods during the thawing process; however, the quality changes during the RF thawing seem to be a complicated and important factor for which further studies are needed.

P05-100
Effect of Polyglycerol Syrup and Modified Starch on Bread Quality of Ready-to-Bake Product
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Introduction: Bread is one of the most widely consumed food in the world. Making bread is also one of the most developed technologies. In bakery industry freezing is applied to store
the dough. Quality of frozen dough deteriorates consistently during freeze storage. The purpose of this study was to investigate the effect of polyglycyrlic syrup and modified starch on bread quality of ready to bake products.

**Method:**
Ratios of all materials are the same except modified for starch and PSG. The amounts of PSG and modified starch were 0% to 1% against the weight of wheat flour. After mixing the dough, it was fermented for 30 minutes at 27°C, relative humidity 80%. Fermented dough was divided into 40 g portions and rolled into ball shape. Divided dough balls were frozen at -45°C for 30 minutes and stored at -18°C for 60 days. At the required time interval frozen dough was thawed for 2 h at room temperature. Thawed dough was fermented for 30 minutes at 40°C, relative humidity 85% and baked for 11 minutes.

**Results:**
The specific volume of 0% modified starch and 0% PSG (M0P0), 1% modified starch and 0% PSG (M1P0), 0% modified starch and 1% PSG (M0P1) and 1% modified starch and 1% PSG (M1P1) were 2.49, 2.88, 2.93, and 3.46 ml/g at 0 day, respectively. Specific volume of frozen dough stored at 60 days was 1.97, 2.10, 2.09, and 2.20 ml/g, respectively. The hardness values of M0P0, M1P0, M0P1, and M1P1 made of the unfrozen dough were 23.91, 15.30, 16.35, and 12.08 N, respectively, while those made of frozen dough stored for 60 days were 42.68, 36.64, 37.32, and 30.46 N, respectively. In conclusion, PSG and modified starch improve survival of yeast and its activity and dough strength.

**Significance:**
This result provided application of polyglycyrlic syrup and modified starch improve bread quality of ready to bake products. It also could provide opportunity for other cereal processed products.

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**P05-101**

**Application of a Supercooling Process on the Cutting of Frozen Atlantic Salmon (Salmo Salar) Fillet**

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**Introduction:**
Supercooling is the process of lowering the temperature of a product below its usual freezing point without phase change, and it is a method of preserving freshness and maintaining high quality of food by partial ice crystallization. The supercooling process (SP) has been used for resolve the problem of freezing process and maintains the quality of frozen fish. Frozen fish is difficult to cut because it is too hard at low temperatures. Therefore, SP could be used to cut the frozen fish for maintaining high quality. The objectives of this study were to determine the effect of SP on cutting force of Atlantic salmon fillet and to observe the microstructure and drip loss.

**Method:**
The samples were taken only at the dorsal part and then made into a rectangular shape. The normal freezing (NF) was carried out at -20°C using a stocker. The SP was conducted at -4°C using the low temperature incubator. The samples were stored for 3, 7, 14, and 30 days at -20°C. The cutting test was conducted using the texture analyzer. Samples were compressed to a 90% strain with a knife probe. Temperature of thermal cabinet was controlled at -4°C. All of the samples was adjusted the same temperature with the cutting temperature. The maximum force required to cut through the sample was recorded as shear force. In addition, the microstructure was observed using light microscopy.

**Results:**
The cutting force of sample with NF was higher than SP at day 0. The cutting force of sample with SP was no significant difference between the samples during storage time. The microstructure of fillet with SP showed less damaged cells than NF. Between 14 and 30 days of storage the drip loss was significantly lower in SP samples compared to NF.

**Significance:**
This study showed that SP is useful to cutting the frozen Atlantic salmon for prevent destruction of cell from freezing. It would be advantageous in terms of energy use and maintaining the quality of salmon fillet.

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**P05-102**

**Evaluation of Selected Commercial Merlot Wines Using Sensory Evaluation and a Potentiometric Electronic Tongue**

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**Introduction:**
Application of electronic tongues in food analysis is becoming popular. In wine quality evaluations, they have been used to study discrimination and prediction of wines based on criteria such as vintage or origin. The objective of the study was to evaluate the discrimination, predictive and sensory correlation ability of a potentiometric electronic tongue with respect to selected commercial wines based on their physicochemical parameters.

**Method:**
Merlot wines (n=61) were profiled for eight chemical parameters and analyzed using the electronic tongue for seven taste attributes. A subset of eight representative wines were selected using K-Means clustering and profiled using a sensory trained panel for tannin flavor and mouthfeel attributes. Support vector machines, artificial neural networks (ANN), multiple regression and partial least squares (PLS) regression were used to explore classification and prediction of the electronic tongue data.

**Significance:**
Results from the support vector machines discrimination of samples based on their electronic tongue response for sour, metallic, spicy, salty, umami, sweet, and bitter showed that individual samples could be correctly be identified with 90.1% accuracy. Prediction of the individual electronic tongue responses from the chemical parameters using ANN showed the following accuracy rates: sour (93%), metallic (92%), salty (93%), umami (90%), spicy (49%), sweet (90%), and bitter (92%). Results of the prediction of the electronic tongue responses from the chemical parameters using multiple regression showed some linear relationships (p<0.05) but the highest R-squared obtained was 0.24. A comparison of ANN and multiple regression results indicated that electronic tongue responses were more related to chemical parameters in a nonlinear manner for the 61 wine samples. For the eight wine samples that were evaluated using the trained panel, PLS showed high correlation between their electronic tongue data and the following sensory attributes: bitter (R2=0.59), sour (R2=0.59), sweet (R2=0.89), ethanol burn (R2=0.95), astringent (R2=0.89), and metallic (R2=0.92).

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**P05-103**

**Liking of Food Textures**

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**Introduction:**
The objective of this study was to determine whether people differ in their liking of food textures and whether they can be grouped according to these differences.

**Method:**
Participants completed a survey evaluating their liking of 106 different attributes from the literature related to food texture. Each participant’s liking scores for all of the attributes were centered and standardized. We used a 34-factor principal components analysis (PCA) with Varimax rotation to summarize the data for the different attributes. Texture attributes were the variables, and participants were the observations. We then conducted agglomerative hierarchical clustering (AHC) analysis with factor scores as the variables and participants as the observations to see which factors were important for grouping individuals.

**Results:**
The attributes that were rated sorted into principal components that were, for the most part, meaningful. For example, component 1 was positively correlated with smooth and negatively correlated with rough. None of the 34 factors, however, explained more than 2.9% of the variance. The majority of individuals were clustered into a single group that could not be characterized by its pattern of liking for texture attributes. Other clusters seem to be formed by “outlier” individuals. A 5-cluster AHC was most appropriate for characterizing the data because it produced groups that were sufficiently different without being too small. The smallest group contained only 7 individuals and was characterized by liking for crunchy and disliking for pliable. The second smallest group contained 8 individuals and was characterized by liking for gooey and disliking for lumpy. Liking scores, however, were largely not predictive of groupings. The difficulty in producing interpretable clusters is consistent with the normal distribution of liking ratings that were observed for each of the attributes, rather than a b- or multimodal distribution.

**Significance:**
The relationship between the factors driving individual differences in liking for food textures appears to be complex and has significance for the development of products that appeal to different consumer groups.

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**P05-104**

**Increasing Oil Concentration Affects Consumer Perception and Physical Properties of Mayonnaise-Type Spreads Containing KCI**

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**Introduction:**
Reducing sodium intake remains global challenge for the food industry. KCI imparts bitterness when used at high concentrations. Little is known about how oil concentration (OC) affects consumer perception of saltiness and bitterness of oil-in-water emulsions such as mayonnaise containing KCI. We evaluated consumer perception and physical properties of mayonnaise-type spreads at various oil and tastant (NaCl and/or KCI) concentrations.

**Method:**
A 2x3x3 (tastant-type x tastant-concentration x OC) full factorial design was followed when preparing spreads containing NaCl (0.5, 0.75 or 1.0%) or KCI (0.5, 1.0 or 1.5%), and canola oil (45, 55, or 65% by weight of spread). Following the BIB design principles, each spread was prepared by blending oil, KCI or NaCl, and water. After the BIB design was completed, each combination of KCI or NaCl and oil concentration was fermented for 30 minutes at 40°C, relative humidity 85% and baked for 11 minutes. The samples were taken only at the dorsal part and then made into a rectangular shape. The normal freezing (NF) was carried out at -20°C using a stocker. The SP was conducted at -4°C using the low temperature incubator. The samples were stored for 3, 7, 14, and 30 days at -20°C. The cutting test was conducted using the texture analyzer. Samples were compressed to a 90% strain with a knife probe. Temperature of thermal cabinet was controlled at -4°C. All of the samples was adjusted the same temperature with the cutting temperature. The maximum force required to cut through the sample was recorded as shear force. In addition, the microstructure was observed using light microscopy.

**Results:**
A 2x3x3 (tastant-type x tastant-concentration x OC) full factorial design was followed when preparing spreads containing NaCl (0.5, 0.75 or 1.0%) or KCI (0.5, 1.0 or 1.5%), and canola oil (45, 55, or 65% by weight of spread). Following the BIB design principles, each combination of KCI or NaCl and oil concentration was fermented for 30 minutes at 40°C, relative humidity 85% and baked for 11 minutes. The samples were taken only at the dorsal part and then made into a rectangular shape. The normal freezing (NF) was carried out at -20°C using a stocker. The SP was conducted at -4°C using the low temperature incubator. The samples were stored for 3, 7, 14, and 30 days at -20°C. The cutting test was conducted using the texture analyzer. Samples were compressed to a 90% strain with a knife probe. Temperature of thermal cabinet was controlled at -4°C. All of the samples was adjusted the same temperature with the cutting temperature. The maximum force required to cut through the sample was recorded as shear force. In addition, the microstructure was observed using light microscopy.

**Significance:**
The relationship between the factors driving individual differences in liking for food textures appears to be complex and has significance for the development of products that appeal to different consumer groups.
Results:
The oil and tannic (NaCl or KCl) concentrations had significant effects on saltiness, viscosity, and pH. As OC increased from 45% to 65%, saltiness perception decreased for all spreads [17.2-21.1 to 12.3-16.3], and OIL increased for spreads containing NaCl. Increasing OC increased viscosity. Generally, spreads containing KCl had higher bitterness (21.2-31.3 vs. 16.9-24.4) and pH (4.5-4.6 vs. 4.4) than spreads containing NaCl. RSM plots indicated that bitterness of spreads containing KCl increased with increasing OC from 45% to 55%. The PCA bi-plot revealed two groups (65% and 45-55% OC) of spreads when all sensory/physical attributes were considered simultaneously, and bitterness was positively correlated with pH and negatively correlated with OIL. All spreads containing KCl were penalized for being “too bitter” (TPS<0.6-1.4B). PI was significantly affected by OIL for all spreads, but OC was also a significant predictor for spreads containing NaCl.

Significance:
This study demonstrated that increasing OC of spreads affected consumer perception of saltiness and bitterness, which was associated with changes in physical properties, especially pH and viscosity. This finding is useful for understanding taste perception of oil-in-water emulsion products.

P05-105

Sensory Attribute Preservation of Coated Walnuts
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Introduction:
The walnut seeds are known because of their pleasant sensory attributes and health benefits. Walnuts are susceptible to deterioration and to develop rancid flavor. Edible coatings can decrease deterioration process because they act as barrier. The objective of this study was to evaluate the preserving effect of edible coatings on sensory properties of walnuts during storage.

Method:
Walnuts (var. Chandler) were coated with edible films: carboxymethyl-cellulose (CMC), methyl-cellulose (MC), and whey protein (PS), using immersion technique. Walnuts without coating were used as control sample (NC). Descriptive analysis and consumer acceptance tests were performed on walnut samples. The attributes (measured on an unstructured line scale 0-150 mm) analyzed by descriptive analysis were color, roughness, glossiness, oxidized, walnut flavor, cardboard flavor, sweetness, saltiness, sourness, bitterness, astringent, crunchiness, and hardness. Flavor acceptance was evaluated for a consumer test using a 9-point hedonic scale. The samples were stored for 210 days at room temperature (23°C). The results were statistically analyzed (MLGyM, AM y Test LSD-Fisher).

Results:
The intensity ratings of negative attributes like oxidized and cardboard flavors increased in all treatments during storage. On the last day of storage, NC showed higher intensity ratings (38.76 in oxidized and 22.25 in cardboard flavors). The lowest ratings of these attributes were detected in MC (7.81 in oxidized and 16.58 in cardboard). On the other hand, the intensity ratings of walnut flavor and sweetness considered positive attributes for this product decreased during storage. The decrease of walnut flavor intensity was higher in NC (61.68 on last storage day) and lower in MC (75.86 on last storage day). The other analyzed attributes did not change significantly their intensity ratings during storage. The acceptance test was performed in fresh product (storage day 0). NC and PS showed better score in flavor acceptance (average value: 6.24). The lowest acceptance flavor score was detected in MC (5.39).

Significance:
Edible coatings help to preserve sensory attributes on walnuts during storage, especially walnuts coated with MC. However, some of these coatings, like MC and CMC, can affect consumer acceptance of this food product.

P05-106

Sensory Attributes and Acceptance of Korean Kimchi as an Ethnic Food for US Consumers
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Introduction:
The introduction of a new ethnic food from other cultures to American consumers has always been a great challenge. Therefore, consumer acceptance and the sensory attributes of an ethnic product are critical to the success of the food product. Kimchi is a traditional fermented Korean food made of Chinese cabbage with various seasonings including red pepper, garlic, and fish sauces. Our goal was to discover if kimchi could be accepted by US consumers as an ethnic food. The objective of this study was to evaluate the sensory attributes and the consumer acceptance of selected commercial Korean kimchi products.

Method:
Three Korean kimchi products (J-kimchi: strong hot/spiciness flavor, P-kimchi: strong fish/spicy flavor, and E-kimchi: moderate flavor), the most popular commercial kimchi products in Korea, were purchased from the kimchi manufacturer in Korea. One hundred nineteen consumers (69% women and 77% 18-24 yrs olds) participated. Kimchi samples were served to panelists in 2 oz. serving containers and questions were asked before tasting the samples regarding appearance and aroma (9-point hedonic scale) and the intensity of the aroma (5-point intensity scale). After tasting the samples, attributes of hot/spiciness, garlic flavor, sourness, and sweetness were evaluated using a 5-point scale, followed by overall acceptability on the 9-point scale. Data from the consumer panels were analyzed using ANOVA.

Results:
Results indicated that P kimchi was significantly (p=0.016) liked more than the E and J kimchi for aroma and overall acceptability. The most likely to be purchased was also the P kimchi at 27%, and reasons may be due to lower intensity in aroma, hot/spiciness, sourness, and garlic flavor. The top comments for what attributes were liked more in P kimchi were crisp texture (28%), overall flavor (19%), and spiciness level (19%), while a top disliked factor was fish flavor (27%). This indicated that crisp texture and mild fish flavor were the most important sensory factors of kimchi quality for American consumers.

Significance:
In conclusion, this sensory data can provide useful information for preferred sensory attributes and corresponding intensities of kimchi by American consumers.

P05-107

Sensory and Textural Properties of Gluten Free Muffins Formulations Based on Rice, Cassava, and Cocoyam Flours
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Introduction:
Encouraged by medical conditions or lifestyle choices, an increased number of consumers are following a gluten-free diet. Hence, assessing the use of non-traditional raw materials for the development of novel gluten-free products is of particular interest. This study aimed to determine the effects of substituting 100% of wheat flour with rice (Oryza sativa), cassava (Manihot esculenta), taro (Colocasia esculenta), and cocoyam (Xanthosoma sagittifolium) flours and the egg content on consumer acceptance, sensory characteristics, and textural properties of gluten-free muffins.

Method:
Four formulations containing rice, cassava, taro, and cocoyam flours were developed and six additional formulations, based on a mixture (50:50) of 2 of each of the 4 studied flours, were also evaluated. A 25% of an egg-reduced version of each formulation was additionally developed. A total of 20 formulations were tested and compared against two control products (containing wheat, with and without egg reduction). A descriptive analysis and a consumer study were applied and the texture profile of each product was determined. A panel of 11 trained judges described the products to know their sensory characteristics. 105 consumers evaluated products.

Results:
An external preference-mapping revealed that muffins containing cassava flour and a mixture of cassava and rice flours, with and without egg reduction, had a significantly higher (P < 0.05) preference level compared to others. These products also showed similar sensory characteristics than control samples. Most consumers preferred the egg-reduced formulations and the least accepted products contained 100% taro and rice flours. The control formulations presented higher hardness, elasticity, adhesiveness, cohesiveness, and chewability that its counterparts.

Significance:
Thus, the development of a cassava or rice-cassava based product, with less egg content that the control muffin, is an alternative approach that would not compromise texture and consumer preference of gluten-free muffins.

P05-108

Antibacterial Properties of Cinnamon Extracts and Its Nanoemulsion Formulated by High Pressure Emulsification
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Introduction:
Foodborne illnesses caused by the consumption of food contaminated with pathogenic bacteria have been a concern to public health. Spices are natural plant products, which have been used not only as flavoring and coloring agents, but also as food preservatives and folk medicines throughout the world for thousands of years. Cinnamon has shown various therapeutic actions and reported antimicrobial properties and its potential use in foods preservation. The purpose of this study was to evaluate antibacterial properties of the different extracts obtained from the bark of Cinnamomum loureirii. The extract with good antibacterial property was nano-emulsified and the antibacterial properties were evaluated.

Method:
The bark of Cinnamomum loureirii was extracted with ethanol and n-butane in sub-critical states. The components in n-butane extract and ethanol extract were analyzed by GC-MS and HPLC-MS separately. The antibacterial properties were evaluated by agar-well diffusion method and two-fold broth dilution assay against four food-borne pathogens (Escherichia coli, Yersinia enterocolitica, Staphylococcus aureus and Listeria monocytogenes). The extract with good antibacterial properties was nano-emulsified using Tween 80 and water by high pressure emulsification. Process of nano-emulsion formulation was optimized for parameters such as surfactant concentration ratio, emulsification time and pressure. The antibacterial properties of nanoemulsion were also evaluated.
Significance:
Formulated cinnamon n-butean extract nanoemulsion has the potential as an effective antibacterial agent in preservation of food against microbial spoilage.

Results:
Solvent type greatly influenced the antibacterial activity of the cinnamon extracts. The n-butean extract of cinnamon showed much higher antibacterial activity than ethanol extracts. The n-butean extracts of spices exhibited no apparent difference in antibacterial activity against Gram-positive and Gram-negative bacteria. The formulated nanoemulsion showed significant antibacterial activity against four foodborne pathogens even after being diluted. Antibacterial activity of the nanoemulsion is expected due to the presence of eugenol, which is the major component of the n-butean extract by GC-MS analysis.

P05-109
Effect of Rice Starch Surface Proteins on the Pasting Properties of Starch
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Introduction:
Starch-surface proteins (SSPs) are localized on the surface of starch granules. SSPs could be involved in the processing of starchy foods; however, more detailed research regarding the role of SSPs is necessary. In the present study, we extracted SSPs from rice starch granules, identified the SSP composition, and analyzed the effect of SSPs on the pasting properties and swelling power of starch.

Method:
SSPs were extracted from rice starch by using 25mM sodium hydroxide (NaOH) solution. The extracted solution was centrifuged, and the supernatant was collected. The remaining starch was washed and freeze-dried. The amount of protein in the starch granules was measured by C/N coder and the extracted SSPs were separated using SDS-PAGE. Mass spectra of the proteins were acquired using LC/MS/MS, and were searched against the NCBI database subsets of rice proteins. The starch pasting properties were analyzed by using the Rapid Visco Analyzer and the swelling power of starch was measured. Water was added to the starch, and the solution was heated in a water bath at 37, 70, 75, and 80°C. The heated liquid was centrifuged and the precipitate was collected. The precipitate was weighed (Wp) and dried to obtain a constant weight (Wd) to determine the swelling power (Wp/Wd).

Significance:
These data suggested SSPs restrained the water absorption of the starch.

Results:
After SSPs extraction, the protein content decreased by 0.48 mg per 1 g of starch. From the results of the SDS-PAGE and LC/MS/MS, we identified granule-bound starch synthase 1, gluentin, and prolamin. The pasting temperature of starch removed SSPs decreased from 86.1 to 75.2°C, and the minimum viscosity was reduced. The swelling power of starch after SSPs removal increased at 70, 75, and 80°C; however, there was no effect at 37°C.

P06-001
Evaluating Postharvest Quality of Fresh Farm-Raised Brown Seaweeds, Saccharina Latissima (Sugar Kelp) and Alaria Esculenta (Winged Kelp) Under Refrigeration
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Introduction:
In the quest for alternate food resources, sustainably-sourced seaweeds have caught ample attention recently. Several species of brown seaweeds, including sugar kelp and winged kelp, are currently being tested for their aquaculture potential in the U.S. The recent increase in their consumption has prompted seaweed farmers to diversify into different seaweed products and species. However, factors causing or contributing to quality loss of fresh brown seaweed have been poorly examined. The objective of this study was to assess postharvest quality of refrigerated farm-raised sugar kelp and winged kelp.

Method:
Triplicate batches of washed and bagged seaweed samples were stored at 35°C or 45°C and assessed for aerobic plate counts, color (L*, a*, b*), texture (force), soluble protein, drip-loss, total volatile base nitrogen, and sensory quality for up to two weeks. A twelve-member panel rated sensory attributes (color, texture, aroma, and overall quality) on a 15 cm line scale with opposite descriptors on either side of the scale, where 0 was complete quality loss/degradation and 15 was the best score for the attribute.

Significance:
This is the first study reporting postharvest quality deterioration of fresh brown seaweeds during storage. These results provide seaweed growers with information on fresh seaweed shelf-life, essential to efficiently distribute fresh seaweeds through multiple market channels. This study also contributes data necessary to establish appropriate indices for assessing quality of fresh brown seaweeds.

Results:
For sugar kelp, sensory scores for all attributes dropped significantly by Day 12 at 35°C and by Day 10 at 45°C, compared to Day 1. Overall quality ratings were associated with sensory color, aroma and texture ratings. At 35°C, drip-loss increased significantly by Day 10. At 45°C, b* values increased significantly (p<0.05) by Day 10, indicating an increase in yellowness. For Winged kelp, drip-loss significantly (p<0.0001) increased to 17% by Day 8 at 45°C whereas it reached only 2% by Day 10 at 35°C. Sensory panelists linked blade texture and overall quality, rating both significantly lower on Day 5 compared to Day 1 at 35°F and 45°F. However, based on texture, sensory attributes, and drip-loss, higher temperature resulted in reduced shelf life for winged kelp.

P06-002
Heat and Mass Transfer Simulation Based on Moisture Evaporation and Temperature Distribution During Temperature Sweep
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Introduction:
Heating rate significantly impacts rheological properties of surimi gels during temperature sweep due to moisture evaporation and temperature distribution. However, no reports have been made to identify how moisture evaporation and temperature distribution changes during temperature sweep. A better understanding of moisture evaporation and temperature distribution will easily disseminate the effect of heating rate on gelation.

Our objectives were to: (1) identify moisture evaporation and temperature distribution during temperature sweep using heat and mass transfer simulation, and (2) assess dynamic rheology of surimi at various heating rates.

Method:
The rheological properties of Alaska pollock (AP) surimi paste (3% NaCl) were measured during temperature sweep (10-90°C) using a CVO-100 dynamic rheometer (Malvern Instruments, Worcestershire, UK) at 70% moisture content and various heating rates (1, 5, 10, 20, and 30°C/min). To simulate the temperature and moisture distribution of surimi during temperature sweep, effective moisture diffusivity (Deff) of surimi was estimated using numerical analysis at various temperatures (10-90°C). Finite element analysis was conducted to develop simulations of temperature distribution and moisture evaporation.

Significance:
Our results clearly demonstrated that AP gel could be impaired when the heating rate increased to 20-30°C/min, suggesting a 1-10°C/min heating rate would be more appropriate to investigate gelation behavior and rheological values.

Results:
As expected, Deff increased as temperature increased. A model was developed for Deff as a function of temperature (R2=0.99). Temperature during temperature sweep at various heating rates showed no significant difference. However, the final moisture content significantly decreased from 71.2% to 66.9% as the heating rate decreased from 30°C/min to 1°C/min. This means heating rate of AP surimi affected moisture evaporation more than temperature distribution. The elastic modulus (G') significantly increased as heating rate decreased (P <0.05). The rheogram patterns for phase angle shifted greatly from 270 to 380° during the sweep between 10 to 40°C as the heating rate increased from 1°C/min to 30°C/min. Fast heating might have caused rapid protein denaturation, but did not allow enough time for denatured proteins to form an ordered gel network. Subsequently, un-trapped moisture may have been released, resulting in the increased viscous modulus.

P06-003
Effect of Harvesting Stress and Slaughter Method on Quality and Shelf Life of Fish During Iced Storage
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Introduction:
Aquaculture slaughter techniques are very diverse and fish species vary in their response to different methods. Removal from water followed by asphyxiation in ice slurry is at most cases used to slaughter farmed fish in Europe. The development of new tools and solutions for improving fish welfare and quality, optimizing handling techniques, and minimizing stress and quality degradation of the final product is a challenge for the aquaculture sector, in agreement with the new rules for fish welfare and the consumer demands for safe, natural, and fresh fish products. The objective of the study is to evaluate the effect of stress and slaughter method on the quality and shelf life of whole marine cultured fish during isothermal storage at 0°C.

Method:
Marine cultured whole gilthead seabream (Sparus aurata), sea bass (Dicentrarchus labrax) and red porgy (P狙rus pugulus) were harvested on April, July and November 2015. Two alternative slaughter methods were investigated: ice-shock and electric stunner. Stress parameters (blood glucose, blood lactate, plasma cortisol) were determined immediately after harvesting. Samples were transported in ice to the laboratory within 1 day, packed aerobically, and stored isothermally at 0°C. Quality indices (total viable count, Pseudomonas spp., Enterobacteriaceae spp., pH, sensory scoring, texture parameters, and total volatile basic nitrogen-TVBN) were estimated during storage.

Significance:
This work allowed identifying the effect of slaughter method on stress and its consequences on quality and shelf life of fish during iced storage. The control of slaughter stress and improvement of fish welfare will enhance the benefits of fish farming production.
Results: Pseudomonas spp. growth was well correlated with the sensory changes. Based on microbial growth (limit=107 cfu/g for Pseudomonas spp.), no significant differences were observed between the harvesting methods, regarding fish appearance, microbial spoilage and sensory scoring and subsequently shelf life. Significantly lower hardness was recorded in fish harvested using the electric stunner in November, compared to the ice-shocked fish of the same period. Shelf life ranged between 13-18 days for seabream, 10-16 days for sea bass, and 10-14 days for red porgy, depending on harvesting period.

P06-004
Effect of Pulsed Electric Fields on Extraction of Bioactives From Seaweed
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Introduction: Many bioactives can aid in the fight against culture related illnesses like cardiovascular deceases and obesity. This has led to an increase in demand for high quality bioactives. Sugar kelp (Saccharina latissima), winged kelp (Alaria eculenta), and sea lettuce (Ulva lactuca) are edible seaweeds in the North Atlantic and are a recognized source of antioxidants such as carbohydrates and polyphenols. The most efficient extraction methods for bioactives from seaweed are with organic solvents which is not acceptable by many food and functional food processors leading to a demand for “greener” methods for bioactive extraction. The objective of this research was to evaluate pulsed electric field (PEF) as a novel method for extracting bioactives from marine macro algae.

Method: Extracts were prepared with pulsed electric fields (PEF) at 5, 10, and 15 min (8 kV/cm; 1200 V/cm). Hot water extraction for 40, 60, and 90 min at 95°C was performed for comparison. Total Carbohydrate Content (TCC) and Total Polyphenol Content (TPC) assays were performed to determine potential antioxidant compounds in the extracts and Oxygen Radical Absorbance Capacity (ORAC) assay was used to estimate potential antioxidant properties of the extracts.

Significance: Electroporation can be a useful method to achieve extracts that are rich in bioactive compounds without using organic solvents, providing highly acceptable bioactives to food and functional foods.

Results: Extracts varied in carbohydrate, polyphenol, and ORAC values. Values of TCC, TPC, and ORAC were dependent on seaweed species and extraction method. Extracted total carbohydrate from Ulva were highest at 471.32 mg/g dry extract after 5 min of PEF and significantly higher than the best water extractions tested with 249.54 mg/g after 40 min extraction. Extraction of carbohydrates decreased with time for both the PEF and hot water extraction. The total polyphenols were highest in the water extracts for Ulva and Alaria at 57.94 mg GAE/100g and 70.75 mg GAE/100g but the highest values for Saccharina were obtained with PEF at 78.83 mg GAE/100g after 10 min of extraction. Similar results were obtained for the ORAC values. The water and PEF extraction of bioactives form seaweed was dependent on seaweed specie, bioactive properties, and extraction conditions.

P06-005
Effects of Sweet Potato Starch Coating Incorporated With Thyme Oil on Quality Attributes of Shrimp
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Introduction: Shrimp is enjoyed for the uniqueness of its flavor and texture. However, shrimp is highly perishable due to biochemical and physical changes during post harvest storage, which results in limited shelf life of the product. Packaging plays a prominent role to maintain the food quality. Consumer demand for safe, minimally processed food products and concerns about the impact of the use of nonrenewable petroleum-based food packaging on the environment pose major challenges and opportunities for the food and packaging industries. This has led to a renewed interest in edible coating materials based on biopolymers such as starch and other polysaccharides derived from renewable sources. Therefore, the objective of this study was to develop an edible coating with sweet potato starch (SPS) by incorporating thyme (Thymus vulgaris) oil (TO) to maintain the quality of shrimp in refrigerators.

Method: SPS-based edible coatings (SPSC) was prepared with variable levels of TO including 0 (control), 2, 4, 10, and 60% and was applied on shrimp meat to investigate the physicochemical (texture, color, pH, and lipid oxidation) properties, antibacterial activity and melanosis and sensory evaluation of the coated shrimps at refrigerated storage (4°C) for 8 days.

Significance: The results of this study suggest that the TO incorporation at 4% into SPS coating could be useful in extending the shelf life of shrimp meat during refrigerated storage.

Results: Sensory scores indicated a significant decline in all samples during storage. Three treatments samples received higher scores than the control samples. However, no differences in odor were found in all shrimp samples. Textural properties of coated shrimp were generally more acceptable compared to the control. SPSC application resulted in lower pH (P < 0.05) as compared with the uncoated control. SPSC resulted in lower total plate count of bacteria with TO (P < 0.05) toward the end of storage. Antioxidant activity of SPSC was only apparent during the earlier periods of storage, while TO reduced lipid oxidation as measured by thiobarbituric acid value. SPSC application with TO generally resulted in higher lightness (L*), yellowness (b*) and lower redness (a*) values.

P06-006
Exploring Bacterial Genomic Diversity to Identify New Levaneas of Industrial Potential for the Hydrolysis of Fructans to β-(2–6)/Neofructooligosaccharides
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Introduction: Levaneas (E.C.3.2.1.65) are glycosyl-hydrolytic enzymes that characterizelly catalyze the hydrolysis of β-(2–6) linkages in fructans (neo-levan, levan). As biocatalysts, levaneas have the beneficial ability to generate β-(2–6)–/neofructooligosaccharides (FOSs) from natural fructans, as with agave, levan, and/or microbial levans. Furthermore, levanase can serve as an integral component of the bi-enzymatic system developed in our lab for the production of FOSs and β-(2–6)–oligolevans, using sucrose as an abundant starting material. β-(2–6)– and neolevan-type-FOSs obtained through levanease-catalyzed acid hydrolysis of fructans have demonstrated prebiotic potential and colonic persistence, which may surpass that held by current β-(2–1)-FOSs. Despite several reports demonstrating viable applications of levan-type FOSs in foodstuffs and pharmaceuticals, industrial scale production has yet to be achieved. The objective of the present work was to discover and examine the functionality of a new, broader collection of endo-levaneas via genome mining.

Method: A mass phylogenetic screening was conducted to identify all bacterial species bearing a homologous gene sequence to that encoding levanease for a reference set of microorganisms, ultimately resulting in 121 potential cases. PCR-amplification was performed to verify the findings. Subsequently, recombinant levaneas exhibiting potential for industrial applications were selected based on their magnitude of catalytic activity with low molecular and high molecular weight levans serving as the substrate in separate reaction systems.

Results: Gram-negative Capnocytophaga orcharea, Belleville baltica, and Dyadobacter fermentens were determined to have the highest level of hydrolytic activity with regards to low molecular weight levans. Notably, Gram-positive bacteria Arthrobaubacter aurisrus and Streptococcus Parasanguinis performed better mechanistically with high molecular weight levans, possibly attributed to less steric hindrance in the active site. The activity mode (endo-/exo-), end-product profile, as well as the thermostability of the selected levaneas will be discussed in relation to their gene sequences.

Significance: Bacterial levaneas are value-added assets for the food industry as they give rise to sustainable and economical production of prebiotics, with important applications in nutrition and health maintenance.

P06-007
Evaluation of Fructan of Agave Tequilana Weber Blue Variety as Encapsulant Material of Pitanga (Eugenia uniflora L.)
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Introduction: Agave fructans are a mixture of fructose polymers, with a degree of polymerization from 3 to 80. Present interesting features to be used as wall materials to achieve this finish. As antioxidants, providing a functional prebiotic alternative compared to other wall materials to achieve this finish.

Method: Fractions of agave fructans were characterized through: physicochemical properties, drying rate curves, moisture adsorption kinetics, and rheology, for the microencapsulation juice was homogenized with the wall material (MGP/AGP) and maltodextrin DE10 (MD). Subsequently it was fed into the dryer at an inlet temperature of (110/120/140°C) at a feed rate of 10 mL/min. In resulting microcapsules analyzes were performed to verify the findings. Subsequently, recombinant levaneas exhibiting potential for industrial applications were selected based on their magnitude of catalytic activity with low molecular and high molecular weight levans serving as the substrate in separate reaction systems.

Significance: Determining whether agave fructans have encapsulating capacity is of great importance because they may be used as wall material in the protection of compounds of interest as antioxidants, providing a functional prebiotic alternative compared to other wall materials to achieve this finish.

Results: Upon completion of the above it was concluded that AGP and MGP have suitable for use as encapsulating materials however the AGP exhibiting superior encapsulation when compared with the MD, with the use of physicochemical temperatures, viscosity and thermal properties. With 120 and 140°C yield best results are obtained encapsulation and the microcapsules obtained show better characteristics in terms of protection of bioactive compounds, these microcapsules exhibit spherical form spray drying.
characteristics, the microcapsules with AGP and MGP showed agglomeration while MD microcapsules were rounded depressions and dents. It obtaining differences between the AGP and their partial characterization MGP achieved is evident that with different molecular weight fractions which have significantly different characteristics, and both can be used.

**P06-008**

**Determinant of Factors Affecting the Entrapment Efficiency of β-Cyclodextrins and Their Effects on the Formation of Inclusion Complexes Containing Essential Oils**

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**Introduction:**
Essential oils (EO) are naturally occurring compounds with antioxidant and antimicrobial properties. Despite these advantages, the use of EO still remains a challenge for the food industry mainly due to their high volatility, complex nature, and required high concentrations to achieve desired effect. These drawbacks can be controlled by the encapsulation of the EO into a cyclodextrin to form an inclusion complex (IC). However, several factors can affect the encapsulation process and consequently the entrapment efficiency (EE) of the cyclodextrins. Thus, the goal of this work was to determine some of those factors and then to study their effect on the encapsulation process in order to improve the EE of cyclodextrins. In order to do so, β-cyclodextrin (β-CD) and two different EO (palmarosa and star-anise) were used to study the effect of: (1) order of addition of components to water (EO before or after β-CD), (3) EO quantity (very low to very high), and (3) type of drying method (oven-drying or freeze-drying) on EE.

**Method:**
Each EO was added in different quantities (0.1% - 3%) to a β-CD solution (18mg/mL-1) or to plain water followed by the addition of the β-CDs. The obtained ICs were either oven-dried or freeze-dried, stored, and evaluated for entrapment efficiency (EE) using UV/VIS spectrophotometry and water as a solvent. The results were analyzed using SPSS.

**Significance:**
This study shows that the combination of adding the EO to water after the β-CD, using a low amount of EO, and drying the ICs using and oven improves EE notoriously. These results will allow the food industry to improve the EE of cyclodextrins as well as to reduce costs.

**Results:**
Our results show that the EE was more than doubled when the EO was added after the β-CD (67% vs. 29% and 60 vs. 24% for palmarosa EO and star-anise EO, respectively). The EE was triplicated when used oven-drying compared to freeze-drying (~75% vs. ~25% for both EO). The EE decreased (91% to 66%) as increased the oil concentration (0.1% to 3%) for star-anise EO but not for palmarosa EO where this only happen at a specific EO amount (0.3% to 0.9%).

**P06-009**

**Influence of Starch Swelling Volume and Degree of Cook on Casein Gelation and Texture Development of Yogurts**

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**Introduction:**
Yogurt is traditionally produced from the lactic acid fermentation of milk, leading to a decrease in pH and induced gelation of casein micelles. Gel firmness and other yogurt texture characteristics can be positively impacted by optimizing formulation of the gel network, and increasing the gel strength of the yogurt. The objective of this work was to determine some of those factors and then to study their effect on the encapsulation process in order to improve the EE of cyclodextrins. In order to do so, β-cyclodextrin (β-CD) and two different EO (palmarosa and star-anise) were used to study the effect of: (1) order of addition of components to water (EO before or after β-CD), (3) EO quantity (very low to very high), and (3) type of drying method (oven-drying or freeze-drying) on EE.

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**P06-010**

**Synthesis of β-Sitosteryl Oleate for the Optimization of Physicochemical and Sensory Properties of Reduced-Cholesterol Butter**

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**Introduction:**
The synthesis of β-sitosteryl oleate (BSO) for incorporation into reduced-cholesterol butter was investigated. This became necessary because reduced-cholesterol products usually lack the inconsistencies of their respective controls. Our expectation was that the incorporation of BSO into reduced-cholesterol butter will improve its consistency since BSO is structurally similar to the removed cholesterol fatty acid esters, and as such should have similar physical properties.

**Method:**
The esterification reaction was catalyzed by sodium bisulfate (2%, w/w) at 140°C. The reaction factors investigated were reaction time and substrate molar ratio. The progress of the reaction was monitored by thin-layer and gas chromatographic techniques. Reduced-cholesterol cream (RCC) was then reconstituted to contain 3, 5, and 10% (w/w) BSO, after which fat was extracted from the three formulations and their melting profiles compared to that of milk fat using differential scanning calorimetry (DSC). The reconstituted cream with fat melting profile similar to that of milk fat was used to formulate the experimental butter. This was followed by textural analysis for firmness, hardness and adhesiveness. Finally, a sensory panel evaluated the BSO-fortified reduced-cholesterol butter for spreadability, color, and odor.

**Significance:**
Our results indicated that butter produced by the incorporation of BSO into reduced-cholesterol cream had physical attributes comparable to regular butter, but did not negatively affect the sensory properties. Our work has also demonstrated that the use of phytosterol esters can be used as suitable cholesterol replacement in butter and may be extended to other dairy products.

**Results:**
The highest degree of esterification (94.34% ± 3.62) was obtained when the molar proportion of β-sitosterol to oleic acid was 1:3 after 9 h of reaction. The fat melting profile of the cream containing 3% BSO was comparable to that of milk fat, and thus was used for the formulation of BSO-fortified reduced-cholesterol butter (BSOB). Instrumental analyses showed that the experimental butter (BSOB) was comparable to the control with respect to physical properties such as firmness and adhesiveness. However, sensory analysis indicated no significant differences in terms of spreadability and odor.

**P06-011**

**Effects of Herb Extracts on the Oil Oxidation in Acidic Emulsion of Soybean Oil in Water**

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**Introduction:**
Herbs contain functional components and polyphenols are the most important compounds having functions of antioxidant, anticancer, and antiatherosclerosis. Typical polyphenol compounds found in herbs are cannosic acid, carnosol, rosmarinic acid,caffeic acid, sinapic acid, catechin, caffeic acid, and p-coumaric acid. The antioxidant activity of polyphenols has been reported to be through metal chelating and radical scavenging. Different herbs show different antioxidant activity, possibly due to different composition of polyphenols. This study was carried out to compare the antioxidant activity of rosemary (Rosmarinus officinalis), basil (Ocimum basilicum), cumin (Communium), peppermint (Mentha piperita) and oregano (Origanum vulgare) on the iron-catalyzed oxidation of oil in the acidic (pH 4.0) soybean oil-in-water (40:60, w/w) emulsion, and determine the concentration dependence of their antioxidant activity.

**Method:**
Each herb (freeze-dried) was extracted with 80% ethanol and then added to the sample emulsions containing iron, followed by oxidation at 25°C in the dark. Degree of oil oxidation was evaluated by headspace oxygen contents by gas chromatography, peroxide production by ferric cyanate method, and p-anisidine value by AOCS method. Composition of polyphenols of herb extracts was determined by HPLC.

**Significance:**
This study suggested that the addition of basil and peppermint extract at the level of 200 mg/kg could improve optimally the oxidative stability of soybean oil in the acidic O/W emulsion.

**Results:**
Relative contents of rosmarinic acid and catechin were higher in basil and peppermint extract than rosemary, thyme, and oregano extracts. Peroxide value and p-anisidine value were significantly lower in emulsions with added herb extracts at 100 mg/kg than in the control without any herb extract. The antioxidant activity of basil and peppermint extract (0.1132~0.1158 μmol O2/mL/day in oxygen consumption, 0.0194~0.0220 mmol CuOOH/kg/day in peroxide formation, 0.9003~0.9218/day in p-anisidine value) was higher than other herb extracts. As the addition level of basil and peppermint extract increased from 0 to 50, 100, 200 mg/kg, the antioxidant activity to decrease the oil oxidation significantly increased (p<0.05). However, addition of 400 mg/kg did not show significantly different antioxidant activity from the level of 200 mg/kg.
Introduction: Nano-encapsulation is a platform which offers a promising application for drugs, antioxidant/antimicrobial delivery. Poly (lactic-co-glycolic acid) (PLGA) is a biodegradable and bio compatible co-polymer of lactic acid and glycolic acid which is used for synthesizing polymeric nanoparticles (NP). Nanoparticles are commonly used in the pharmaceutical industry for drug delivery. Hence, the food industry shows significant interest in the application of NP as carriers of natural antimicrobial and antioxidant agents against the foodborne pathogens and enhancing nutritional content in food systems, respectively. Hence, the aim of this study was to evaluate the effect of Aloe Vera gel (liquid form and powder) on the physical characteristics (hydrodynamic diameter, Particle size distribution, poly-dispersion index (PDI) and zeta potential) and stability of PLGA unloaded and loaded NP.

Method: Nanoparticles were formulated using an ultra-sonication-sonvent-evaporation method, which involves the emulsification of organic and aqueous phase solution, followed by the evaporation of the organic solvent (ethyl acetate) under vacuum. The sonication of the emulsion was conducted for 15 min to obtain optimum size formation. The biosynthesis of the loaded NP was followed by centrifugation and lyophilization to improve the long-term stability of the colloidal suspension of loaded NP in emulsion. The SAS system was used for determining significant difference.

Significance: The advantage of encapsulation is to provide protection of the bioactive compounds, hence the eminent target control release attributes makes it the bioactive.

Results: The average particle size of the PLGA unloaded and loaded NP with Aloe Vera gel (liquid form and powder) synthesized with 0.5% dimethylamine borane (DMAB) significantly was different (P < 0.01) and the hydrodynamic diameter were 102.9, 221.4 and 146.7 nm, respectively. The loaded NPs was significantly (P < 0.01) bigger (hydrodynamic diameter) than the unloaded NPs, due to increase dispersed colloidal suspension in the naneomulsion after loading. The poly-disperty index and zeta potential for unloaded and loaded (liquid form and powder) NPs were 0.200, 0.299 and 0.206 and -60, -21.9, and -28 mV, respectively.

P06-013 Effects of Salts on Amorphous Sucrose Properties
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Introduction: The physical state of sucrose influences the texture and other quality traits of a wide variety of foods. Although sucrose is commonly distributed as a crystalline ingredient, once formulated in foods and/or processed by freeze drying or spray drying, sucrose may adopt an amorphous physical state. Amorphous solids are inherently less stable than their crystalline counterparts, and an unwanted recrystallization event in a food can lead to texture change and quality loss. This study investigated the effects of different salts on the stability of amorphous sucrose in different environmental conditions.

Method: Amorphous sucrose was prepared by freeze drying, with and without different chloride salt additives (LiCl, NaCl, KCl, MgCl2, CaCl2, and FeCl3), and stored in controlled temperature and humidity conditions. Differential scanning calorimetry, X-Ray diffraction, and moisture sorption studies documented the recrystallization of amorphous sucrose.

Significance: These results will be helpful not only in guiding judicious choice of additives to prepare stable amorphous sucrose, but also for enhancing the understanding of sucrose physical stability in different formulations.

Results: The presence of a salt significantly decreased the Tg of amorphous sucrose (58.1°C) ranging from 54.7°C for sucrose + LiCl to 39.0°C for sucrose + FeCl3. The recrystallization temperature of NaCl + sucrose and MgCl2 + sucrose samples was higher (~138°C) compared to sucrose alone (128°C) and with other additives. With short equilibration times (5 h) at 25°C, differences in the RH at which recrystallization commenced were present between different salt types, with sucrose and sucrose + KCl recrystallizing at 45% RH, followed by sucrose + LiCl (50% RH), sucrose + NaCl (55% RH), and sucrose + MgCl2 and sucrose + CaCl2 (65% RH), with sucrose + FeCl3 showing no evidence of recrystallization; however, when equilibrium times were extended to 50 h, all samples recrystallized at 45% RH except sucrose + FeCl3. All samples remained amorphous throughout the study when stored at 11% RH and 23% RH at ambient temperature.

P06-014 Processing Effects on the Chemical Properties of Components Used in Formulating Fortified Maize-Bambara Groundnut and Maize-Cowpea Complementary Foods
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Introduction: This investigation was carried out to determine which processing techniques accounted for reductions in mineral and vitamin A contents of fortificants used in complementary foods and the possibility of modifying the treatments. The study investigated the effect of degemering, malting, ashing, and emulsification on the chemical properties of respective food components used in formulating fortified maize-bambara groundnut and maize-cowpea complementary foods.

Method: Dried maize seeds were degemered and milled into flour. Bambara groundnut and cowpea seeds were malted, cleaned and milled. Cattle (rib) bones used as source of calcium were cracked open, washed clean with hot water, oven-dried, ashed, and milled. Alternanthera brasiliana leaves and Hibiscus sabdariffa calyces used as sources of iron and zinc were ashed and milled. Red palm oil used as source of pro-vitamin A was used to form a stable emulsion with Brachystegia eurycoma seed flour, dried and milled. The diastatic activity, calcium, iron, zinc, and pro-vitamin A contents of the relevant components were determined.

Significance: Processing affected the chemical properties of components used in formulating maize-bambara groundnut and maize-cowpea complementary foods. It also pointed to the need to modify the treatments and eliminate the use of cattle bone in the formulation.

Results: Degemering maize led to 10.24%, 18.15%, 18.25%, and 0.56% losses in calcium, iron, zinc, and pro-vitamin A respectively. Malted bambara groundnut and cowpea seeds had peak diastatic activities of 32.5 ol and 36.25 ol respectively after 72 hours. Malting resulted in losses of 8.49% and 12.56% of calcium, 23.93% and 9.38% of iron, 6.66% and 9.48% of zinc respectively. Pro-vitamin A contents of cowpea and cowpea by 17.85 and 38.60% respectively. Ashing Alternanthera brasiliana and Hibiscus sabdariffa led to 2.31 and 0.54% loss in calcium, 1.07 and 1.125 of iron, 2.71 and 1.75% of zinc respectively. On the other hand, ashing increased the calcium content of cattle bone from 391 to 401 g/kg. Un-emulsified red palm oil had pro-vitamin A content of 17,241 µgRE/kg, but its emulsification with Brachystegia eurycoma seed flour led to 57% loss in pro-vitamin A content.
P06-016
Enhancing the Stability of an Anthocyanin Colorant and Vitamin C in a Model Juice by Inclusion of Green Tea Catechins
C. Gajadeera, University of Minnesota, A. Marti, B. Ismail, Email: cgajadee@umn.edu

Introduction:
Thinopyrum intermedium is commonly known as intermediate wheatgrass (IWG), is a perennial crop with favorable agronomic characteristics; reduces soil and water erosion, increases nitrogen fixation and disease resistance. We have previously shown that in comparison to wheat controls, IWG lines had higher protein and dietary fiber contents. However, the protein distribution is significantly different from that of hard red winter wheat (HRWW). The difference in protein distribution coupled with higher fiber content negatively affects the dough rheology in terms of protein network formation. Therefore, the objective of this study was to determine the effect of bran reduction on the gluten secondary structure in IWG dough using Fourier transform infrared (FTIR) spectroscopy.

Method:
IWG grains sample was milled and bran was separated. Bran was added back to refined IWG flour at 100%, 75%, 50%, 25%, and 0% of original bran content. Using Differential Scanning Calorimetry (DSC), gluten protein glass transition temperatures at various moisture contents were determined to identify optimum dough forming conditions. Different flour samples were evaluated for dough strength using farinograph following compogmentation with catechins. Catechins were assumed to protect the anthocyanin chromophore against degradation by Vitamin C, shown by loss solution fading. This was evidenced by decreasing the end change in L* by 20 for solutions containing green tea catechins. Monomeric anthocyanins were also protected against Vitamin C degradation by catechins, shown by a significant difference in end concentrations (2.81 vs 0.51 uM).

P06-017
Effect of Bran Reduction on Gluten Secondary Structure in Intermediate Wheatgrass (Thinopyrum Intermedium) Dough
C. Gajadeera, University of Minnesota, A. Marti, B. Ismail, Email: cgajadee@umn.edu

Introduction:
Thinopyrum intermedium, commonly known as intermediate wheatgrass (IWG), is a perennial crop with favorable agronomic characteristics; reduces soil and water erosion, increases nitrogen fixation and disease resistance. We have previously shown that in comparison to wheat controls, IWG lines had higher protein and dietary fiber contents. However, the protein distribution is significantly different from that of hard red winter wheat (HRWW). The difference in protein distribution coupled with higher fiber content negatively affects the dough rheology in terms of protein network formation. Therefore, the objective of this study was to determine the effect of bran reduction on the gluten secondary structure in IWG dough using Fourier transform infrared (FTIR) spectroscopy.

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P06-018
Inhibiting Peanut Allergen Digestion With p-Aminobenzamidine Attached to Allergens
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Introduction:
Peanut allergens can be digested into peptide fragments despite being known as resistant proteins. Once absorbed, the peptide fragments from digested allergens could bind to immunoglobulin E (IgE) antibodies and cause an allergic reaction in allergic individuals. To reduce peanut allergy, one approach is to inhibit or limit the digestion of peanut allergens. Our objectives were to make peanut allergens (Ara h 1 and Ara h 2) more resistant to digestion and test them in a model system using trypsin as the digestive enzyme.

Method:
Ara h 2 with a higher resistance was prepared by incubating p-aminobenzamidine (pABA) (a protease inhibitor) with a peptide extract in the presence of glutaraldehyde. Ara h 1 modified with pABA was prepared on a PVDF membrane due to solubility problem. A control was prepared using glycine instead of pABA or without treatment. Excess pABA or glycine was removed by centrifugation or washing the membranes. The resulting modified allergens were subjected to trypsin digestion and analyzed by gel electrophoresis. IgE binding was performed in Western blot.

Significance:
The model system demonstrated that peanut allergens could be made more resistant to digestion and warrants further investigations into more complex systems that may support the concept that making peanut allergens more resistant to digestion could potentially reduce the absorption of allergens and, thereby, allergic responses.

Results:
Results showed that both Ara h 1 and Ara h 2 allergens, when covalently attached with pABA, were more resistant to trypsin digestion than native allergens. Treatment of the allergens with glycine (control) instead of pABA did not result in more resistant allergens. The pABA-modified allergens showed some IgE binding or allergenic reactivity, which should not be a concern based on the assumption that the modified allergens may not be absorbed.

P06-019
Antimicrobial Effect of Reactive Oxygen Species (ROS) Generated From Ultraviolet (UV-A) Light Exposure of Benzoic Acid
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Introduction:
Benzoic acid (BA) is a commonly used food preservative whose antimicrobial activity is based on the intracellular acidification. However, in a unique observation, we found that the exposure of 5 mM benzoic acid to UV-A (365 nm) light for 30 minutes caused a 51.07±7.7 log reduction in Escherichia coli O157:H7 compared to 0.86±0.26 log reduction in presence of 5 mM benzoic acid in dark or 0.39±0.09 log reduction in presence of UV-A alone. We postulate that this synergistic antimicrobial activity of benzoic acid and UV-A light was due to the generation of diverse reactive oxygen species upon exposure of BA to UV light spectrum including UV-A, B, or C. To test this hypothesis, we investigated the generation of ROS in terms of ROS such as singlet oxygen and hydrogen peroxide by exposing BA solution to UV-A (315-400 nm), B (280-315 nm), or C (100-280 nm).

Method:
10 mM BA was exposed to UV-A (365 nm, 2015 uW/cm² intensity), B (312 nm, 1427.5 uW/cm² intensity) or C (254 nm, 4762 uW/cm² intensity) light with a same dose level. Singlet oxygen was detected using a previously established method based on measurement of Furfuryl alcohol (FFA) degradation rate by singlet oxygen using high pressure liquid chromatography (HPLC). Hydrogen peroxide generation was measured using ferrous oxidation-xylene orange (FOX) assay that is based on generation of a colored complex between xylene orange and ferric ions formed by oxidation of ferrous ions by hydrogen peroxide using a spectrophotometer.

Significance:
We envision that this synergistic interaction of BA and UV light can be harnessed for diverse applications such as advanced oxidative processes for degradation of xenobiotic compounds and inactivation of pathogenic microorganisms in foods and on food-contact surfaces.

Results:
3.57±0.50 pm, 31.74±0.94 pm and 58.66±2.70 pm singlet oxygen and 0.06±0.01 uM, 1.69±0.10 uM and 1.35±0.06 uM hydrogen peroxide were generated from exposure of BA to UV-A, B, and C light respectively. Thus, UV exposure of BA produced diverse ROS and UV and UVB were more efficient wavelengths than UVA in terms of ROS generation.

P06-020
Total Dietary Fiber Content of Grape Pomace as Affected by Particle Size Reduction
J. Yu, North Carolina A&T State University, R. Maman, G. Chen, Email: jyu@ncat.edu

Introduction:
Particle size reduction of grains and dietary fiber rich materials by grinding is usually demanded for better acceptance of the final products. Grape pomace (GP) has great...
potential to serve as a cheap source of antioxidant rich dietary fiber to improve the nutritional value of food products. This study investigated the degree of grinding or particle size on the total dietary fiber (TDF) of GP.

Method:
Pomaces from 4 grape cultivars were dried, free seeds removed, and then ground into 4 fractions of different particle sizes. The particle size of each fraction was determined using a laser particle size analyzer. The total dietary fiber (TDF) of each fraction was quantified using two methods: The AOAC official method 991.43 and a modified AOAC method. The modification was made by changing the three-step digestion into two-step digestion by replacing protease and amyloglucosidase with pancreatin.

Significance:
The findings of this study indicate that the particle size of GP influences the dietary fiber profile and influence the analysis of TDF by the current AOAC method. These findings may promote efforts to standardize food particle size for dietary fiber analysis.

Results:
The particle size showed tremendous effect on the TDF content of grape pomace. As GP particles became smaller, the TDF quantified became lower. The TDF correlated to particle size linearly (R² = 0.91-0.98). The findings indicate that as particle size decreases, (1) the digestibility of GP increases, and (2) the amount of TDF can be detected by the current TDF method decreases. To compare the TDF content of different food materials, it is important to ensure that all materials are ground to the similar particle size. The study also found that there was an influence of particle size on the TDF and pancreatin method when the particle size of GP was 486 micrometer or larger, but as particle size of GP fell below 209 micrometer, the TDF obtained by pancreatin method was significantly higher than that by AOAC method (P<0.05). More work is needed to optimize the pancreatin method to achieve results comparable to those obtained by AOAC method 991.143.

P06-021
High Power Ultrasound Treatment Effects on Process Yield Efficiency and Extra Virgin Olive Oil Characteristics
B. Iqdad, University of Florida, M. Marshall, R. Goodrich Schneider, G. Baker, B. Welt, Email: bmi133@ufl.edu

Introduction:
High power ultrasounds (HPU) provide rapid heating for olive paste and works to disrupt cell walls, in turn helping the small droplets of olive oil to exit the wall of tissues and subsequently coalescing. This improves oil yield and reduces malaxation time without affecting the quality criteria for extra virgin olive oil (EVOO). In this study, the effect of (150 W and 20 kHz) of (HPU) treatment after the crushing step was examined at lab-scale to improve the extraction process efficiency.

Method:
In this study, the effect of (150 W and 20 kHz) of (HPU) treatment after the crushing step was examined. The olive paste from the malaxation step in the yield, which means that there is a reduction of 10 minutes for mixing time. In addition, there are no significant differences within the change for the quality parameters for 2 and 4 min treatment, but there is a significant difference for the 6, 8, and 10 min treatment with control.

Results:
The results showed that the treatment by HPU caused a rapid heating of the olive paste as a function of using this technology, increasing the olive paste temperature from 19°C to 28°C. HPU treatment increased the oil yield by 1.19 % and the oil extractability by 1.19 %.

Emulsions with emulsifier concentrations of 3 or 4% showed initial Z-values of 43.28 and 43.28 µm and the highest viscosity (43.94±2.32 mPa*s) and (43.94±2.32 mPa*s), respectively, enhancing the emulsions’ stability. Emulsions with emulsifier concentrations of 3 or 4% showed initial Z-values of 43.28 and 43.28 µm; and 40.89 mV; which were values are regarded to be stable emulsions systems. This prediction was confirmed during storage, owing to the significant differences (p<0.05) showed in creaming property at the end of the experiment. Besides, in all cases, the analysis of the dispersed phase droplet size in the emulsion over time, demonstrated that the instability mechanism that drove to separation of the emulsions was Ostwald ripening. Factors such as density and pH did not affect emulsions’ stability.

P06-023
Effect of Instant Controlled Pressure Drop Treatment on the Content of Non-Nutritional Compounds of Vetch (Vicia Sativa)
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Introduction:
The common vetch is a native crop in Europe, North Africa, and West Asia and is also grown in the highlands of Mexico. This crop is used to benefit soil for other crops, providing organic matter and improving its structure due to water infiltration. The use of common vetch in Mexico is limited to use as a forage food. It is well known that some legumes have non-nutritional factors that also limit the use of it for human consumption. Instant controlled pressure drop (DIC) is a high temperature, short time treatment followed by an abrupt pressure drop towards a vacuum implying an autovaporization of small amount of water from the product. Hence, it induces an instant cooling and texture expansion of the treated product and prevents its thermal degradation.

Method:
A sample of common vetch was grounded (mesh 0.1 mm) prior to analytical procedures. A proximate chemical analysis was performed in duplicates, according to AOAC standard methods. DIC technology was applied in order to reduce concentration of non-nutritional factors. A central composite rotatable design, varying pressure (1.0 - 4.5 MPa) and time (1.0- 6.0 min) was used for DIC treatment.

Significance:
The results make it possible to know if the instant controlled pressure drop technology is ideal for the removal of non-nutritional factors. After reducing, it is possible to formulate wider use of common vetch as a novel and non-commercial source for human consumption, or a novel source of some biological activity of interest in further investigations.

Results:
Proximate analysis gave the following results: moisture (12.5%), ash (1.8%), total nitrogen (15.3%), crude fat (2.8%), and crude fiber (8.7%). DIC treatment reduced the amount of non-nutritional factors such as oligosaccharides (verbascosae 2.54 to 1.78 mg/g; raffinose 16.33 to 11.43 mg/g, total phenols (114 to 75.8 mg/g), and flavonoids (145.55 to 99.89 mg/g), prior to our DIC process. After the DIC process, a reduction of 40% of non-nutritional factors was estimated. Traditionally, for the removal of non-nutritional factors, a process of soaking and cooking is done, but is not as effective as DIC process.

P06-024
Stability During Storage of Oregano Essential Oil Encapsulated by Emulsification by Means of Emulsifier Blends
G. CARDOSO-UGARTE, Universidad de las Americas Puebla, E. Palou, A. López-Malo, N. Ramirez-Corona, M. Jimenez-Munguia, Email: gabriel.cardosoue@udlap.mx

Introduction:
Among encapsulation techniques, emulsification has been recently studied as an encapsulation technique able to provide protection to several active ingredients such as essential oils. Although there are a wide variety of emulsifiers in the market, each system requires a specific emulsifier or a blend of these to meet a precise hydrophilic-lipophilic balance. The aim of this study was to analyze the effect of four different concentrations of a blend of emulsifiers in the stability of oregano essential oil (EOO) encapsulated by emulsification during storage.

Method:
Homogenization of emulsions was performed using a mechanical homogenizer. Aqueous phase (40%) consisted of distilled water and hydrophilic emulsifier Tween 80; a lipid phase (60%) was formulated by mixing OEO in a concentration of 16.6% and corn oil. A blend of emulsifiers was used at concentrations of 20%. The influence of four different concentrations (1, 2, 3, or 4%) of the emulsifiers’ blend over the stability during storage at 25°C of emulsions containing OEO was tested in this study.

Significance:
The study of the emulsifiers’ blend concentration used in emulsions is recommended in order to optimize the amount of the emulsifier used in the microencapsulated OEO in order to enhance its stability during storage. Further studies are suggested to evaluate its application in food systems.

Results:
The emulsions formulated with 3 or 4% of the emulsifiers’ blend, showed the smallest droplet sizes (1.33±0.384 µm and 1.53±0.324 µm) and the highest viscosity (43.94±2.32 mPa*s) and 71.04±2.46 mPa*s, respectively), enhancing the emulsions’ stability. Emulsions with emulsifier concentrations of 3 or 4% showed initial Z-values of 43.28 and 40.89 mV; which were values are regarded to be stable emulsions systems. This prediction was confirmed during storage, owing to the significant differences (p<0.05) showed in creaming property at the end of the experiment. Besides, in all cases, the analysis of the dispersed phase droplet size in the emulsion over time, demonstrated that the instability mechanism that drove to separation of the emulsions was Ostwald ripening. Factors such as density and pH did not affect emulsions’ stability.

P06-025
Characterization of Proso Millet Grown as a Second Crop in Minnesota
C. Tyl, A. Marti, J. Hayek, A. Vuellar, J. Anderson, B. Ismail, Email: tylox001@umn.edu

Introduction:
Millet is a drought-tolerant, nutritious grain that is well suited for both diabetics and people with celiac disease. Among the millet varieties, Proso millet has not been utilized for food products to the same extent as other millet varieties. As part of an ongoing evaluation of Proso millet as a second crop (in combination with Camelina or field pennycress) in Minnesota, the aim of our work was to characterize six varieties of decorticated Proso millet grown in two Minnesota locations in 2015 and compare them to a commercial millet sample.

Method:
Proximate analysis was conducted using standard methods. Total, digestible, and damaged starch was determined using enzymatic assays. Other properties determined included color on a Minolta chromator, pasting profiles with a micro
viscoamylograph, and optimum water absorption on a farinograph. The phenolic and 
carotenoid profiles were analyzed with HPLC, and antioxidant activity via two in vitro 
assays (Folin-Ciocalteu and 1,1-Diphenyl-2-picryl-hydrazyl assay). The test weight, 
protein solubility, and digestibility were also assessed.

Significance:
The characterization of the investigated Proso millets will lead to the selection of those 
varieties for future breeding purposes that are best suited for the production of specific 
cereal-based goods such as wafers, cookies, or bread.

Results:
Moisture contents and test weights were inversely correlated, with growing location 
influencing these properties to a higher extent than variety. Sample color most notably 
differed in lightness and yellowness, indicating differences in carotenoid content. Lipid 
contents tended to be higher in the samples grown at the location that led to higher 
moisture contents. In addition, some varieties displayed higher lipid contents than 
others. Dietary fiber contents tended not to be influenced by growing location; however, 
there were differences among varieties. Preliminary results indicate that the commercial 
millet had a higher setback value in the pasting profile, but peak viscosities were similar. 
Other data is currently being collected.

P06-026
Control of Emulsion Stability in Reduced-Fat Salad Dressings Through Understanding of Factors Dictating Phase Behavior
M. Beltz, Tate & Lyle, S. Zhou, Email: mark.beltz@tateandlyle.com

Introduction:
Salad dressing consists of oil and water emulsified together, along with vinegar, herbs 
or other seasonings that provide the distinctive flavors. The rheological properties of 
the oil and water phases, their relative volumes in the system, and the interfacial forces 
between them, are the primary drivers of emulsion formation and stabilization. This 
work will describe the generation of phase diagrams reflecting variations in aqueous 
phase viscosity and volume relative to the oil phase, first with model Newtonian 
thickeners, and then with starches.

Method:
Steady shear viscosity measurements were performed on the oil and the aqueous 
components. Emulsions were prepared using a hand held rotor-stator type mixing 
device. Electrical conductivity was used to determine whether the continuous phase 
was oil or water. Emulsion stability was assessed visually after letting the emulsion stand 
for 24 hours. The extent of creaming or separation of free oil was recorded.

Significance:
The work will show that emulsion stability, and ultimately the sensory attributes and 
consumer acceptance, can be controlled by careful tailoring of the swelling power of the 
starch.

Results:
Ease of emulsification was shown to be a function of aqueous phase viscosity relative to 
phase oil, and volume fraction of each. The aqueous phase viscosity, and therefore ease 
of emulsification, can be controlled by starch swelling power.

P06-027
Implication of Starch Thickening Behavior on Emulsion Formation, Stability, and Finished Product Texture of Salad Dressings
J. Simms, Tate & Lyle, R. Wicklund, M. Beltz, S. Zhou, Email: joni.simms@tateandlyle.com

Introduction:
Traditional salad dressing products consist of oil and water emulsified together, along with vinegar, herbs, and other seasonings that provide the distinctive flavors. The rheological properties of the oil and water phases, their relative volumes in the system, and the interfacial forces between them, are the primary drivers of emulsion formation and stabilization. This work will describe the generation of phase diagrams reflecting variations in aqueous phase viscosity and volume relative to the oil phase, first with model Newtonian thickeners, and then with starches.

Method:
Mayonnaise-type dressings at 40% oil were prepared with 3.5% (w/w) pregelatinized starches with different swelling power, and dressings were emulsified through a Boston shear mill (Admix, Inc.) at different speeds. Finished dressings were visually evaluated for emulsion formation and stability in terms of degree of free oil separation. Viscosity and rheological profile of each phase, as well as the prepared dressing emulsion, were analyzed over shear rates of 0.1 to 100 s⁻¹ with the Discovery HR-3 advanced rheometer (TA Instruments) using cup and bob geometry. Oil droplet size was characterized by light microscopy and imaging software.

Significance:
This work demonstrates the importance of understanding the multi-functional impact of starch behavior in food systems such as emulsified salad dressings.

Results:
Results indicate that as viscosity of the aqueous phase increase as a result of using a starch with higher swelling power, emulsion formation was severely restricted. Emulsion formation was enhanced when the viscosity of the aqueous phase was most similar to the viscosity of the oil phase, which was achieved with starches with lower swelling powers, when comparing starches on an equal weight basis. An optimal starch swelling power was found that minimized the viscosity ratio of the two phases while also enhancing the texture, body and creaminess of the dressing.

P06-028
Influencing the Uniformity of Fabricated Potato Crisps Through Starch Selection
C. Hathorn, Tate and Lyle, S. Avakashia, J. Smoot, Email: chellani.hathorn@tateandlyle.com

Introduction:
The processing of fabricated potato crisps is a delicate art that is heavily reliant on the 
functionality of the starch combined with potato flakes to take the dough. Through targeted starch selection, it is possible to impact the uniformity, pillowing nature, crispiness, crunchiness, hardness, and breakdown rate of these crisps. Dough characteristics can also be impacted, including stickiness, sheetability, and tensile strength.

Method:
Using descriptive profiling, this work leverages radar plots to visually compare how starches of different functional nature impact the above variables. The data is then compared with principal component analysis to create a localized product map for the starches under investigation.

Significance:
This understanding enhances how a manufacturer can control the quality of existing products or introduce novel textural experiences into their potato crisps.

Results:
From the sensory data it is revealed that starches which exhibit power law dependence of modulus with frequency in rheology experiments give doughs with the best sensory properties. Furthermore these doughs give maximum expansion associated with optimal consumer preference.

P06-029
Simulation of the Intermittent Drying Process in Soybean (Glycine Max) With Image Analysis
H. Park, OSU Seafood Lab, W. Yoon, Email: hwpark0978@gmail.com

Introduction:
Drying technologies are used to decrease the high moisture content of soybeans to 
extend its shelf-life during storage. Conventional air drying is the most frequently used 
dehydration method in the food industry. For soybean drying, intermittent drying 
can be used to prevent the deterioration of soybeans. However, no reports have been 
made to analyze the intermittent drying process of soybean. A better understanding 
of diffusion of water in the soybean would enable prediction of the drying process of 
soybean.

Our objectives were to: (1) simulate the mass transfer during the conventional air drying 
of soybean with numerical analysis and image analysis; (2) apply the simulation model 
to the intermittent drying of soybeans.

Method:
The initial moisture content and the diameter of soybean were 20% and 7.5mm, 
respectively. The drying experiments were conducted to achieve the target moisture 
content (10%) in a commercial lab scale tray dryer at 35°C. The drying conditions were as 
follows: continuous drying; 40-40 intermittent drying (40 min drying-40 min tempering); 40-20 intermittent drying (40 min drying-20 min tempering). The finite element analysis was used to simulate the drying process. To identify the moisture distribution in soybean, an image processing technique using the Canny edge operator in MATLAB (Mathworks® Inc., Natick, MA) was used, and two structure models were evaluated. The moisture content variation in the models were 9, 11, and 13% for the second layer.

Significance:
Our results demonstrated that the two structure model accurately described the 
moisture evaporation of soybean at both the continuous drying and the intermittent 
drying.

Results:
The effective moisture diffusivity was 5.541×10⁻¹² m²/s at 35°C. With the effective 
moisture diffusivity, the conventional simulation model with a uniform moisture 
content showed a slower drying rate than the experimental result. The RMSE values of 
the conventional model, 2-structure-9%, 2-structure-11% and 2-structure-13% were 
1.379, 0.415, 0.129, and 0.467, respectively. Because the drying simulation model of 
the conventional model, 2-structure-9%, 2-structure-11% and 2-structure-13% were 
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Significance:
Our results demonstrated that the two structure model accurately described the 
moisture evaporation of soybean at both the continuous drying and the intermittent 
drying.
**Introduction:**
Pollen is the germ cells in the stamens of a flower, which is a flavonoid-rich material used in medicine. Recent research indicated that pollen has antimicrobial effect against the pathogens in plants and foods. As an environmental friendly hurdle technology, heat treatment with addition of pollen can be used against Escherichia coli O157:H7, which contaminates meat products during processing.

The objectives of this study are (1) to examine the effect of heat treatment with flower pollen on bacteria inactivation and (2) investigate flower pollen as a natural preservative against E. coli O157:H7 in ground pork.

**Method:**
E. coli O157:H7 (ATCC 43894) was grown in fresh TSB. The rye grass flower pollen was dissolved and the filtrate was used. Fresh ground pork was used in experiments after sterilizing at 121°C for 15 min. The culture solution of E. coli O157:H7 (80 mg/mL) were put into glass tubes then treated by heating in water baths at 55, 57.5, 60, 62.5, and 65°C, respectively. The same procedures were conducted for the 10 g of ground sterile pork samples with/without pollen (150 mg/mL). D-values and z-values were calculated for the thermal treatment samples.

**Significance:**
This study clearly showed that the addition of flower pollen to ground pork may be applicable for sterilization to protect against foodborne pathogens.

**Results:**
The D-values in the culture were D55 = 10.03, D57.5 = 3.84, D60 = 2.76, D62.5 = 1.31, and D65 = 1.04 min, respectively, which were reduced to D55 = 3.13, D57.5 = 3.02, D60 = 1.80, D62.5 = 1.11, and D65 = 0.79 min with the addition of pollen. The z-value without addition of pollen was 10.24°C, which increased to 15.11°C with addition of pollen. The D-values in ground pork were D55 = 5.59, D57.5 = 2.58, D60 = 2.07, D62.5 = 1.30, and D65 = 0.87. When treated with the addition of pollen, the D-values decreased to D55 = 1.87, D57.5 = 1.56, D60 = 1.11, D62.5 = 0.73 and D65 = 0.50. The z-value increased from 13.05°C to 16.86°C.

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**P06-031**

**Improvemnt Functionality of Bread With Olive Pulp Powder**

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**Introduction:**
One of the most important byproducts of olive oil processing is olive pulp. Olive and its products are rich in phenolic compounds, so it can be used to increase the functional properties of some foods, which is substantial since in recent years awareness of people between diet and health has increased. This study aimed to evaluate the uses of olive pulp by investigating its probable usage in bread formulation to improve the functional properties of bread.

**Method:**
The breads including O; 1; 2.5, and 7.5 % of the olive pulp were produced according to AACC standard method (No 54-10) with some modifications. The color, texture, volume, and series of characteristics of breads were determined besides phenolic content and radical scavenging activity as a bioactive property.

**Significance:**
evaluation of food industry waste has attracted attention due to their economical importance. In the present study the possible usage olive paste powder as an important waste of olive oil industry was investigated. The results of the present study highlighted that functionality of the bread could be improved with addition of olive paste without adversely.

**Results:**
Findings of the present study indicated that the specific volume decreased due to increased rate of bread olive pulp. Darkening in color was observed with increasing ratio of olive pulp powder in the bread formulation. Functional properties of the bread significantly increased with addition of olive waste powder. Phenolic compounds in the crust of the bread ranged from 261.27 to 1141.73 mg GAE/g and for the crust from 79.45 to 1087.18 mg GAE/g. The value of DPPH crumb varied between 147.86 and 259.56 mg TE/L while for the crust it was between 243.34 and 1890.94 mg TE/L. Textural properties of the control and enriched breads were found to be very similar at 397.76 g to 935.19 g.

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**P06-032**

**Fragility Assessment of Various Gelatin-Polysaccharide Composites Approaching the Glass Transition Temperature**

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**Introduction:**
Gelatin is a commonly used in the pharmaceutical and food industries. Its mechanical properties are highly dependent on the polymer molecular weight (Mw), amino acid profile, and plasticizers. The prediction of molecular mobility of these systems at different weight fractions (0, 0.4, and 0.8). The surface chemical characteristic of the films was evaluated by FTIR spectroscopy. The Tg of each composite was obtained by differential scanning calorimetry (DSC). This data was mathematically represented by the Gordon-Taylor equation. Water sorption behavior was assessed by Dynamic Vapor Sorption (DVS) and modeled following the Guggenheim-Anderson-de Boer (GAB) equation. The activation energy (ΔE) and fragility index (m) were successfully calculated by Vogel-Tammann-Fulcher (VTF) approach and Angel’s dynamic fragility concept using Tg values at different heating rates.

**Significance:**
Study of the strong-fragile concept of gelatin polysaccharides composites provides relevant information about the stability of the system during production and storage, which is important for food and pharmaceutical industries.

**Results:**
The glass transition temperature of composites decreases with increasing sugar content. On the other hand, composites containing maltodextrin has a higher Tg values than the composites with glucose or sucrose. The water content at monolayer (mo) ranged from 1.5 to 13% (w/w). The activation energy decreases with the increase of sugar content in the composite. Moreover, with the increasing moisture content the activation energy decreases as the Tg, except composites containing maltodextrin. Additionally, study of fragility showed that the addition of polysaccharides into gelatin decreases the fragility index (from m = 70-60 even until m = 0-10). Thus, the composite films are stronger than pure gelatin. FTIR spectrum shows specific peaks of the gelatins and polysaccharides that testified to the integration of the components in the composite.

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**P06-033**

**Development and Optimization of the Extraction Process of Added Value Compounds From Oats by Supercritical Carbon Dioxide**

Y. Escobedo, C. Fontes Candia, I. Salmerón, D. Chávez, S. Pérez, Email: a220478@gmail.com

**Introduction:**
Oat has many health benefits due to its content of fiber and phenolic compounds, like avenanthramides, which are present only in oats. Thus, oat is a potential source of added value compounds with a growing interest in the food, pharmaceutical, and cosmetic industries. Supercritical fluid extraction (SFE), where the solvent is taken beyond its critical temperature and pressure, is an alternative to conventional extraction methods to obtain these phenolic compounds. The aim of this study is to develop an extraction process to obtain added value compounds from oat by supercritical carbon dioxide and ethanol (co-solvent).

**Method:**
A local oat variety was characterized by proximal analysis prior to be milled. Granulometric analysis was performed to adjust samples’ particle size. Pressure, temperature, and ethanol concentration were set as the variables to develop extractions.Response surface methodology (RSM) was selected for controlling experiments. Variables such as polyphenol content (PFT), antioxidant capacity (ORAC), total dietary fiber content, and beta-glucans were evaluated as responses. Preliminary extractions of a central composite design were performed at: pressure 3000 psi, temperature 45°C, and ethanol solution concentration 70%, extraction time 60 minutes. From the extracts obtained, eight compounds were quantified by HPLC (vanillin, p-coumaric, ferulic, and sinapic acids, vanillin, and avenanthramides a, b, and c).

**Significance:**
As a result, SFE can be an alternative to extract specific added value compounds from oats, analogues avenanthramides.

**Results:**
Oat percentage of moisture was 10.07 ± 0.06; protein 10.23 ± 1.01; fat 4.45 ± 5.84; fiber 17.67 ± 0.31; ash 4.03 ± 0.00; carbohydrates 53.54. The granulometric analysis showed that 70% of particles had a particle size distribution of 0.5 mm, this result was desirable because in this range, effects of particle size are not significant. Preliminary extractions showed mean values of vanillin 14.44 ± 5.765 μg/g, avenanthramides a, b, and c of 2.688 ± 3.650, 2.490 ± 3.414, 4.796 ± 3.391 μg/g, respectively. For p-coumaric, ferulic, and sinapic acids they were 4.643 ± 2.634, 5.142 ± 1.827, 0.404 ± 1.046 μg/g respectively. Vanillin acid had the highest concentration of 44.69 ± 3.345 μg/g. Compared to reported values the contents of avenanthramide c and sinapic acid were higher than those reported through conventional methods.

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**P06-034**

**Tuning the Size and Magnetic Property of Fe3O4 Particles by Poly(Acrylic Acid) for Pathogen Capture**

Y. Song, University of Maryland, College Park, Y. Li, Z. Tang, Q. Wang, Email: elaine.yy.song@gmail.com

**Introduction:**
Foodborne diseases account for estimated 48 million illnesses, 3000 deaths, and an expenditure of 5 to 6 billion dollars each year in the United States, indicating the importance and urgency to efficient detection of pathogens. Magnetic nanoparticles (MNPs) have been studied widely in the past few years. The small size confers MNPs with unique properties including high magnetic susceptibility and low coercivity.
Consequently, MNPs have found wide application in food processing and food safety analyses, such as enzyme immobilization and pathogen (or toxin) separation. However, the aggregation of MNPs resulting from the high surface energy and strong magnetization hinders their further application and therefore should be overcome. This study was focused on synthesizing MNPs of various sizes, which were less prone to aggregation and maintained excellent magnetic properties.

**Method:**
MNPs were synthesized via three different hydrothermal routes, using ferric ammonium citrate as iron source and poly (acrylic acid) (PAA-1800, PAA-30000, and PAA-100000, with the numbers indicating the molecular weight) as the stabilizer. The particle size and morphology were measured by dynamic light scattering and scanning electron microscopy. The magnetic property was determined by vibrating sample magnetometer. The identity of MNPs was confirmed by X-ray diffraction.

**Significance:**
Reduced aggregation of the MNPs allows them to maintain high surface area in long-term storage, which will facilitate the application in food safety analyses, such as pathogen capture and their electrochemical detection.

**Results:**
Among the three routes tested, one-step hydrothermal synthesis demonstrated the highest yield and most efficient separation. When this approach was adopted, the particles prepared with PAA-100000 were 90%, 57%, and 35% smaller in size compared to the samples synthesized with PAA-1800, PAA-30000, and PAA-50000, respectively. The saturation magnetization (63 emu/g) did not vary significantly among these four samples. Compared to other samples, the particles prepared with PAA-100000 also exhibited 65% lower coercivity and remanence, which resulted in reduced aggregation and improved water-dispersibility after one-month storage. Bovine serum albumin (BSA) and lysozyme as protein models were successfully conjugated with the MNPs via covalent carbodiimide cross-linking chemistry, suggesting the feasibility of antibody immobilization on MNPs surfaces.

**P06-035**
**Modeling the Softening of Carbohydrate-Based Foods During In Vitro Gastric Digestion**
K. Drechsler, UC Davis, G. Bornhorst, Email: kdrechsler@ucdavis.edu

**Introduction:**
Food texture represents food structural and surface properties and will affect softening in the gastric environment. The Food Breakdown Classification System (FBCS) was developed with the objective of classifying solid food breakdown in the stomach according to initial hardness and softening rate during in vitro gastric digestion. Before widespread implementation of the FBCS, appropriate methods must be developed for the dehydrogenase of food softening during gastric digestion. The goal of this study was to determine the influence of carbohydrate matrix on the softening rate of grain-based foods during in vitro gastric digestion by three texture tests.

**Method:**
Six carbohydrate matrices (brown rice, white rice, quinoa, couscous, orzo, pretzel) underwent in vitro oral digestion (0.2 mL/g simulated saliva, 30 sec) followed by in vitro gastric digestion in a shaking water bath (6 mL/g simulated gastric juice, 100 rpm, 37°C) up to 2 hours. Triplicate digestions were completed. Hardness was quantified as the peak force during compression using one of three methods: bulk compression in a 50 mm diameter cell to 33% or 67% of sample height or compression of three individual grains to 50% of sample height using a TA-XT2 Texture Analyzer (Texture Technologies Corporation). Changes in hardness were fit to a unimodal Weibull distribution in MATLAB.

**Significance:**
A longer softening half time may imply a slower rate of breakdown, which may decrease nutrient release rate and promote prolonged satiety. In order to develop functional grain-based products, it is important to understand the response of grains to the gastric environment.

**Results:**
Food initial hardness was significantly affected by carbohydrate matrix and compression test (p<0.05). Initial hardness ranged from 1.70-59.04 N for individual compressions. Pretzels had a significantly (p<0.05) greater initial hardness compared to all other foods tested. Softening half time was significantly affected by carbohydrate matrix (p<0.05) but not compression test. For all methods, smaller initial hardness generally resulted in longer softening half time. Quinoa had the longest average softening half time (444 minutes) and lowest initial hardness (1.70 N, individual compression), while pretzel had the shortest half time (<5 minutes) and largest initial hardness (59.04 N, individual compression).

**P06-036**
**Optimizing Deep-Fat Frying of Sweet Potato (Ipomoea Batatas): Effect of Pretreatment and Freezing Rate**
A. Giaretta, A. Rady, A. Adefeji, Email: andrew.giaretta@gmail.com

**Introduction:**
Sweet potato is a common root crop with considerable amounts of the good carbohydrates, dietary fibers, and micronutrients. It is often consumed fried, and the concern about fried foods is not new. The process of freezing, following parrying, affects the quality of subsequent fried sweet potatoes. Quick freezing leads to the formation of small ice crystals and, therefore, less damage to the product structure and consequently less oil uptake. The objective of this study was, therefore, to optimize the frying process of sweet potato by evaluating the combined effect of freezing temperature, surface pretreatments, dimensions, cultivars, and freezing rates on the quality attributes (fat and moisture content, color, texture, porosity and water activity).

**Method:**
Full factorial experimental design (2x4x3) was used for the first phase of the study where two cultivars of sweet potato (Murasaki and Covington) were cut into two dimensions (strips and slices), pretreated (blanching, methylene chloride, sodium alginate, and mixed gums coated), parfried at 180°C for 60 s, frozen at -20°C and finished-fried at (165, 175, and 180°C). In the second phase, the effect of freezing rate (-20, -40, and -60°C) was tested on the quality of finished fried Murasaki cultivar. All experiment was conducted with at least two replicates.

**Significance:**
This study demonstrated the importance of effective freezing, sweet potato cultivar and surface pretreatment on quality attributes, especially fat content and texture, of finished fried sweet potato.

**Results:**
Significantly lower fat content (9.51 %) was obtained when frying was done at 180°C compared to other temperatures. Murasaki strips pretreated using mixed gums produced significantly (P<0.05) lower fat uptake (10.34%) compared to Covington. Color results also showed Murasaki yielded lighter par-fried samples for chips and strips with higher L value; whereas the opposite trend was found for the finish fried samples (P<0.05). The maximum force required to fracture samples and springiness was significantly higher for Murasaki than Covington, which indicate Murasaki produces crispier and more desirable textural attributes. The effect of freezing rate was significant on fat content, moisture content and final texture of the finished fried Murasaki potato.

**P06-038**
**An Ultrasound-Enhanced System for Saccharomyces Cerevisiae Inactivation Using Supercritical CO2 Treatment in a Continuous Regimen**
I. Paniagua-Martínez, C. Ozuna, A. Mulet, M. García-Alvarado, B. José Javier, Email: pami_110@hotmail.com

**Introduction:**
Supercritical carbon dioxide (SC-CO2) inactivation technology represents a promising non-thermal processing method, as it promotes minimum impact on nutritional food properties. However, in some cases, high pressures or temperatures and too long treatment times are required to guarantee the food’s safety. In order to obtain the required lethality at shorter processing times, the aim of this work was to study the effect of pressure, temperature, and product residence time on yeast inactivation using the continuous flow SC-CO2-HPU system constructed for this application and to model and optimize the process operation.

**Method:**
A pilot plant equipment for supercritical CO2 with high power ultrasound (SC-CO2-HPU) treatment which operate in a continuous regimen was designed and built. The core of the equipment is a 300 mL sonication vessel followed by a 52 mL holding tube. Apple juice, previously inoculated with 1.10×10^7 CFU/mL of S. cerevisiae, was treated in the equipment at different juice residence times (3.06-9.2 min), temperatures (31-41°C) and pressures (100-300 bar). Inactivation ratios were fitted to a hybrid (Boolean-real) model in order to perform a statistical evaluation of the effect of the process variables.

**Significance:**
The ultrasound assisted continuous system has shown a great potential for microbial inactivation using SC-CO2 under mild process conditions.

**Results:**
The results demonstrated that the maximum inactivation achieved by the system was 7.8 log cycles. The hybrid model demonstrated that HPU has a significant and decisive effect on inactivation after shorter residence times. A multi-objective optimization performed with the hybrid model showed that 6.8 log cycles of inactivation could be obtained after a minimum residence time of 3.1 min) with HPU application, whereas under the same conditions but without HPU, the inactivation would be 4.3 log-cycles.

**P06-039**
**Preliminary Study of the Impact of the Instant Controlled Pressure Drop Process on Two Varieties of Mexican Coffee (Coffea Arabica)**
C. Tellez-Perez, Tecnologico de Monterrey, M. Cardador Martinez, Email: ctellezpe@itesm.mx

**Introduction:**
Coffee: one of the most commercialized products in the world, however, in many countries the first steps of processing from harvesting to green coffee beans remains unsophisticated. The most commonly used method to separate seeds from beans is a wet-processing technique, which generates a huge contamination of water. Furthermore, bean drying involves low rates of water elimination, which causes loss of quality because of mold and yeast contamination.

Therefore, the objective of this study is to evaluate the feasibility of using the Instant Controlled Pressure Drop (DIC) on the first steps of coffee processing. The coffee variety...
used was Oro Azteca (OAC). DIC is a thermo-mechanical process induced by subjecting raw materials to saturated steam, and followed by an abrupt pressure drop towards vacuum (about 5 kPa).

Method:
Before DIC treatment, coffee berries were classified by ripening state, washed and divided in two groups. One group was de-pulped mechanically (DOAC) and the other was kept whole (WOAC). Controls were also separated. DIC treatment was applied by using a central composite rotatable design (steam pressure from 0.3 to 0.45 MPa and heating time from 90 to 180 s). After treatment, controls and samples were dried at 45°C for 48 h. Evaluated response parameters were caffeine (mg eq. caffeine/g dry matter), caffeic acid (mg eq. caffeic acid/g dry matter), and water content (g H2O/g dry matter).

Significance:
The DIC treatment positively affected quality.

Results:
DIC treatment improves the drying step. Moisture content of fresh beans was reduced from 40% d.b. to 5.7% d.b for both DOAC and WOAC. The increase of steam pressure positively impacted moisture reduction. Moisture content of controls was of 14.2% d.b and 9.48% d.b for whole and de-pulping berries. Caffein content after drying varied slightly for DOAC and WOAC being of 5.03 and 5.61 mg eq./g b.s respectively. Controls presented 6.26 mg eq./b.s and 3.98 mg eq./b.s for whole and de-pulping. Caffeic acid content was of 0.58 mg eq./b.s and 0.92 mg eq./b.s for DOAC and WOAC. Controls showed 0.97 mg eq./b.s and 0.57 mg eq./b.s for whole and de-pulping.

The DIC process could be a good solution to reduce time of drying and preserve important biomolecules.

P06-040
Effect of Controlled Pressure Drop on Non-Nutritional Compounds of Germinated Black Beans (Phaseolus Vulgaris L.)
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Introduction:
Common beans are an important source of proteins and calories for food consumption, and they are also one of the most important crops in countries like Latin America, Africa, and Asia. However, nutritional value can be affected by the presence of non-nutritional compounds, which can decrease nutrient intake. Recent research has reported that small quantities of these non-nutritional compounds improve health conditions and prevent diseases. Multiple processes like germination and the Instant Controlled Pressure Drop (DIC) can modify the concentration of these compounds. The main goal of this research project is to evaluate the change of these non-nutritional compounds in bean seeds and germinates under DIC treatment.

Method:
For the DIC treatment, germinates were treated for 10 to 80 s with 0.1 to 0.3 MPA along with a central composite design. Non-nutritional compounds were analyzed by HPLC. Proximate analysis was done according to AOAC.

Significance:
The big advantages of DIC are the short processing time and that it can be applied to any type of food, therefore, this technology offers new perspectives, especially for the efficient use of legumes as vegetal protein sources, as well as other bioactive compounds.

Results:
Bean germination generated an increment of protein content (12%), ash (19%), and decreased the quantity of phenolic compounds. which can decrease nutrient intake. Recent research has reported that small quantities of these non-nutritional compounds improve health conditions and prevent diseases. Multiple processes like germination and the Instant Controlled Pressure Drop (DIC) can modify the concentration of these compounds. The main goal of this research project is to evaluate the change of these non-nutritional compounds in bean seeds and germinates under DIC treatment.

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P06-041
Microbial Safety of Dry Pet Food Processed Using Extrusion: Enterococcus Faecium as Surrogate for Salmonella
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Introduction:
Minimizing Salmonella contamination in dry pet food products is a big challenge in the pet food industry. An extrusion system provides a high-temperature, high-pressure and high-shear environment during dry pet food processing. Extrusion temperature has been recognized as a potentially effective critical control point (CCP) but few publications regarding this topic were found.

Method:
A surrogate organism for Salmonella, Enterococcus faecium (ATCC 8495), was used in this project. The capability of a pilot-scale single screw extruder equipped with a Differential Diameter Cylinder (DDC) to reduce E. faecium population was investigated. The raw materials were inoculated to 6.1 log CFU/ml and samples were at the exit of the preconditioner and the extruder for microbial analysis while the extruder was operating under a throughput of 180 kg/hr and a screw speed of 394 RPM; the downspout temperature ranged from 89 to 94°C and the die temperature was from 140 to 150°C. Titanium dioxide was introduced into the extruder to explore the residence time distribution (RTD) in the extruder based on the tracer concentration. The impact of throughput and screw speed on the RTD was analyzed as well.

Significance:
The extrusion system successfully removed E. faecium from the pet food and could be used as an effective CCP during manufacturing.

Results:
Preconditioned samples had a recovery of 2.97 log on non-selective agar and no recovery on selective media. E. faecium was completely removed from the pet food after extrusion (21.68% of in-barrel moisture, ~74.6 s retention time). The specific mechanical energy input was 89.5 kJ/kg (± 14.06), which also contributed to microbial reduction in terms of shear force.

P06-042
Impact of Macronutrients on the Temperature Dependence of Water Activity in a Multicomponent Food System
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Introduction:
It is well established that water activity (aw) is temperature dependent and also the driving factor for Salmonella survival in low moisture foods during heat-based processing. Currently, most aw measurements are conducted at ambient conditions (~20°C) although elevated temperatures used in thermal processes serve as preventive controls. The influence of macronutrient composition on the temperature dependence of aw in complex component products is not well known.

The objective of this study was to evaluate temperature dependence of aw in a multicomponent food system.

Method:
A second-order response experimental design was used to construct a multicomponent food system matrix based on product composition and recording temperature. Rice flour, soybean oil, and soy protein were selected as high mono- component model foods and mixed to formulate matrices of varying ratios of carbohydrate (0-67%), protein (0-86%), fat (8%-99%), and moisture content (~5-7%). Water activity was measured in triplicate using an AquaLab TDL Water Activity Meter for each formulation in the response surface at multiple temperatures. Water activity at various temperatures and formulations were compared using a two-tailed t-test.

Significance:
When conducting thermal inactivation studies in low moisture foods, measurement of aw at ambient temperature may not be appropriate for accurately assessing microbial inactivation at elevated temperatures. It is important to consider macronutrient composition when predicting microbial inactivation, as ambient aw measurements may result in an underestimation of thermal resistance.

Results:
The carbohydrate:protein:fat:moisture weight ratios for select representative high-carbohydrate, high-protein and high-fat matrices in the response surface tested were 45:20:7:7, 12:59:24:5, and 19:21:5:5, respectively. Water activity values at 20°C and 40°C, were 0.5329±0.0028 and 0.5761±0.0015 in the high-carbohydrate, 0.3039±0.0027 and 0.3422±0.0158 in the high-protein, and 0.2894±0.0047 and 0.2512±0.0096 in the high-fat matrices respectively. Water activity increased significantly (p<0.05) with an increase in temperature in both the high-carbohydrate and high-protein matrices but aw decreased significantly (p<0.05) with an increase in temperature in the high-fat matrix. At the same temperature, the aw of each macronutrient formula was significantly different (p<0.05).

P06-043
Growth and Survival of Salmonella in Partially Sprouted Pumpkin, Sunflower, and Chia Seeds Subsequently Dried for Direct Consumption
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Introduction:
Recently, new products based on dried, partially sprouted seeds have been associated with foodborne salmonellosis. Typically, sprouted seeds have been a major concern with respect to foodborne illness, but little is known about the risks associated with seeds that have been partially sprouted and then dried. The purpose of this study was to determine the growth of Salmonella during germination of pumpkin, sunflower, and chia seeds, and the survival of Salmonella during subsequent drying.

Method:
Pumpkin, sunflower, and chia seeds were dry inoculated at 5-log CFU/g with a 4-serotype cocktail of Salmonella, and then soaked in sterile water at 25 and 37°C for 24 h. Salmonella and total aerobic mesophilic plate counts (APC) were determined on xylose lysine deoxycholate and tryptic soy agar supplemented with yeast extract, respectively. Samples were enumerated directly after water addition and every 2 h over 24 h. Seeds contaminated with Salmonella using this procedure were subsequently drained and dried at 25 and 51°C. The water activity (aw), populations of Salmonella and APC of seeds were monitored during drying.
28 days, respectively. On the glass surface, the steel surface, survival rate of In general, environments would improve their control and detection in food plants. Understanding pathogen behavior in dry phase associated with the growth curve of stressed bacteria emphasizes the importance of enrichment step in pathogen detection. Evaluation of antimicrobial resistance of clinical isolates carried more antimicrobial resistance genes (ARGs) than seafood-derived isolates. For further analysis, V. parahaemolyticus isolates with the same subtype. A total of 46 V. parahaemolyticus isolates recovered from clinical samples (n=28) and seafood (n=18) were classified using a Multilocus Sequence Typing (MLST) approach. Antimicrobial resistance phenotypes (18 antimicrobials; disk diffusion method) and genotypes (38 antimicrobial resistance genes; PCR) of the isolates with the same subtype V. parahaemolyticus were evaluated.

Significance:
This study could provide a strong evidence for microevolution of bacterial antimicrobial resistance.

Results:
These isolates represented 23 sequence types (STs), and ST655 was the dominant sequence types (n=13). Among the isolates of ST655, antimicrobial resistance of clinical isolates was much higher than that of seafood-derived isolates. For further analysis, clinical isolates carried more antimicrobial resistance genes (ARGs) than seafood-derived isolates. It is possible that the human intestinal tract serves as a particular environment for promoting horizontal ARGs transfer and leading to the increasing of antimicrobial resistance of V. parahaemolyticus.

P06-045
Survival and Growth of Stressed Cronobacter Sakazakii Compared to Escherichia coli O157:H7 and Salmonella Enteriditis on Glass and Stainless Steel Surfaces
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Introduction:
Cronobacter sakazakii is an opportunistic ubiquitous pathogen which has been isolated from various low moisture foods. Its ability to tolerate dry stress better than other members of the Enterobacteriaceae family provides the bacterium with an advantage in warm and dry areas around food plants. This study compares the growth rate of C. sakazakii, E. coli O157:H7 and S. Enteriditis when exposed to dry stress at 25°C on glass surface for 2,7, 12, and 15 days and the survival rate of these pathogens on stainless steel surface for 7, 14, 21, and 28 days.

Method:
The growth characteristics of dry-stressed bacteria were evaluated by suspending the stressed cells in nutrient broth and monitoring their growth for 10 hours at 35°C by aerobic plate count (APC). Ability of pathogens to survive on the stainless steel surfaces and effectiveness of traditional swabbing technique to detect injured organisms was evaluated by standard qualitative cultural methods.

Significance:
The results of this study correlates with other research findings indicating the potential of C. sakazakii to survive on dry surfaces for prolonged periods of time. The extended lag phase associated with the growth curve of stressed bacteria emphasizes the importance of enrichment step in pathogen detection. Understanding pathogen behavior in dry environments would improve their control and detection in food plants.

Results:
In general, C. sakazakii had greater survival rate than E. coli O157:H7 and S. Enteriditis. On the steel surface, survival rate of C. sakazakii was 100, 75, 67 and 50% after 7, 14, 21 and 28 days, respectively. On the glass surface, C. sakazakii had no reduction in viable counts after 15 days of drying, but the growth curve of stressed cells exhibited 2 hours longer lag phase compared to non-stressed cells. E. coli O157:H7 was undetected in APC after 15 days of drying and upon resuscitation in nutrient broth the lag phase of stressed cells had increased by 6 hours. S. Enteriditis was undetected in APC after 12 days of drying and upon resuscitation there was no increase in the lag phase.

P06-046
Characterization of Single-Walled Carbon Nanotube-Based Biosensor for the Detection of Yersinia Enterocolitica
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Introduction:
Rapid, selective and sensitive detection methods for pathogenic bacteria in foods are crucial tools to ensure the safety of food products. Biosensors as rapid detection methods can provide several advantages over the conventional detection methods, however biosensors still need to be improved. The objective of this research is to integrate nanotechnology into biosensors to detect psychrotrophic foodborne pathogen, Y. enterocolitica.

Method:
The specific binding of Y. enterocolitica with the anti-Yersinia enterocolitica polyclonal antibodies (anti-Yersinia pAbs) was confirmed by indirect enzyme linked immunosorbant assay (ELISA). The developed biosensor was fabricated with single-walled carbon nanotubes (SWCNTs) on the silicon dioxide template with gold electrodes. The anti-Yersinia pAb as an acceptor was self-assembled onto the SWCNT bundles connected between electrodes after the hybridization of 1-pyrenebutanoic acid succinimidyl ester (PASE) as a linker. The measurements for each step were performed using linear sweep voltammetry (LSV) with a potentiostat. The slope of the current/ voltage (I/V) curves between 0V and 0.1 V for each treatment was calculated using linear regression analysis, and the resistance (ΔR) was calculated by inversing the I/V value for sensing responses.

Significance:
This research suggests that a SWCNT-based biosensor in conjunction with antibodies could be developed for good sensor properties with high sensitivity and selectivity to detect foodborne psychrotrophic pathogens.

Results:
The indirect ELISA confirmed that the pAbs were only specific to Y. enterocolitica among tested 11 bacterial cells. The application of the linker to the SWCNTs and the immobilization of the anti-Yersinia pAbs onto the linker increased the resistance significantly (P<0.05). The binding of anti-Yersinia pAbs with Yersinia enterocolitica resulted in a significantly increase in the resistance from 4 to 8 kΩ. The increase in the resistance of the bacterial culture was proportional to the concentration of the Y. enterocolitica culture. The limit of detection (LOD) of the SWCNT-based biosensor was determined as 10^3 CFU/mL of Y. enterocolitica.

P06-047
The Determination of Microbial Safety of Fresh-Cut Salads Served in Istanbul
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Introduction:
Fresh fruits and vegetables are important components of the human diet. Minimally processed vegetables (MPV) are often consumed raw and they could pose a health risk if they are contaminated with pathogenic microorganisms. In the present study, we aimed to determine the microbial quality of fresh-cut salads 3 important touristic district areas of Istanbul (Uskudar, Kadikoy, and Umranije), Turkey.

Method:
Ninety samples of salads were collected between June 2013 and December 2013 and examined for total aerobic mesophilic bacteria, yeast and mold, psychrophilic bacterial counts, fecal coliforms bacteria and E. coli, S.aureus, E.coli O157:H7, L.monocytogenes, and Salmonella spp. In the meantime, the samples which included S.aureus were subjected to a coagulase test.

Significance:
The data obtained in this study provides information on the microbial quality of fresh-cut salads commercially sold in Istanbul/Turkey. The results show that fresh-cut salads contain a high load of microorganisms. These results suggest that effective control measures should be implemented.

Results:
The enumeration of total aerobic mesophilic bacteria, psychrophilic bacterial counts, yeast and mold and S.aureus in Uskudar, Kadikoy and Umranije ranged from 2.57 to 7.48 log CFU/g, 2.00 to 7.48 log CFU/g, 2.00 to 7.37 log CFU/g and 2.00 to 5.30 log CFU/g, respectively. No Salmonella spp. was detected in the samples analysed in this study. A total of 23.3% of the samples enumerated coagulase positive for S. aureus. E.coli was isolated 6.7% of the samples analyzed. E.coli O157:H7 and L.monocytogenes were determined in 8.9% and 12.2% of the samples, respectively.
**P06-048**

Evaluating the Impact of School Nutrition Programs Cooking Techniques on *Escherichia coli* Populations in a Commercially Available Marinara Sauce Product

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**Introduction:** Food preparation practices in commercial settings are especially critical in preventing outbreaks of foodborne illness. Implicated as the third leading factor in outbreaks of school associated foodborne illness is improper or “slow” cooling. To scientifically characterize and validate cooling methods that are both effective and feasible for preventing foodborne pathogen growth is critical to public health.

**Method:** Commercially available marinara sauce was heated to 165°F, measured to 2 and 3 inch depths in commercial serving pans and allowed to cool to 135-140°F before inoculation with *Escherichia coli* (E. coli; target population of 104 CFU/g). Pans were placed in a commercial walk-in freezer (-20°C) or situated in ice water baths in a commercial walk-in refrigerator (-4°F). All pans were either uncovered or covered, with or without a gap, to allow for air exposure. At 0, 4, 8, 12, and 24 hours, samples were plated onto MacConkey agar and incubated for 18-24 hours to quantify E. coli populations.

**Significance:** Researching cooling methods that are effective at controlling foodborne pathogens in school lunch programs will directly benefit public health by reducing the risk of foodborne illness, particularly in an environment that serves young children who are an at-risk population for severe illness and life-threatening complications from foodborne pathogens. Translating these data into educational materials and trainings for school nutrition personnel would directly impact the health of children in a positive and meaningful way. This study may be targetted specifically for school nutrition programs, but these data can also inform cooling protocols used in other commercial foodservice settings as well.

**Results:** No statistically significant difference (P > 0.05) in E. coli populations was observed for time, cover (refrigerator vs. freezer) variables. Interaction combinations were also tested for all variables and none were statistically significant (P > 0.05). However, product depth was statistically significant (P = 0.0386), with a 0.25 log10 CFU/g difference E. coli populations. Although depth is statistically significant, the difference in populations recovered is marginal. The lack of statistical differences among treatment variables and variable interactions indicates that all foodservice cooling methods evaluated were effective at controlling E. coli populations in marinara sauce.

**P06-049**

Inhibition of Diarrheagenic *Escherichia coli* Using Proanthocyanidins

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**Introduction:** Diarrhea is a leading cause of death among children under five years old in both developed and developing countries. *Escherichia coli* are the causative agents of infantile diarrhea and hemorrhagic colitis. We investigated natural control of *Diarrheagenic Escherichia coli* using American cranberry (*Vaccinium macrocarpon*) proanthocyanidins against three groups of diarrheagenic *Escherichia coli* (Enteropathogenic *Escherichia coli* (EPEC), Enterotoxigenic *Escherichia coli* (ETEC) and Enterohemorrhagic *Escherichia coli* (EHEC)).

**Method:** Four concentrations (4.5, 9, 18, and 36 mg/ml) of proanthocyanidins (PACs) were prepared in Brain Heart Infusion (BHI) broth. Six, seven and ten strains of EHEC, EPEC, and ETEC respectively were cultured in BHI and 6-7 log CFU/ml of bacterial inoculum were used to determine the minimal inhibitory concentration (MIC), minimal bactericidal concentration (MBC) and log CFU/ml reduction. The pH effect of PACs in comparison to organic acids was also examined. All experiments were conducted three times, and bacterial populations were analyzed as log CFU/ml. The experimental design was Randomized Complete Blocks (RCB). Analysis of variance (ANOVA) was performed on cell counts using JMP General Linear Models (GLM) procedure with JMP 12 software (Statistical Institute Inc. USA). Significance differences were defined as P < 0.05. Differences among the treatments were analyzed for the level of significance by least significant difference (LSD).

**Significance:** In conclusion, American cranberry proanthocyanidins significantly control the growth of diarrheagenic *Escherichia coli* and have potential to prevent diarrhea.

**Results:** Results showed that proanthocyanidins extracted from American cranberry had better antibacterial action than organic acids. After overnight incubation at 37°C, proanthocyanidins at pH 4 showed 6 log CFU/ml reductions, while organic acids displayed 1-2 log CFU/ml reduction at pH 4. Additionally, results showed that MBC and MIC of PACs were 18 and 36 mg/ml respectively. A 6-log CFU/ml reduction at MBC was observed from EHEC, EPEC, and ETEC cocktails.

**P06-050**

Effect of Osmotic Stress on the Morphology and Viability of the Probiotic Yeast *Saccharomyces boulardii*

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**Introduction:** High concentrations of salt and sugar have been used to reduce the water activity in food matrices. This high external osmolality usually limits the growth of microorganisms, such as yeasts, affecting several metabolic activities that will have an impact on the microstructure and composition of the cells. The stability and permeability of the cellular membranes play a fundamental role on the adaptation to different kinds of stresses; since a sudden increase in the external osmolality results in water removal from the cell to the outside, producing a loss of turgor as well as changes in the intracellular solute concentration and in the cellular volume. *Saccharomyces boulardii* is a yeast used as a probiotic in humans and some morphological changes and survival under hyperosmotic conditions were studied in this work to explore the possibility of its addition to high-salt or high-sugar foods.

**Method:** Growth kinetics was performed in hyperosmotic broths with NaCl and sucrose in concentration ranges of 0.2 to 2.0 M. Optical density was used to evaluate the growth in hyperosmotic YPD broths. Samples were observed by scanning (SEM) and transmission electron microscopy (TEM).

**Significance:** Microscopy tools are good alternatives to study the strategies used by microorganisms to survive in foods containing high amounts of sugar or salt.

**Results:** Samples were observed by scanning (SEM) and transmission electron microscopy (TEM). SEM revealed a change in the morphology (swelling) in the walls of the yeast grown in high-osmolality broths. TEM showed that, as a result of the high osmolality, the cell wall was thickened and vesicles were formed in the cytoplasm. The growth kinetics results indicated that *S. boulardii* could be considered as an osmotolerant yeast, since it reached concentrations of 3.4x105 and 3.6x107 CFU/ml at sucrose concentrations of 2 M and 1.5 M respectively. The results also suggested that that this yeast could also be considered moderately halotolerant since it reached a concentration of 3.9x106 and 3.4x105 CFU/ml in broths with 0.4 and 1.4 M NaCl. *S. boulardii* was still able to produce 0.5% ethanol in the 2.0 M broth.

**P06-051**

Synergistic Effect of Sugars and Phenolics on Antioxidant Activity of Pomegranate Juice

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**Introduction:** Addition of phenolics for fortification is a common way to increase nutritional value and antioxidant activity of fruit products. Sugars are common additives in production of those products. Consequently, the influence of phenolics and sugars on anthocyanins and antioxidant activity was investigated.

**Method:** Pomegranate juice samples were prepared with addition of only phenolics (gallic acid, catechin and quercetin; individually and in combinations), only sugars (sucrose and trehalose) or a combination of phenolics and sugars. The control was pomegranate juice without addition of phenolics and sugars. Spectrophotometric methods were used for determination of antioxidative activity and anthocyanins.

**Significance:** The results of this study showed the importance of interactions between matrix constituents during product formulation, thus, in some cases, there is no positive effect of the addition of phenolics.

**Results:** Sample with addition of trehalose had the same anthocyanin content (172.78 µg/mL) as a control sample (172.81 µg/mL) while a sample with sucrose addition had lower content (168.08 µg/mL). All samples with addition of phenolics had higher content than the control sample. Considering only samples with addition of phenolics, the highest anthocyanin content was found in samples with added gallic acid, catechin+gallic acid, and catechin+quercetin+gallic acid. In samples with addition of sugars, the highest anthocyanin content had samples with catechin+quercetin+gallic acid. The DPPH, ABTS, and FRAP methods were used for determination of antioxidative activity, and on the basis of these results, a synergistic effect of phenolics addition was determined. Antioxidative activity determined by ABTS was higher in all samples in comparison to control. A synergistic effect was determined in juice with addition of catechin+quercetin and juice with addition of trehalose and catechin+quercetin+gallic acid. Antioxidative activity determined by FRAP was higher or the same as in the control. A synergistic effect was determined only in juice with added trehalose with all phenolics combinations. Using a DPPH radical for determination of antioxidative activity, different results were observed. In comparison to the control, lower antioxidant activity was determined in juice with gallic acid, juice with sucrose and catechin + gallic acid and quercetin + gallic acid, and juice with trehalose and catechin + quercetin. A synergistic effect was observed only in juice without added sugars.
Impact of Corn Flake Processing on Phenolics and Antioxidant Capacity
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Introduction: Epidemiological studies suggest that regular consumption of breakfast cereals would help reduce risk of obesity and cardiovascular disease. However, average nutritional quality of ready-to-eat breakfast cereals has been of recent concern. This research examined changes in phenolics and antioxidant capacity during processing of corn into flakes and evaluated the effects of processing condition, corn genotype, and growing year on phenolics, with the ultimate goal of improving the nutritional quality of corn flakes.

Method: Three commercial corn hybrids grown in three years with three replicates per year were dry-milled, cooked, baked, and toasted into flakes to determine the impact on phenolic content and antioxidant capacity.

Significance: Our findings will provide a guide to optimize processing conditions and selection of proper corn hybrids for higher phenolic content and antioxidant capacity in corn flakes.

Results: Genotype and processing effects were significant for phenolics; the yearly effect was not. Cooking and toasting were the two critical processing points to induce phenolic changes. Total phenolic content significantly decreased during cooking, and significantly increased again during toasting. Processed corn flakes had lower antioxidant capacity than raw corn kernels. Significant losses of antioxidant capacity were observed during dry-milling and pressure cooking. Baking and toasting did not further alter the antioxidant capacity of corn. Significant linear correlations were observed between antioxidant capacity and phenolics, while higher correlation was observed for bound rather than soluble phenolics. During thermal processing, bound phenolics tended to be released into soluble phenolics, and more firmly bound phenolics in the cell wall matrix were liberated. Total phenolic content of corn increased with higher cooking pressure, but decreased with extended pressure cooking time. Increased baking time and temperature both induced significant increases in phenolics. Extended toasting time could also liberate more bound phenolic compounds to increase total phenolic content, but higher toasting temperature did not facilitate faster liberation.

Atmospheric Cold Plasma Inactivation of Escherichia Coli O157:H7 and Aerobic Microorganisms in Cold-Stored Romaine Lettuce Packetaged in a Commercial Polyethylene Terephthalate Container
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Introduction: Leafy greens continue to be a significant vector for foodborne pathogens, including Escherichia coli O157:H7. Dielectric barrier discharge atmospheric cold plasma (ACP) treatment is a promising method for microbial decontamination of produce. An important aspect of this technology is the potential for antimicrobial treatment inside sealed packages. Data is lacking on the suitability of commercially available packaging for this.

The objectives of this study were to (i) study the effects of externally-applied ACP treatment on the growth of Es. coli O157:H7 and mesophilic aerobic microorganisms in packaged Romaine lettuce, including the determination of sublethal injury and (ii) investigate the effects of the ACP treatment on quality properties of lettuce during post-processing cold storage.

Method: Romaine lettuce, with and without inoculation with a cocktail of three strains of Es. coli O157:H7 (~6 log CFU/g lettuce), were packaged in a polyethylene terephthalate (PET) commercial clamshell container and treated at 47.6 kV at 1.1 kHz for 5 min using the ACP treatment system equipped with a pin-type high voltage electrode. Romaine lettuce samples were analyzed for inhibition of Es. coli O157:H7, total mesophilic aerobes, and yeasts and molds, color, carbon dioxide (CO2) generation, weight loss, and surface morphology during subsequent storage at 4°C for 7 d.

Significance: The results from this study demonstrate the potential of applying ACP to decontaminate lettuce contained in a conventional plastic package. Antimicrobial effects of this prototype terminal processing step were obtained without altering color, quality, or leaf respiration during post-treatment cold storage.

Results: The ACP treatment reduced the initial counts of Es. coli O157:H7 and total aerobic microorganisms by ~1 log CFU/g with the temperature change from 24 ± 1.4 to 26.6 ± 1.7°C. The reductions in the numbers of Es. coli O157:H7, total mesophilic aerobes, and yeasts and molds during storage were 0.8-1.5, 0.7-1.9, and 0.9-1.7 log CFU/g, respectively. The ACP treatment, however, did not significantly affect the color, CO2 generation, weight, and surface morphology of lettuce during storage (P > 0.05).

Mesophilic aerobic bacteria showed evidence of sublethal injury following the ACP treatment.

Design of Vacuum Microwave Evaporator System and Concentration of Apple Juice With This System
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Introduction: Concentration of fruit juices reduces cost of storage, packaging, and transport, and in addition with this treatment juice becomes microbiologically and chemically more stable. In recent years, with the changes in consumer preferences, alternative methods are used instead of a traditional heating processes because of an increased demand for minimally treated, high quality, and natural foods. Microwave heating provides volumetric heating of food products, and concentration carried out quickly with the combined system that allows mass and energy transfer quickly in a short time. The aim of our study is producing concentrated apple juice with a vacuum microwave evaporator system, an alternative to traditional methods such as rising film evaporator and vacuum evaporator systems.

Method: A microwave vacuum evaporator system will be designed for this purpose: a system set at 2450 MHz frequency, working in magnetron pairs and powered from 230 to 1000 W with the vacuum level from 0 to 1000 mbar, was planned. Then the apple juice was concentrated at the powers of 334, 501, and 668 W at 500 mbar vacuum. HMF, color, and evaporation rates at these conditions were determined.

Significance: This system could be used in the fruit juice industry.

Results: As a result, evaporation rates were found to be 15.09, 31.93, and 36.67 g water/sec. and HMF values were found to be 2.93, 2.67, and 2.55 ppm, respectively, for the powers of 334, 501, and 668 W. The total color differences were 1.70 for 334W, 1.66 for 501, and 1.20 for 668W. The lower color difference, HMF value, and the highest evaporation rate were found at 668 W.

Effects of Gamma and Electron Beam Irradiation on Populations of E. Coli Artificially Inoculated on Mung Bean, Clover, and Fenugreek Seeds, and on Germination and Growth of Seeds
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Introduction: Sprouts have frequently been implicated in outbreaks of foodborne illnesses, mostly due to contaminated seeds. Intervention technologies to decontaminate seeds without affecting sprout yield are needed. The objectives of this study were to compare gamma rays with electron beam in inactivating E. coli artificially inoculated on three seeds (fenugreek, clover and mung bean) with different surface morphology and to evaluate germination and growth of irradiated seeds.

Method: Fenugreek, clover and mung bean seeds, inoculated with E. coli K12, were irradiated with gamma rays and low energy electron beam at doses up to 12 kGy. The survival of E. coli, germination rate and growth of the seeds were then determined. The attachment of bacteria in relationship with surface morphology of the seeds was also investigated using scanning electron microscopy (SEM).

Significance: Our results suggested that gamma irradiation could be used to inactivate low levels of E. coli contamination without damage on germination and yield of the three seeds, while electron beam irradiation needs to be optimized for complete inactivation.

Results: Results showed that the D10 values (dose required to achieve 1 log reduction) for E. coli K12 on mung bean, clover, and fenugreek were 1.11, 1.21, and 1.40 kGy, respectively. Electron beam treatment at doses up to 12 kGy could not completely inactivate E. coli inoculated on all seeds even though most of the seeds were E. coli-free after 4-12 kGy irradiation. Gamma irradiation at doses up to 6 kGy did not significantly affect the germination rate of clover and fenugreek seeds but reduced the germination rate of mung bean seeds. Doses of 2 kGy gamma irradiation did not influence the growth of seeds while higher doses of gamma irradiation reduced the growth rate. Electron beam treatment at doses up to 12 kGy did not have any significant effect on germination or growth of the seeds. SEM imaging indicated there were differences in surface morphology among the three seeds, and E. coli resided in cracks and openings of seeds, making surface decontamination of seeds with low energy electron beam, a challenge due to the low penetration ability.

Use of Edible Films to Extend the Shelf Life of Fresh Peeled Oranges (Citrus Sinensis) During Refrigerated Storage
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Introduction: Peeled oranges are the primary fresh citrus product marketed in Puerto Rico. However,
this product is highly perishable. We compared different edible film treatments for their efficacy in extending the shelf life of fresh peeled oranges stored at 4 ± 0.5°C for twenty-eight days.

Method:
Four edible film treatments were evaluated: NatureSeal® (NS), NatureSeal® with 2% potassium sorbate (NS+SP), hydroxypropyl methylcellulose with 2.5% of glycerol (HPMC), hydroxypropyl methylcellulose with 2.5% glycerol and 2% potassium sorbate (HPMC+SP), and a control treatment (fruit without edible film). Aerobic microorganisms, yeast and molds were counted on petri plates. Weight loss, external appearance, texture, color, pH, water activity (aw), Brix, Vitamin C, and titratable acidity were measured in the treatments at 0, 3, 7, 14, 21, and 28 days after application of the edible film treatments.

Significance:
Edible films extend shelf life of fresh peeled orange, with storage at refrigerated temperatures, without affecting the physico-chemical properties of the fruit.

Results:
Edible films containing SP provided the lowest microbial counts 16.83% reduction in yeast and mold compared to controls. There were no significant differences among the edible film treatments regarding weight loss, texture, pH, aw, “Brix, Vitamin C and titratable acidity. Fruit treated with HPCM edible films had the best external appearance. Overall, this study found the edible film HPCM+SP produced the best results.

P06-058
Impact of Instant Controlled Pressure Drop Technology Coupled With Microwaves in the Extraction of Golden Delicious Apple Peel Pectin
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Introduction:
Pectin is a polygalacturonic acid polymer found inside the vegetal cellular wall. This compound is used widely throughout the industry, from food and pharmacology to cosmetics, as a homogenizing, stabilizing, and gelling agent. The traditional methods used to obtain this polymer have shortcomings that translate to end product's quality and process inefficiency. Furthermore, as the current extraction processes focus on citric as their main source, alternative technologies must be developed to utilize other precursor materials.

Method:
In this work, we evaluated the extraction efficiency of pectin from Golden Delicious apple peels for Instantaneous Controlled Pressure Drop (DIC) coupled with Microwave (MW). In the experimental controls were traditional heating (citric acid solution pH 1.6 for 30 min at 97°C), and MW (citric acid solution pH 1.6 for 30 min 0.5 kW h). In order to study the DIC effect we used a central composite rotatable design, varying pressure (1.0, 1.5, 2.8, 4.0, and 4.5 MPa) and exposure time (1.0, 1.43, 2.5, 3.56, and 4.0 min) prior to MW.

Significance:
As the commercial use of pectins arise, it becomes key to find alternative ways to optimize their extraction from natural resources and adapt these innovative techniques to diversify the employment of resources in order to acquire quality products. The use of coupled technologies such as Instant Controlled Pressure Drop (DIC) and Microwave (MW) then becomes interesting as a means to obtain pectin of high quality.

Results:
We obtained a maximum pectin yield of 32.46% (w/w) for the treatment at 4.0 MPa for 3.6 min, while the maximum esterification degree (76.67%) was obtained with 1.5 MPa and 1.43 min DIC conditions. Controls presented a lower yield of 25% (w/w) and 15.18% (w/w) for MW and conventional heating (CH), respectively. Esterification degree was 71.7% and 75.18% for MW and CH. A DIC-MW combination increased the quantity of pectin extract and did not appear to affect the quality of extracted pectin in comparison to a conventional acidic hydrolysis protocol subjected to either heating or MW.

P06-059
Identification of the Antimicrobial Activity of Enterococcus Genus Strains
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Introduction:
The Enterococcus genus belongs to lactic acid bacteria (LAB) that are used in meat products as starter cultures, as they have the ability to inhibit pathogenic strains. Enterococcus faecium UAMI-3 and Enterococcus faecium MMXV22 strains were isolated from Spanish-style sausage and Mexican chorizo type, respectively. These strains have antimicrobial activity against different bacteria, however the nature of the metabolites responsible for this activity is unknown, and therefore the aim of this study was to characterize the compounds with antimicrobial activity produced by Enterococcus.

Method:
The identification of the strains was performed by sequencing of the 16S rRNA gene. The antimicrobial activity was determined by agar diffusion against pathogenic microorganisms and B. subtilis, and protein extraction was performed by two methods: adsorption-desorption and acid precipitation. Protein identification was performed by LC-MS/MS. The minimum inhibitory concentration (MIC) was determined against Staphylococcus aureus and Listeria innocua. The genes encoding Enterocin A (entA) Entorocin B (entB) and peptidoglycan hydrolases were identified by sequencing. Additionally, to verify the presence of Entorocin A, the complementary DNA (cDNA) of entA gene was obtained by amplification from RNA.

Significance:
The antimicrobial activity show by E. faecium UAMI-3 and E. faecium MMXV22 is due to the production of peptidoglycan hydrolases (PS4 and N-acetylmuramoyl-L-alanine amidase) and not by bacteriocins. The activity of N-acetylg glucosaminidase observed, is important for the food industry and biotechnology, as it can be used to control pathogens extending the shelf life of food products.

Results:
Two strains showed 100% similarity with Enterococcus faecium. There was not antimicrobial activity in the extracts obtained by the adsorption-desorption technique. The CDNA with 100% similarity to entA gene was obtained, nevertheless, the peptide was not found. The antibacterial activity was found in the extract obtained by acid precipitation method. In this fraction, two proteins were identified, PS4 protein (156 kDa) from E. faecium UAMI-3 strain and N-acetylmuramoyl-L-alanine amidase (70.4 kDa) for E. faecium MMXV22 strain. The MIC against L. innocua was 10 µg/mL and 20 µg/mL for S. aureus, these results are the same for E. faecium UAMI-3 and E. faecium MMXV22 strains.

P06-060
Identification and Biochemical Characterization of Lactic Acid Bacteria Isolated From Spanish-Style Sausage
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Introduction:
Lactic acid bacteria (LAB) produce lactic acid as the main product among other metabolites that help inhibit proliferation of some undesirable or pathogenic microorganisms; LAB play an important role in the quality of foodstuffs for its significant contribution to the flavor, smell and texture improving the sensory characteristics. The aim of this study was evaluate the biotechnological potential of LAB isolated from a Spanish-style sausage produced without a starter culture.

Method:
Twelve-strains isolated were identified by sequencing of 16S rDNA gene. They were stored at -70°C in MRS medium with glycerol (50:50) and each strain was reactivated in MRS medium. The strains were assessed to different tolerance test as, resistance to pH values (3.5, 4.5, 5.5, 6.0, and 6.5); growing to concentrations of NaCl (4, 4.5, 5, 5.5, and 6%); temperature resistance (50, 60, 70 and 80°C) and bile salts (0.3%) at 2, 4 and 6 h of incubation. In addition, different activities were tested as, proteolytic, lipolytic, amino decarboxylase (histidine, tyrosine, ornithine, and lysine) and antimicrobial. The sensitive strains used to evaluate the inhibitory capacity of the strains was Weissella viridescens, Leuconostoc mesenteroides, Lactobacillus curvatus, Salmonella typhimurium, Pedococcus acidilactici, Escherichia coli, Staphylococcus aureus and Listeria monocytogenes.

Significance:
This study shows that three of the tested strains are of great interest for survival of stress conditions and inhibitory power, as well possessing as the biotechnological potential to be considered as a starter or bioprotective culture, but more studies need to be performed to ensure this hypothesis.

Results:
All strains had 99-100% identity with different LAB genus. Sixty-six percent of bacteria were resistant to pH 5, and 16% tolerate all NaCl evaluated concentrations. Three strains showed resistance to temperatures and one of them (Pedococcus lollii-LMG25667) had an increased survival rate to 87%, also was resistant to bile salts with 38% survival. All strains studied showed proteolytic activity and only two lipolytic activity. By other hand, the strains identified as, Weisella viridescens, Lactobacillus sakei, Lactobacillus curvatus, Salmonella typhimurium, Pedococcus acidilactici, Escherichia coli, Staphylococcus aureus and Listeria monocytogenes.

P06-061
Pre-Treated Mealworm and Silkworm as a Novel Non-Meat Ingredient in Meat Emulsion
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Introduction:
Edible insects have been suggested as a potential alternative protein source in the human diet. Previously, functional characteristics of insect protein, such as emulsifying capacity and gel formation ability, were reported. However, little research has been undertaken to determine the efficacy of edible insects as a potential non-meat ingredient. Therefore, the objective of this study was to determine the addition of pre-treated insect flours on technological and textural properties of emulsified meat products.

Method:
Crude ground mealworm larvae (Tenebrio molitor) and silkworm pupae (Bombyx mori) were pre-treated by defatting with n-hexane, or defatting and acidifying with 0.1 H HCl. A meat emulsion (control) was formulated with 60% pork, 20% backfat, and 20% ice, 1.5% NaCl, 0.3% sodium tri-polysphosphate, 0.012% sodium nitrite, and 0.05% ascorbic acid.
acid. Insect flour incorporations were prepared with a replacement of 10% pork portion. Protein solubility and emulsifying capacity of insect flour and cooking yield and textural properties of insect flour added meat emulsions were evaluated. Experimental design was a randomized complete block design with three independent replicates. Data were analyzed using SPSS for one-way ANOVA, and means were separated by using Duncan's test (P < 0.05).

Significance:
Our results show that mealworm larvae and silkworm pupae flours could replace 10% lean portion in meat emulsion without any adverse impacts on technological properties. Furthermore, different pre-treatment methods considerably affected the textural properties of meat emulsion. Our findings suggest the potential feasibility of edible insect flour as a novel non-meat ingredient. Further studies on determining sensory characteristics of processed meat products formulated with edible insect flours would be warranted.

Results:
Pre-treated insect flours exhibited a higher emulsifying capacity than crude insect flours (P < 0.05). In meat emulsion, a significant increase in cooking yield was observed for all insect treatments. Protein solubility of meat emulsion was not affected by the addition of insect flours (P > 0.05). In terms of textural properties, in both insect types, crude and defatted insect flours resulted in significantly higher hardness, springiness, and cohesiveness of meat emulsions compared to defatted and acidified insect flours.

P06-062
Allergenicity of Buckwheat Protein After Hydrolysis With Alkaline Protease Following High Pressure Treatment
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Introduction:
Buckwheat has been widely consumed in Korea, Japan, and other East Asian countries. Buckwheat could, however, cause severe allergic symptoms such as anaphylaxis even a small amount of ingestion. Various techniques have been used to reduce allergenicity of food allergens, such as chemical treatment, physical treatment, and enzymatic hydrolysis. High pressure treatment has been applied to reduce the allergenicity of food. This study was performed to evaluate effects of combined treatment, enzymatic hydrolysis using alkaline protease following high pressure treatment on allergenicity of buckwheat.

Method:
Buckwheat protein was extracted from buckwheat flour with 0.086M NaCl and 0.033M NaHCO3. Extracted buckwheat protein was vacuum packed and treated with high pressure at 600 MPa for 30 min. After high pressure treatment, buckwheat protein was hydrolyzed with alkaline protease for 240 min at 60°C. Allergenicity was analysed using enzyme-linked immunosorbent assay with sera from fourteen patients who have allergic reaction to buckwheat.

Significance:
Enzymatic hydrolysis of buckwheat protein with alkaline protease following high pressure treatment could significantly reduce allergenicity of buckwheat. It could mean that hydrolysis with alkaline protease following high pressure treatment may lead possibility to develop hypoallergenic buckwheat ingredients.

Results:
Allergenicity of buckwheat protein which hydrolyzed with alkaline protease following high pressure treatment using thirteen patients’ sera reduced below normal control level. Allergenicity of buckwheat protein with remaining one patient’s serum was slightly above normal control level which absorbance decreased from 2.48 to 0.57, result in 83.8%. Hydrolysis of buckwheat protein with alkaline protease following high pressure treatment gave a relatively efficient reduction of allergenicity of buckwheat protein.

P06-063
Inactivation of Human Norovirus Under TiO2-UVC Photocatalysis Using a Solid Agar-Based Model Simulated for Berry Fruits
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Introduction:
Human norovirus is a major food- and water-borne pathogen causing acute gastroenteritis. Food-borne virus contamination of frozen berry products was recently reported in Europe. To assure food safety, it is necessary to set-up a more efficient treatment method for raw or minimally processed fresh products. TiO2-UVC photocatalysis (TUVP) is an advanced non-thermal technology destroying pathogens via a strong oxidation process. This study investigated the potential of TUVP process to inactivate human norovirus surrogate, murine norovirus 1 (MN1-1), and evaluated the oxidative damage of the virus.

Method:
Viral infectivity was assessed using plaque assay. The killing mechanism of virus was evaluated using qRT-PCR, propidium monoazide (PMA) pretreated RT-PCR assay, and protein analysis. Hydroxyl radical concentration and oxidation potential of disinfectant was measured and correlated with inactivation kinetics.

Significance:
Overall findings indicated that TUVP treatment was more effective than UV-C treatment alone to inactivate MN1-1 and demonstrated a high correlation between the steady-state concentration of hydroxyl radical and the degree of inactivation.

Results:
MN1-1 was inoculated in a solid agar-based model (SAM) simulated for blueberries. Scanning electron microscopy images showed that SAM had similar surface and matrix characteristics to blueberries. MN1-1 inoculated on surface or injected in SAM was treated under UV-C lamps with or without TiO2 coating. MN1-1 on SAM surface was reduced to non-detectable level when treated with TUVP for 5 min. MN1-1 injected samples obtained significantly less reduction compared to surface inoculated viruses, showing 2.73 and 3.20 log reduction with UV-C and TUVP treatment for 10 min, respectively. Viral RNA was significantly reduced under TUVP treatment for 10 min. The reduction of viral genome detected by PMA-qRT-PCR was 0.6-0.7 log higher than that of qRT-PCR. TUVP process produced higher concentration of hydroxyl radical than UV-C irradiation alone, consistent with the inactivation efficiency. The CT values (disinfectant concentration × contact time) to attain 1 log reduction under TUVP treatment was lower than UV-C treatment, indicating that initial inactivation phase was highly affected by hydroxyl radical concentration.

P06-064
Effects of High Hydrostatic Pressures and Thermal Pasteurization on Carotenoids and Carotenoid Esters in Persimmon Tissues
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Introduction:
High hydrostatic pressure (HHP) applied during food processing can improve the retention of food quality attributes and nutritional values in comparison with pasteurization. Persimmon is a good source of bioactive compounds, mainly carotenoid and phenolic compounds. The aim of this work was to study for first time the effects of HHP and pasteurization on carotenoid and carotenoid esters of different persimmon tissues (peel, flesh, and whole fruit). From this study, a design in the use of persimmon ingredients will be developed to obtain functional beverages with an enhanced carotenoid bioactivity and bioaccessibility.

Method:
Astringent persimmon fruits ( Diospyros kaki L. cv. Rojo Brillante) were harvested at maturity stage III in Valencia (Spain). Persimmons samples (peel, flesh or whole fruit) were packaged in bags Doypack® (Polyskin XL, Flexibles Hispania, S.L.). HHP treatment was carried out in a Stansled ISO-LAB system (SW-IL-100-250-09-W) equipment, at 200 MPa/25°C/6 min conditions. Pasteurization was made at standard conditions (90°C/15 min). Analysis of carotenoids and carotenoid esters was performed by HPLC-UV-diode-MS, with a C30 reverse-phase column.

Significance:
The progress in the knowledge of the effects of processing (non thermal and thermal) in the carotenoid and carotenoid esters composition of vegetable tissues, has a great importance to develop new functional ingredients and for the posterior study of their bioactivity and bioavailability.

Results:
Among 28 carotenoids and carotenoid esters were identified in peel, flesh and whole persimmon fruits. In saponified extracts, β-cryptoxanthin and β-carotene are the most abundant carotenoids. Esters of xanthophylls as lutein, neoxanthin, violaxanthin, zeaxanthin and β-cryptoxanthin were present in non saponified extracts together significant amounts of free α-carotene, β-carotene, and lycopene. Total carotenoid concentrations in the persimmon peel, flesh and whorfe fruit were 10.54, 0.15, and 0.30 mg/100 g freeze-dried, respectively. HHP treatment did not affect the qualitative and quantitative composition of carotenoids and carotenoid esters, but thermal pasteurization produced a significant decrease mainly in the concentration of xanthophylls and their esters.

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P06-065
Effect of Pulsed Electric Fields on Yeast Extract Production by Autolysis
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Introduction:
Yeast extract is a valuable product obtained from processing brewer’s or baker’s yeast (S. cerevisiae). It is commonly used as a natural flavoring agent for products like soups and broths due to its unique meaty flavor. This flavor is imparted by peptides, amino acids and nucleotides created during cell autodigestion (autolysis) where intracellular lytic enzymes break down the cell’s constituents. Common methods for the production of yeast extract include autolysis in the presence of salt, high pressure homogenization and enzymatic treatment. These methods however have drawbacks such as high salt content in the final product, poor solid/liquid separation due to extensive cell disintegration, and high cost, respectively. Moreover, autolysis of non-disrupted cells requires several hours to be completed. Pulsed Electric Fields (PEF) have been shown to permeabilize microbial cells leading to the release of intracellular contents without leading to cell fragmentation. Thus this novel technology may facilitate protein and amino acid release during autolysis, increasing extract yield and shortening typically long autolysis times. The objective of this work was to investigate the effect of PEF technology as a pretreatment on the autolysis of S. cerevisiae cell suspensions.
Method: S. cerevisiae suspensions (1% v/w on dry basis) were subjected to various PEF conditions (2-22 kV/cm, 50-250 pulses, 300 Hz, 15μs pulse width) and left to autolyze at 52°C for up to 48 h. The course of autolysis was monitored by measuring total soluble solids yield, total protein release, total α-amino nitrogen release and total carbohydrate in the suspension supernatant.

Significance: The results of this study demonstrate the potential of PEF technology as a pretreatment for obtaining high quality yeast extract in significantly shorter time compared to conventional techniques.

Results: PEF treatments led to significantly shorter autolysis times in terms of protein and soluble solids yield. Necessary times for complete autolysis were two- to four-fold lower for PEF treated suspensions compared to approximately 24 h needed for untreated samples, depending on the treatment conditions. Moreover, cell extracts obtained by PEF treatment were of superior quality compared to extracts obtained by other technologies due to easier removal of cell debris and the absence of added salt.

P06-066 Assessing the Quality of Bell Peppers Processed by Ultrasound Decontamination Technology

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Introduction: Current lifestyle trends have led to the popularity of ready-to-eat salads which are only minimally processed. However, this has been accompanied by an increase in foodborne illnesses since fresh produce, apart from having a relatively short shelf-life, favors the growth of pathogenic foodborne microorganisms when not appropriately decontaminated.

The objective of this research was to assess the effect of the alternative decontamination technology of ultrasound on selected and nutritional properties of yellow bell peppers. A number of different experimental protocols were developed in order to assess the quality indices of the product. Optimal ultrasound treatment parameters were identified, aiming at minimal quality effects on the bell peppers.

Method: The investigated ultrasound treatments (200 W, 90 μm, 26 kHz, and immersion of US probe in 3 cm water) were: 5 m continuous; 5 s on, 5 s off for 10 m; 10 s on, 6 s off for 8 m; and 2 s on, 8 s off for 25 m, while thermal treatments were also applied as a negative control. PME, POD, total polyphenol content and Vitamin C levels were analyzed before and after the ultrasound treatments.

Significance: Based on the results, it can be concluded that ultrasound is a decontamination technology that has the potential to be implemented in the fresh produce industry reducing any impact to nutritional and quality indices. Further investigations with respect to other critical quality indices and ready-to-eat food products need to be performed.

Results: After analyzing the above four food quality indices in yellow bell peppers, it was found that ultrasound applied for 5 m continuously caused the least reduction in both polyphenol content and Vitamin C. The polyphenol concentration before and after ultrasound treatment (5 m continuous) were 1.74 and 1.64 g GAE/L of extract, respectively, while Vitamin C concentration was reduced by only 28.79 mg/100 g when treated with ultrasound for 5 m continuous, while PME and POD were present at very low levels, i.e., 0.08 moldm-3min-1and -3.08 x 10-5 µmol mg-1 protein min-1, respectively.

P06-067 Improving Drying Characteristics and Quality of Goji Berry Using Non-Thermal Pretreatments: Pulsed Electric Field and Osmotic Dehydration

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Introduction: Goji berries are very rich in nutrients with high antioxidant capacity (“superfood”). They are mainly consumed dried. Drying is a slow and energy intensive process because the waxy peel has low permeability to moisture. Therefore, peel chemical and physical pretreatments are considered before drying in order to facilitate water diffusion. However, they cause heterogeneity in the xaxes removal and problems during storage. An alternative to energy intensive drying is the osmotic dehydration-OD. OD that causes water to flow from the product into the osmotic solution while osmotic solute is transferred from the solution into the product could be used as a pretreatment to further processing. Pulsed electric field-PEF show promising features of inducing cell membrane permeabilization with short time leaving the product matrix largely unchanged while positively affecting mass transfer rates in subsequent processing of foods. In this study, PEF and/or OD of goji berry, for enhancing the drying rate and preserving the quality of dried fruits was applied. The objective was to evaluate the effects of processing time, temperature and PEF intensity on drying kinetics and fruit quality.

Method: Drying was carried out at 40-60°C; osmotic dehydration was carried out using sucrose solutions of 40-60°Brix at 30-35°C (wfruit:wsolution=1:5). Pre-treatments were dipping in 2% ethyl oleate-2.5% Na2CO3 solution at 40°C for 3 min and PEF (1-21kL) (Tambient). Five kinds of samples were compared: untreated dried, dipped in solution dried, PEF-pretreated dried, OD-pretreated dried, PEFOD-pretreated. Water loss-WL, solid gain- SG, water activity-aw, shrinkage and quality indices (color, antioxidant activity) were estimated.

Significance: It could be suggested that PEF may have a potential as a preprocesing step to OD/ drying of high quality goji berry.

Results: Results show that dried fruits were obtained in less time after being pretreated, preserving better the color and increasing the antioxidant activity. OD caused substantial WL/SG. Application of PEF significantly enhanced rates. High rate of mass exchange was achieved for PEF-pretreated samples, leading to a level of WL/SG that allows the product to retain instrumentally measured color and adequate decrease of water activity. Color seemed to be negatively affected by PEF intensity. OD compared to conventional drying significantly improved the overall quality.

P06-068 In Vitro Bioaccessibility of Carotenoids From Persimmon (Diospyros Kaki, cv. Rojo Brillante) Used as an Ingredient in a Model Dairy Food

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Introduction: Persimmon is among the fruits with the highest levels of bioactive antioxidant compounds, such as carotenoids. As awareness of the potential health benefits of carotenoids grows, there has been an increased interest in determining bioaccessibility of these compounds. In this context, dairy products represent an easy and convenient way to add beneficial ingredients.

The present study evaluated the in vitro bioaccessibility of carotenoids from dairy persimmon-based products formulated with whole or skimmed milk and different persimmon tissues (whole fruit, flesh, and peel).

Method: Astringent persimmon fruits were selected for the study because these fruits were richer in bioactive compounds. Once formulated products were made, carotenoid bioaccessibility was measured considering two sequential stages (gastric and small intestinal). Analyses of carotenoids were carried out by high performance liquid chromatography using a reverse phase C-30 column and a UV-vis diode array detector.

Significance: The significance of this study is the information about carotenoid persimmon bioaccessibility in dairy products with different fat content in order to select the most appropriate persimmon ingredient and food formulation to improve functionality.

Results: The major carotenoids in persimmon samples were beta-cryptoxanthin, zeaxanthin, lutein, lycopene, and β-carotene, and their isomers. Concentrations of beta-cryptoxanthin were ten times greater in peel than in pulp samples, being the most abundant compound. In vitro bioaccessibility of carotenoids were significantly lower in skimmed products than whole products, indicating that a minimal amount of fat is required to allow micellization and absorption by gastrointestinal cells. Addition of whole fruit or peel from persimmon to the model product had a marked positive effect in the amount of carotenoids found after digestion.

This research could be useful for development of new functional products enriched with carotenoids from fruits without the need to ingest supplements or change the food habits of individuals.

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P06-069 Anti-Diabetic Effect of Yellow Catfish Hydrolysates In Vivo and In Vitro

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Introduction: Yellow catfish (YC) has been considered a traditionally healthy food in Korea. It was generally known to have effects of kidney diseases, improve liver function, and heal a hangover and tuberculosisc. However, scientific research on these biological effects of YC was not elucidated until now.

Method: In this study, we determined the anti-diabetic effect of YC hydrolysates by investigating its protein tyrosine phosphatase 1B (PTP1B) inhibitory activity, the effect of insulin release from INS-1 cells, and glucose utilites in C2C12 skeletal muscle cell. In addition, we confirmed effects on changes of blood glucose levels, serum insulin levels, the pancreatic weights, and the size of pancreatic islet insulin and glucagon cells in ICR mice
fed with YC hydrolysates. To obtain biological active peptides, YC was enzymatically hydrolyzed by Alcalase (YCA) for 10h at 50°C and further treated with 80% ethanol to get high concentration of bioactive peptides (EPYCA).

Significance: These results demonstrated the possibility that yellow catfish could be used as a functional natural resource controlling diabetes mellitus.

Results: The PTP1B inhibitory activity of YCA was 88.1% and that of EPYCA was increased to 97.1% which was corresponded to 5.93 ug/ml of IC₅₀ value. (The IC₅₀ of positive control, insulin, was 16.65ug/ml.) The blood glucose level of group fed with the high fat diet was 315.88±57.10mg/dl. In the case of YCA group treated with the dose of 125, 250, 500mg/kg, it was decreased to 214±34.54, 175.8±20.98, and 147.3±17.7mg/dl, respectively (p<0.01 or p<0.05), showing the significant blood glucose reducing effects of YCA.

P06-070
Epigallocatechin Gallate (EGCG) and Piperine Coloaded Nanocarriers: Solid Lipid Nanoparticles (SLN) and Nanostructured Lipid Carriers (NLC)
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Method: Epigallocatechin gallate (EGCG) and piperine have been demonstrated to exert antioxidative activity as polyphenol component. However, EGCG and piperine have limiting factor as oxidation, heat, acidic condition, and light because of structural instability. In order to protect EGCG and piperine, these were needed for loading in delivery system until they were absorbed in our body. Therefore, the objective of this study was to fabricate solid lipid nanoparticles (SLN) and nanostructured lipid carriers (NLC) coloaded with EGCG and piperine, respectively, and to comparatively evaluate their physicochemical properties, stability, and release properties.

Results: As a result, SLN and NLC coloaded with EGCG and piperine were developed with an average size about 200 nm and 100 nm, respectively. And both nanocarriers had moderate stability in water phase. For storage period, the particle size and the zeta-potential of NLC were maintained better than SLN. In addition, the encapsulation efficiency of SLN and NLC was 82% and 90%, respectively. And the encapsulated EGCG and piperine were released in simulated intestinal conditions and then gradually increased. It indicated that the wall material of SLN and NLC was degraded by digestive enzymes. In conclusion, SLN and NLC were similar in the respects of encapsulation efficiency and release property. However, NLC had more potential and outstanding results in storage stability.

Significance: This study was confirmed that EGCG and piperine were protected by nanocarriers and it’s possible to control the release time of core materials. Therefore, a nanostructuring procedure of SLN and NLC can be used to prepare nanocarriers loaded with various functional ingredients.

P06-071
Knowledge, Perception, and Use of Functional Foods Among Consumers in the Greater Accra Region of Ghana
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Method: Functional foods (FFDs) are foods or dietary components that provide health benefits beyond basic nutrition. They present a better and cheaper alternative for improving health and general wellbeing of consumers than nutritional supplements. Acceptance and willingness to choose an FFD are dependent on several factors, including the consumer’s attitude, knowledge, sensory attributes, and socio-demographic variables. This study sought to assess the knowledge, perception, and use of functional foods among Ghanaian consumers and to identify factors that influence the consumption of functional foods, using the Greater Accra region as a case study.

Results: A cross sectional consumer survey was conducted in urban and peri-urban settings in the Greater Accra region of Ghana using a semi structured questionnaire of 360 consumers, 180 each from urban and peri-urban dwellers. Questions were asked to determine consumer’s perception, knowledge, and extent of patronage of functional foods and also to determine the factors (determinants and impeders) that influence the acceptance and willingness to patronize functional foods. Anova and Chi-square tests were used to compare categorical variables and determine the association between variables.

Significance: The use of functional foods may offer a new, less demanding way of gaining better health and longevity and their use should be encouraged by extensive education of the Ghanaian populace. This will reduce the cost of medical care, which is a problem in Ghana.

Results: Results showed that awareness of functional foods was high among both urban and peri-urban respondents (95% and 96%), respectively. The media was the most frequent source of information by both urban and peri-urban respondents. The availability and cost of FFDs influenced their consumption. FFDs were less frequently consumed by respondents who were in urban settings. Most respondents did not know the active ingredients or components in the foods perceived to have nutraceutical properties (76.7%).
nutrition dose with high clamworm content was prior to the positive control group in regaining the mice weight, protecting the intestine, maintaining its function, and promoting the wound healing.

Results: The body weights of those in A, B, C, D, and E groups decreased significantly on PB2 and PBDA (P<0.05), while the body weight of those in A group has been significant difference with F group on PB2 B, 10, 12, 14. Moreover, the levels of serum endotoxin and TNF-α in any groups were higher on PB1 than that in pre-injury period. The levels of serum endotoxin in A, B, C, D, and F groups were lower on PB 2, 14 than in the E group (P<0.05). The levels of serum TNF-α in A/E groups were always lower/higher than those in the F group at each time point (P<0.05).

P06-074 Carbohydrate Hydrolyzing Enzyme Inhibition of Selected Aged Garlic Extracts S. Jo, K. Ha, Y. Kwon, E. Apostolidis, Email: sunghoon04@daum.net

Introduction: Garlic is a well-known herbal medicine and tonic in the world. The garlic is classified as fresh, dry or aged garlic depending on how it processed. During the heat processing of raw garlic (fresh) to produce aged garlic, phenolic contents and profiles could be altered. The purpose of this study was to evaluate the effect of aging on phenolic contents and profile of two kinds of garlic (California white and Elephant garlic) and their in-vitro inhibitory activity against carbohydrate hydrolyzing enzymes.

Method: Fresh garlic varieties (California white and Elephant) were purchased from a local market, washed with tap water, and aged at 60°C for 2 weeks. Fresh and aged garlic from both varieties were ground to a powder, extracted (10 gr in 100mL methanol for 30 min) and evaluated for their phenolic content (using the Folin-Ciocalteau's Method), HPLC phenolic profile, rat alpha-glucosidase, sucrose, and maltase inhibitory activity (using rat intestine acetone powder). Statistical analysis was determined by SPSS independent t-test and one-way analysis of variance (ANOVA).

Significance: The aim of this investigation is to identify the effect of heat processing (aging) of garlic towards the release of phenolic bioactives relevant for potential blood glucose management.

Results: The total phenolic compound content of aged California white garlic extract increased with heat processing (from 165 to 315 mg/100 g). However, Elephant garlic extract had similar phenolic content after heat processing (around 200 mg/100 gQ). All the extracts where then evaluated for their dose-dependent activity against carbohydrate hydrolyzing enzyme. When tested at the same dose, garlic aging resulted to an increased alpha-glucosidase inhibitory activity in California white garlic (from 20 to 44% inhibitory activity), while aging had no effect on the Elephant garlic (in both extracts around 20% inhibitory activity). Our observations suggest that aging results to an increased phenolic content and alpha-glucosidase inhibitory activity in California white garlic, while it has no effect on Elephant garlic. The specific maltase and sucrase inhibitory activities, along with the antioxidant activities and phenolic profiles (using HPLC), of the resulting extracts is currently under investigation.

P06-075 Physicochemical and Sensory Properties of Makeolli Brewed With Purple Sweet Potato Paste and Different Kinds of Koji by Different Saccharification and Fermentation Methods J. Eun, S. Moon, Email: jbeun@chonnam.ac.kr

Introduction: Recently, the consumption of makeolli, Korean traditional rice wine, has decreased due to the change of widespread eating habits. New product development and the manufacturing process change of makeolli can overcome this. Purple sweet potato (PSP) is a good raw material for new Makeolli, because it's rich in natural pigments and anthocyanin. Therefore, two kinds of koji and two saccharification and fermentation methods were evaluated to develop makeolli with purple sweet potato paste (MPPS), and its physicochemical and sensory properties were investigated.

Method: Steam and rice (SR) and rice powder (RP) were used to make koji. Simultaneous saccharification and fermentation (SSF) and separated hydrolysis and fermentation (SHF) methods were employed for manufacturing of Makeolli. Soluble solid content (SSC), pH, reducing of sugar content (RSC), alcohol content, color, and titratable acidity (TA) were measured during fermentation. In SSF, koji, yeast, water and PSP were mixed and fermented at 25°C for 12 days. In SHF, koji, yeast and water were mixed and fermented at 25°C for 5 days, and then SR or RP, yeast, water, and PSP were added and fermented at 25°C for 5 days continuously. The sensory evaluation was conducted after the fermentation.

Significance: Further study is required to standardize for commercialization of MPPS in future.

Results: During the fermentation period after 6 days, the SSC of MPPS by SSF increased but the one by SHF decreased. The RSC of MPPS by SSF increased after 2 days but by SHF it increased for 6 days and then decreased. TA of MPPS with RP koji was higher than one with SR koji. The alcohol contents were 12.13%~16.13% after the fermentation. The pH of all samples increased during fermentation. MPPS with RP by SSF showed the highest a* and b* values. In sensory evaluation, MPPS with SR koji by SSF had the most preferable flavor, sweetness and overall acceptance among all the samples. In conclusion, SR koji is better than RP koji, and SHF is better than SSF for manufacturing MPPS. MPPS manufactured with CR koji by SHF have the best sensory qualities.

P06-076 Pulse Flour and Fraction Blends: Functionality and Applications P. Asnojara, AGT Food and Ingredients, Y. Wang, A. Lam, R. Lam, M. Tulbeek, Email: punatratkorn@agtfoods.com

Introduction: Pulses, which contain a wide variety of different crops ranging from your edible dry beans to lentils and peas all have similar but different properties. Food manufacturers learning to use these flowers and their fractions are often faced with the challenge of not knowing whether one pulse flour or fraction is compatible with another.

Method: In this study, chickpea flour was blended with yellow pea starch fraction or yellow pea flour at 10%, 20%, and 30% w/w. Foods from vegan meats (i.e. pakoras) to extruded direct expanded snacks using these flour blends were investigated. Blends were tested for their functional properties such as water and oil holding capacity and viscoelastic properties.

Significance: This research demonstrates that pea flour blends well with chickpea flour due to their compatible functional and pasting properties. This provides additional tools for the industry to understand how pulse flour and fraction blends may be used to achieve the viscosity required in formulating new products.

Results: Water and oil holding capacities did not change significantly with blending for both pea starch fraction and pea flour. RVA was used to look at the pasting properties of these blends where inclusions of pea flour with chickpea flour had no effect on the RVA profile with pea flour inclusion rates up to 20% (final viscosity: ~2500 cP; peak time: ~6.2 min) whereas at 30% there was a slight increase in the viscosity of the flour (2738 cP; peak time: 6.2 min). When blended with a pea starch fraction, the effect was additive whereby the starch fraction increased the viscosity of the blends (chickpea control final viscosity: 2385 cP; peak time: 6.13 min; 70% chickpea flour: 30% starch fraction blend final viscosity: 3388 cP (peak time 6.4 min)). This is attributed to the high viscosity of the pea starch fraction compared to chickpea flour. No noticeable changes in peak times were observed due to the similar hydration properties of pea starch fraction in the pea starch fraction. When used in applications like pakoras, both the control and those containing a pulse blend produced pakoras with good flavor and texture.

P06-077 Textural and Sensory Characteristics of White Bread Enriched With Chlorella (Chlorella Pyrenoidosa) Powder I. Farhani, Indonesia International Institute For Li, J. Jeffry, S. Canamara, E. Ervina, I. Surjawan, Email: I.farhani@i3l.ac.id

Introduction: Chlorella pyrenoidosa, which is known as chlorella, is a fresh-water single celled microalgae endowed with a host of health building nutrient. In addition to chlorophyll, Chlorella contains vitamins, minerals, dietary fiber, nucleic acids, amino acids, enzymes, CGF (Chlorella Growth Factor), and other substances. Chlorella has been mass cultivated and marketed as a health food as well as a supplement in animal feed. Chlorella is also incorporated into food to enhance its resistance to oxidation as well as to give it a wide range of appealing colors from green to orange. There have been many reports on the antioxidant potential of Chlorella. In this research, the quality, textual, and sensory characteristics of bread adulated with chlorella powder as a functional ingredient were examined.

Method: The basic white bread formulation was used as the control and the addition of Chlorella powder (0.5%, and 1%) used as treatments. Proximate values (moisture, crude protein, crude fat, crude fiber, and ash) of Chlorella powder were determined. Crude protein of treated bread was determined using the Kjeldahl method. Textural attributes (hardness, adhesiveness, springiness, cohesiveness, gumminess, and chewiness) of treated breads were determined using a texture analyzer. A 60-member consumer panel rated the sensory quality (aroma, texture, color, taste, overall liking) of Chlorella-added bread using a 1-5 hedonic scale.

Significance: Chlorella powder has a high protein content (58%) which gives it the potential to be used in bread or baked goods requiring a high protein profile.

Results: The proximate values of Chlorella powder had a moisture content of 4.9%, protein content of 58.0%, fat content of 8.9%, fiber content of 11.6%, and ash content of 6.8%. The bread containing 1% chlorella powder had 6% higher protein content than in the control (12%). The bread containing 0.5% chlorella powder had the highest liking scores in aroma (6.95), texture (7.2), taste (7.55), and overall (7.65) when compared to control 6.1, 6.5, 6.8, and 7.05, respectively. All sensory attributes scored by the panelists for the
bread containing 1% chlorella powder had the lowest liking scores. Texture of the 0.5% chlorella bread showed lower values of chewiness and gumminess when compared to the same attributes of the control.

**P06-078**

**Developing Quinoa-Cassava Extrudates Fortified With Cranberry Concentrate and Studying the Effect of Extrusion on Their Physicochemical Properties**

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**Introduction:**
Consumption of ready-to-eat (RTE) breakfast cereals has been on the rise since its inception due to its convenience as a quick source of energy and nutrition. Recent awareness and interest in health and wellness has shifted the focus to healthy eating and eating changes in the US population. Hence, the objective of this research was to extrude a breakfast cereal using nutritious raw material and enhance them with an industrial by-product. Subsequently the effect of extrusion was analyzed on phenolic and anthocyanin content along with physical properties.

**Method:**
The extrusion base is a gluten free base that used 50:50 blends of quinoa and cassava. Quinoa, an ancient grain, was chosen for its high nutrient content and cassava acted as an extrusion aid. Cranberry concentrate, a by-product that arises when manufacturing Cranis™, was used to enhance the nutrient property of this product. A single screw extruder equipped with a 4:1 compression ratio screw and a 4.5 mm diameter die hole was used at a constant screw speed of 130 RPM. Box-Behnken Design was used to design the experiments for three independent variables: temperature (120°C, 140°C, and 160°C), cranberry solids (3%, 4%, and 5% (db)), and feed moisture (16%, 18%, and 20%). Extrudates were collected at steady state, and dried for 24 hours at 45°C in a convection oven.

**Significance:**
This study opens new avenues to develop gluten free extruded RTE products that are naturally colored with high beneficial compounds from industrial by-products.

**Results:**
Analysis showed that barrel temperature and feed moisture had the most impact on the physico-chemical properties of the extrudates. Interestingly, the total phenolic content and anthocyanin content were higher in extrudates processed at higher barrel temperatures. Extrudates processed at 160°C, 16% moisture and 4% cranberry solids showed some of the most desirable properties such as low bulk density of 0.28 g/ml, a breaking strength of 0.46 N/mm², a 71.73% retention of phenolic content and a 35.51% retention of anthocyanins.

**P06-079**

**Effect of Pre-Cooking and Addition of Phosphates on the Quality of Microwave Cooked Catfish Fillets**

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**Introduction:**
In the US marketplace there are many examples of precooked poultry products designed to be reheated in a microwave oven and, to a lesser extent, fish products such as tilapia. However, there are few US catfish products designed to be microwave cooked or reheated. The first objective of this study was to examine the properties of raw frozen catfish fillets microwave cooked or oven precooked frozen fillets reheated by microwave cooking. The second objective was to evaluate the effect of a commercial phosphate blend on properties of microwave cooked or oven precooked raw frozen catfish fillets.

**Method:**
Both fresh and frozen (containing a commercial phosphate blend) fillets were purchased from a commercial Mississippi catfish processor and stored frozen. Fillets (5-7 oz) were trimmed and cut into three pieces each weighing approximately 50 g. For the experiment 6 fillet pieces were used for each treatment. Treatments included plus and minus oven precook and plus and minus phosphate. After microwave cooking, sample analysis included weight loss, moisture content, color (L“a”b”) using a Minolta colorimeter, pH, and mechanical texture (hardness). Precooked pieces of fish were cooked in a 121°C oven until an internal temperature of 60°C was obtained, followed by storing frozen until analyzed or cooked to 93-99°C in a microwave.

**Significance:**
This study will be used to develop precooked catfish products that can be reheated in a microwave.

**Results:**
Preliminary microwave cooking studies determined that cooking at 870 W for 2.5 minutes was the best for a uniform cooking condition of the ~50 g catfish fillet pieces. Cooked fillets showed less than 3% moisture loss when they contained phosphate, relative to a 9.4% moisture loss for fillets without phosphate. A large cooking loss of ~40% was observed for the precooked fillets after microwave cooking, correlated to a higher moisture loss (8.5% and 9.6% for fillets with and without phosphate, respectively) to comparable samples that were not precooked. Fillet hardness determined by peak force per thickness revealed similar texture properties between treatments for fillets without phosphate, while precooked fillets containing phosphate had an overall harder texture comparable samples that were not precooked. Fillet hardness determined by peak force.

**P06-080**

**Physical and Chemical Properties of Highly Concentrated Emulsions Prepared With Flaxseed Oil and Curcumin-Loaded Whey Protein Nanoparticles**

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**Introduction:**
Particulate-stabilized emulsions can be prepared at a low surfactant:oil ratio. Particulates with encapsulated antioxidants can be studied to emulsify oils with a high content of unsaturated fatty acids to prevent their oxidation. The objective of this project was to study physical and chemical properties of emulsions with flaxseed oil emulsified by curcumin-loaded whey protein particles.

**Method:**
Emulsification of curcumin was achieved by adulterating the aqueous mixture with 2% w/v whey protein isolate (WPI) preheated at 85°C for 15 min and 0.2mg/mL curcumin to pH 12.0 followed by acidification to pH 5.5-7.0. The dispersions were characterized for various physical properties. Emulsions were prepared with the pH 5.5 dispersion and 75%w/v flaxseed oil by shear homogenization. The macroscopic stability was studied during storage at 22°C for 30 days. The structures of emulsions were studied with confocal laser scanning microscopy (CLSM) and dynamic rheology. The oxidative stability of emulsions was evaluated for the thiobarbituric acid reactive substances (TBARS) during storage at 40°C for up to 8 days.

**Results:**
After encapsulation, the dispersions were transparent at pH 6.0-7.5. At pH 6.0, the hydrodynamic diameter was 155 nm and the particle dimension measured in atomic force microscopy was about 100 nm. The dispersions had an encapsulation efficiency higher than 86% at pH 6.0-7.5, but showed aggregation at pH 5.5 based on compositional and atomic force microscopy analyses. Compared to WPI, the reduction of fluorescence intensity implied the successful encapsulation of curcumin, and the encapsulation did not change zeta-potential at pH 5.5-7.5. Emulsions prepared with curcumin-loaded WPI nanoparticles did not show creaming after 1-month storage, and the CLSM results showed the jammed emulsion droplets that, along with the polydispersity of oil droplets, contributed to the oil phase fraction higher than 64% expected from the maximum packing fraction of monodispersed solid particles. Frequency sweep results showed the solid-like properties of emulsions. After 8-day storage, the TBARS of the emulsion (182.8 millimolar/kilogram oil) was significantly lower than the control emulsion without curcumin (301.3 millimolar/kilogram oil).

**Significance:**
The present findings indicate that protein nanoparticles loaded with lipophilic antioxidants can be used to prepare emulsions with physical and chemical stabilities.
physiochemical and functional properties. Based on our findings, potential applications where pea protein isolates may be beneficial as replacers or enhancers will also be discussed.

P06-082
Protein Conformational Changes During Protein Nanoparticle Assembly and Disassembly: A Fluorescence Spectrophotometric Study
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Introduction:
Protein-based nanoparticles are promising delivery systems as their matrix is composed of food-grade biopolymers naturally present in food products. Proteins also display affinity for hydrophobic and hydrophilic components, which makes them appropriate carriers for a wide range of bioactive molecules. However, attaining full functionality requires a vast understanding of conformational changes and interactions that occur during nanoparticles assembly and delivery processes.

Method:
Whey protein isolate and gliadin particles were produced by liquid antisolvent precipitation (LAS). LAS relies on decreasing the solvent power of the protein solution, triggering protein precipitation and nanoparticle production. Protein conformational changes were attained by progressively adding controlled quantities of antisolvent or solvent to protein solutions and nanoparticles, respectively. Fluorescence emission intensity of intrinsic probes (e.g. tryptophan and tyrosine) and added fluorophores (mainly molecular rotors such as Fast Green FCF) were recorded after each addition using a Fluoromax 3 (Horiba Scientific Inc.). Tryptophan and tyrosine were excited at 295 and 280 nm, respectively and Fast Green at 600 nm. Particle size measurements were also performed on all the systems using a Zetasizer (Malvern Instruments Ltd.)

Results:
In whey protein solutions and nanoparticles, tryptophan emission intensity was highly sensitive to the folding and unfolding processes. A sigmoidal relationship was observed between tryptophan maximum intensity and antisolvent concentration, i.e., approximately constant intensity at low antisolvent amounts, a noticeable increase between 30-53% antisolvent and a plateau above that concentration. The formation of nanoparticles was also accompanied by a bathochromic shift. Due to structural differences, tryptophan was not sensitive to nanoparticle formation when using gliadin, however, tyrosine showed remarkable sensitivity to the addition of the antisolvent. Quenching of tyrosine emission at higher antisolvent concentrations could be correlated with the progressive conformational changes in structure and nanoparticle formation. Fast Green was added to the protein solutions before the progressive addition of the antisolvent. This fluorescent probe was sensitive to additional conformational changes at antisolvent concentrations above 40%.

Significance:
The availability of spectrophotometric techniques to assess changes in nanoparticles during their production and disassembly will contribute to elucidate molecular mechanisms and dynamics underlying the particle production and delivery processes, enhancing their applicability and functionality.

P06-083
Effect of Ultrasonic Treatment and Spray Drying in Oxidation of Fish Oil/Whey Protein and Fish Oil/Whey Protein/Dextran Conjugates Emulsions
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Introduction:
Oils highly rich in omega-3 fatty acid are known to be very beneficial to human health. However, the incorporation of these bioactive ingredients to food products often is limited by their instability and the impact on their sensory properties. Emulsification followed by spray dry can prevent chemical deterioration. Several biopolymers were used for encapsulation; among them Maillard conjugates are good options due to their affinity for hydrophobic and hydrophilic components, which makes them appropriate for food-grade biopolymers naturally present in food products. Proteins also display a particular functionality that will be enhanced during nanoparticles assembly and delivery processes.

Method:
WPI and DX 15-25 kDa were conjugated by Maillard reaction through dry method during nanoparticles assembly and delivery processes. The results show a good linear correlation between the concentrations and the intensity of intrinsic probes (e.g. tryptophan and tyrosine) and added fluorophores (mainly molecular rotors such as Fast Green FCF) were recorded after each addition using a Fluoromax 3 (Horiba Scientific Inc.). Tryptophan and tyrosine were excited at 295 and 280 nm, respectively and Fast Green at 600 nm. Particle size measurements were also performed on all the systems using a Zetasizer (Malvern Instruments Ltd.)

Results:
In whey protein solutions and nanoparticles, tryptophan emission intensity was highly sensitive to the folding and unfolding processes. A sigmoidal relationship was observed between tryptophan maximum intensity and antisolvent concentration, i.e., approximately constant intensity at low antisolvent amounts, a noticeable increase between 30-53% antisolvent and a plateau above that concentration. The formation of nanoparticles was also accompanied by a bathochromic shift. Due to structural differences, tryptophan was not sensitive to nanoparticle formation when using gliadin, however, tyrosine showed remarkable sensitivity to the addition of the antisolvent. Quenching of tyrosine emission at higher antisolvent concentrations could be correlated with the progressive conformational changes in structure and nanoparticle formation. Fast Green was added to the protein solutions before the progressive addition of the antisolvent. This fluorescent probe was sensitive to additional conformational changes at antisolvent concentrations above 40%.

Significance:
The availability of spectrophotometric techniques to assess changes in nanoparticles during their production and disassembly will contribute to elucidate molecular mechanisms and dynamics underlying the particle production and delivery processes, enhancing their applicability and functionality.

P06-084
Inhibitory Effect of Rice Bran Protein Fractions and Its Enzymatic Hydrolysates on Mushroom Tyrosinase Activity
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Introduction:
Enzymatic browning is a major cause of quality loss in many vegetables and fruits. It is mainly caused by polyphenol oxidase that also known as tyrosinase. Rice bran is the main by-product obtained from rice milling industry. Rice bran protein extract has been reported as enzymatic browning inhibitor. However, the effect of rice bran protein fractions on mushroom tyrosinase inhibition has not been previously studied. Therefore, the objectives of this research were to investigate the inhibitory effect of rice bran protein fractions and its enzymatic hydrolysates on mushroom tyrosinase activity.

Method:
Rice bran protein fractions were prepared by extraction with distilled water, NaCl, NaOH, and ethanol, and then isoelectric precipitation to obtain albumin, globulin, glutelin, and prolamin, respectively. Mushroom tyrosinase inhibitory effect of each rice bran protein fraction was analyzed by measuring the absorbance at 475 nm with L-DOPA as substrate. The highest mushroom tyrosinase inhibitory fraction with different protein concentrations were investigated for tyrosinase inhibition, then it was hydrolyzed with papain, trypsin, alcalase or flavourzyme for 1 hr. Mushroom tyrosinase inhibitory effect of the enzymatic hydrolysates were also determined.

Results:
We found that the inhibitory effect on mushroom tyrosinase of 2 mg/ml albumin fraction was higher than that of globulin, globulin and prolamin fraction with the value of 12.64, 9.96, 7.61, and 5.14%, respectively (p<0.05). Molecular weights of albumin, globulin, and glutelin fraction determined by sodium dodecyl sulfate-polyacrylamide gel electrophoresis were in the range of 10 to 60 kDa; while that of the prolamin fraction was in the range of 10 to 15 kDa. Increasing albumin fraction concentration from 1 to 8 mg/ml gradually increased mushroom tyrosinase inhibitory effect from 8.56 to 19.76% (p<0.05); however, the inhibitory effect of albumin fraction at 8 mg/ml was similar to those at 9 and 10 mg/ml (p>0.05). Albumin fraction at 8 mg/ml was further hydrolyzed with papain, trypsin, alcalase or flavourzyme. Albumin hydrolyzed with papain showed the most effective mushroom tyrosinase inhibition with the inhibitory value of 33.60% (p>0.05).

Significance:
These results revealed that rice bran protein fractions, especially papain hydrolyzed albumin, could potentially be used as natural tyrosinase inhibitor.

P06-085
Trace Element Analysis in Gelatin Using X-Ray Fluorescence Spectrometry
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Introduction:
Commercial samples of food grade gelatin extracted from porcine, bovine, and piscine sources were purchased. The gelatin was then spiked with known concentrations of Cr, Fe, Cu, and Zn over the concentration range of 0 – 100 μg/g. Loose powder samples were then prepared by weighing 5 g of gelatin into a sample cup. The porcine and bovine samples were used as calibration standards while the piscine samples were used as verification samples. Analysis was performed on a benchtop energy dispersive X-ray fluorescence spectrometer (Epsilon 1, PANalytical). One measurement condition (20 kV, 250 μA, in air) was used to measure all samples. The total analysis time including sample preparation was 5 minutes per sample.

Results:
The results show a good linear correlation between the concentrations and the measured intensities over the whole calibration range (0 – 100 μg/g) for all elements. The root mean square (RMS) error ranges from 0.4 μg/g for Zn and 1.2 for Fe. The software calculated lower limits of detection (LLD) were also low ranging from 0.3 μg/g for Fe and Cu and 0.4 μg/g for Cr and Zn. These LLDs were within the limits specified by food regulations. Method precision was tested by analyzing a piscine gelatin sample consecutively for 17 days with no recalibration during this period. The method was

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found to be precise with relative RMS errors ranging from 0.9% for Cu and Zn and 1.8% for Cr. In conclusion this work shows that bentchop XRFs is capable of quantifying trace elements in gelatin obtained from various sources at the levels required by food regulations.

Significance: XRFs offers new trace elemental analysis options.

PO6-086
Application of Optical Sensing Techniques for Predicting Simultaneously Nutritional and Processing Quality Properties of Dried Beans
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Introduction: Fast, accurate, and noninvasive sensing techniques are needed by dry bean breeders and processors to predict various quality parameters simultaneously. A prior knowledge of some key physicochemical and sensory quality traits before processing would substantially help in the rapid and objective quality characterization and inspection of dry beans. The present study evaluated the suitability of visible and near-infrared spectroscopy (Vis/NIRS) over the wavelength range of 400–2,498 nm and an hyperspectral imaging system (HIS) over the range of 400–1,000 nm for predicting minerals (Ca, Cu, Fe, K, Mg, Mn, P, S, and Zn) and cooking time quality traits simultaneously. Different sets of bean samples harvested and tested in 2014 and 2015 were used for analysis.

Method: For analysis, several preprocessing techniques for reflectance spectra data including: smoothing, first and second derivatives, continuous wavelet transform decomposition, and two-band ratio methods were evaluated and compared. More than 600 parameters were extracted by these methods for each bean sample. The best parameters were then selected for predicting the quality traits based on partial correlation regression (PCR) analysis. The prediction models using both systems were compared in terms of their correlation coefficients (R) and standard error of prediction (SEP).

Results: Overall, Vis/NIRS technique showed better prediction results for minerals than those using HIS with accuracies higher than 86.0% and 77.8%, respectively, which should be explained by the wider range of wavelength points used in the Vis/NIRS analysis. However, comparable prediction results were found for cooking time using either Vis/NIRS or HIS giving accuracies higher than 85.0%. These results indicate that optical sensing techniques (i.e., Vis/NIR and HYP) combined with a suitable preprocessing technique have great potential for predicting mineral and processing quality properties of dried seeds with a single measurement. Currently, spectral data is being processed for predicting the bioavailability of nutrients in a similar set of beans.

Significance: This study tests the feasibility of Vis/NIR spectroscopy and hyperspectral imaging techniques for predicting from “intact dry beans” nutritional and cooking time traits which are essential for breeders and processors. A prior knowledge of these quality traits before packaging would allow better decisions by bean breeders and processors.

PO6-088
An Electrochemical Immunosensor for Rapid and Sensitive Detection of Mycotoxins Fumonisin B1 and Deoxynivalenol in Corn
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Introduction: Mycotoxins, such as aflatoxin (AF), deoxynivalenol (DON), fumonisin B1 (FB1), ochratoxin A (OTA), and zearalenone, are a group of toxic secondary metabolites produced by certain fungi. They naturally contaminate foods and feeds, which lowers the product quality; poses severe health risk to humans and animals, and causes profound economic loss worldwide. Due to the widespread prevalence of multiple mycotoxins in foods and feeds, a rapid and effective method for highly sensitive and selective detection of mycotoxins is urgently need to ensure the food and feed quality and human health.

Method: We report an electrochemical immunoassensing method for rapid and sensitive detection of two mycotoxins, fumonisin B1 (FB1) and deoxynivalenol (DON). A disposable screen-printed carbon electrode (SPE) was used as a sensing platform. The working electrochemical signal response of the modified SPE was recorded for analyzing the toxin concentration.

Results: Under optimized test conditions, the limit of detection and linear range achieved for FB1 were 4.2 ppb and 0.2 to 4.5 ppb (R²=0.99); and the corresponding values for DON were 8.6 ppb and 0.05 to 1 ppm (%RSD=5.7%). The immunosensor can specifically detect the target toxin in co-existing toxins environment. The sensor performance was also tested in extracted corn samples and demonstrated high sensitivity and low matrix interference.

Significance: Hence, our electrochemical immunosensing scheme can be adopted for highly sensitive and rapid detection of multiple co-contaminant mycotoxins in food and feed products. In future, the current sensing platform can easily integrated with automated microfluidic system potential to allow not only simultaneous detection of multiple mycotoxins with low detection limit and also screening mycotoxins contaminant level in foods and feeds with low-cost.

PO6-089
Implementing Preventive Controls in a Mixed Type Facility: Overcoming Hurdles in Co-Localized Food and Non-Food Production
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Introduction: FDA recently finalized the Preventive Controls for Human Food regulations (September 17, 2015) as required by the Food Safety Modernization Act (FSMA). The Preventive Controls (PCs) regulations require an owner or operator of a covered facility to develop a written food safety plan for all known or reasonably foreseeable hazards at the facility and to develop preventive controls including at critical control points to prevent or minimize these hazards.

Method: To examine the hurdles that must be overcome when implementing PCs, we present a case study involving implementation in a mixed type facility where food ingredient processing is co-located with industrial chemical production.

Results: We developed a PC safety plan by adapting existing GMP procedures and modeling the implementation based on HACCP principles; we identified key implementation and technical issues, we adapted HACCP concepts and principles to PCs in a mixed operations facility, and identified system gaps in existing GMPs. We focused on facility operations including raw material records, sanitation SOPs, production SOPs, physical segregation of materials and processes, and QA/QC procedures for food vs. non-food products. As a result of our evaluation of existing GMP and controls, we identified critical criteria for raw material acceptance, production points of potential contamination, divergence/segregation from industrial (non-food) processes, stage gate/testing point for acceptance into food GMP stream, quarantine/release by supplier and acceptance/rejection criteria by receiving facility (food customer). We developed a roadmap of processes, procedures, and document generation to guide the facility operator to incorporate and augment their GMP to meet PC requirements.

Significance: With this roadmap, the facility operator was able to segregate food and non-food production and materials, plan and allocate resources to meet PCs, and assure food customer of FSMA compliance for the food ingredient.

PO6-090
Assessment of Quality Parameters of Agave Syrups by Physicochemical Methods and MIR
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Introduction: Recently, a significant increase in the number of products placed on the market under the name of agave syrup has been observed. These products come from different regions of Mexico and presumable are obtained from different varieties of agave; mainly Agave tequilana and Agave salmiana. The variability of production methods and raw material: agave’s species, growing region; and part of the plant used for their production (leaves, pineapple, or both), generates a wide range of products sold under the name of agave syrup. Although the document NMX-FF-110-SCFI-2008 establishes the desired physicochemical characteristics, and test methods for this product, these parameters vary widely and there is no guarantee of the product authenticity. Therefore, it is necessary to evaluate the variability among commercial products in order to establish quality parameters for agave syrup. The main objective was to evaluate the physicochemical parameters in samples of commercial agave syrup as indicative of quality.

Method: Sixteen commercial agave syrups from five producing regions in Mexico: Guadalajara, Coahulla, Mexico state, Hidalgo, and Queretaro, were analyzed for their physicochemical properties (pH, Brix, color, IR, and ash content) according to NMX-FF-110-SCFI-2008. All analysis was performed twice. Additionally, mid-infrared spectroscopy was used to determine differences among the studied samples.

Results: Results showed significant differences among sample in pH (3.6 – 6.1) and “Bx (70-76’Bx). There were non-significant differences on the mineral content (0.10-0.13%) which is considered a quality criterion indicating the possible botanical origin of syrup. No significant differences on moisture were found (20-23%). Color had greater variability: darker colors are associated with traditional production processes involving high temperature treatments and presence of hydroxy methylfurfural. Analysis of IR spectra showed differences in composition, especially of carbohydrates. Our results suggest that products that are sold as agave syrup do not correspond to a category with identity or clearly defined properties.
Significance: Consumers do not get a standard product when buying agave syrup because of chemical parameter variations. Agave syrup processing standardization is necessary in order to raise the quality of the product that leads to generation of an origin denomination, preventing adulteration or low quality agave syrups, and allowing competitive marketing in Mexico and abroad.

P06-091
Correlation of Sensory Properties and Chemical Properties in Commercial Kimchi

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Introduction: Kimchi is the generic term given to a group of fermented vegetable foods in Korea. Kimchi is classified according to its major ingredients, such as Korean cabbage, radish, and other vegetables. During kimchi fermentation, how large quantities of organic acids such as citric, malic and succinic acids are produced in addition to lactic acid, and various inorganic salts such as NaCl and the red pepper powder containing spicy components like capsaicinoids are normally used in the recipe of kimchi preparation. All these components contribute to the sensory properties of kimchi to some extent. The aim of the present investigation is to study interactions between chemical properties and sensory characteristics of kimchi.

Method: The chemical properties and sensory characteristics of market-available kimchi from 27 companies were evaluated in comparison. Firstly, freshly made kimchi were purchased from the market and the chemical properties of kimchi were determined by measuring pH, titratable acidity, salinity, and capsaicinoid contents. Consumers rated the acceptance of each kimchi product on a 5-point hedonic scale and the sensory characteristics included 15 items: appearance, taste, flavor, overall preference, amount of seasoning, redness, garlic flavor, anchovy flavor, off-flavor, hot taste, salty taste, sweetness, sour taste, and crispiness. The sensory descriptors were determined by a panel composed of 50 people aged 20–50 years. The second step consisted in studying interactions between chemical properties and sensory evaluation.

Results: The chemical properties of commercial fresh kimchi are significantly different that it showed pH of 4.01–5.88, titratable acidity of 0.38–1.10%, salinity of 1.48–3.22%, and capsaicinoid contents of 1.60–4.20mg%. Sensory assessment of sour taste was positively related to the titratable acidity and pH was negatively related. The salinity was also positively related to salty taste. In particular, capsaicinoid contents showed a close relationship with hot taste for kimchi (R2=0.632). The results of regression analysis, R2 in the color, off flavor, flavor, and texture were 0.728, -0.662, 0.708, and 0.900, respectively.

Significance: It was found that salinity, color, and texture had the greatest effect on overall preference in commercial kimchi.

P06-092
Perception of Creaminess and Fattiness in Free Oleic Acid Supplemented Safflower Oil Emulsions: Effects of Ethnicity and CD36 Genotype

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Introduction: Recent reports suggest that the sensation of free-fatty acids on the tongue elicits a "fatty taste." The discovery of oral receptor proteins (e.g., CD36, GPR40 and GPR120) that respond to specific fatty acids reinforces the notion that "fatty" is a primary taste. The term "oleogustus" (oleo=fat; gustus=taste) has recently been coined to describe this sensation. If free-fatty acids elicit a so-called "fatty taste," then supplementing dietary fats with free fatty acids may be a strategy to enhance the perceived creaminess of fat modified foods. This study determined if (1) subjects could distinguish between safflower oil emulsions with and without added free oleic acid; and (2) whether variation in the gene that controls the fatty-acid receptor, CD36, influenced fat perception.

Method: We prepared safflower oil emulsions (0.1–15.8% wt/vol) with increasing free oleic acid at a constant ratio of 3% of the oil since dietary fats contain 1-3% free-fatty acids. We prepared safflower oil emulsions with and without added free oleic acid; and (2) whether variation in the gene that controls the fatty-acid receptor, CD36, influenced fat perception. The generated terms from the PAE sessions were analyzed using Generalized Procrustes Analysis (GPA). Four PAE sessions were held: two sessions consisted of only females (n=16 and n=15) and two sessions were held for males (n=11 and n=17). Four beer samples were chosen from locally available commercial beer. Two of these samples were considered to be micro brewed and the other two samples were nationally available brands (macro brewed).

Results: Both the males and the females generated results that included five identical terms, however the importance assigned to each attribute differed with gender. Notably, bitterness was perceived to be of more importance to the female panelists. The results indicated that the two craft beers were very different from the macro-brewed beers. In all groups the micro brewed beers were associated with considerably more sensory attributes than the macro-brewed beers.

Significance: It can be concluded that both the female and male groups found discernable differences between the micro and macro brewed beers, however they placed emphasis on different aspects of the beer. This research allows the brewing industry to develop products that are acceptable to female consumers.

P06-094
Adapting Qualitative Multivariate Analysis (QMA) for Deeper Consumer Understanding of the Brazilian Chocolate Biscuit Landscape

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Introduction: Category appraisal approach of linking sensory attributes and consumer liking has been widely used for understanding product performance in the marketplace, and several statistical analysis techniques have been applied e.g., Landscape Segmentation Analysis/Matrix Preference Mapping, etc. (Hal Macfie, 2007). However, these techniques require large scale consumer data and take time to field and analyze. This study presents Qualitative Multivariate Analysis – QMA (Beckley, et.al 2012) as an alternative approach to rapidly gain deeper understanding of consumer perception, motivations, and triggers across different products in the category and it allows us to identify gaps or new opportunity spaces in a way that we could form meaningful product guidance to a product development organization.

Method: A category of chocolate biscuits in Brazil was used as a case study. QMA was conducted through 4 consumer workshops: each workshop consisted of 8 Brazilian consumers, and lasted for 3 hours. During the workshop, consumers were presented with various in-market chocolate biscuits and prototypes. They were asked to taste these products, engage in in-depth discussion, and participate in various activities e.g., building benefits hierarchy, value diagram, etc., with the goal to understand current product landscape and identify potential new product opportunities.

Results: Results highlighted importance product attributes of chocolate biscuit, for Brazilian consumers. These attributes include layering of flavors and textures, crunchiness, creaminess of chocolate flavor, and amount of filling and coating. In general, current in-market products met consumer expectation on these attributes. However, through prototypes that were provided, consumers articulated additional insights for new product opportunities e.g., offering different types of flavor filling, providing different sensations and unique mouth experiences, and having a product with a pleasant flavor that lasts even after ingestion.

Significance: This study showcases an alternative approach to current category appraisal techniques. The QMA methodology can be conducted in a short period of time and in a small setting, which enables us to rapidly understand consumer perspective related to various attributes and identify potential new product opportunities.

P06-093
Who Drinks What? Using Preferred Attributes to Determine How Males and Females Evaluate Beer

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Introduction: Beer is the most popular alcoholic beverage in North America based on consumption and production. The variety of beers available has increased due to the recent emergence of many micro brewing operations. It has been suggested that the increased popularity of craft beer products are affecting preferences among beer consumers. Despite these factors, the majority of beer consumers are men. Men consume approximately 60% of beer by total volume. The main objective of this project is to compare and contrast descriptors of beer products created by both male and female groups and determine what attributes drive women's liking of beer.

Method: The Preferred Attribute Elucidation (PAE) method was used to create a description of four beers common to residents of Nova Scotia, Canada. PAE is a relatively new method which allows for the use of untrained panelists. This method enables product developers to determine which attributes drive liking or disliking of a product. The generated terms from the PAE sessions were analyzed using Generalized Procrustes Analysis (GPA).

Results: Both the males and the females generated results that included five identical terms, however the importance assigned to each attribute differed with gender. Notably, bitterness was perceived to be of more importance to the female panelists. The results indicated that the two craft beers were very different from the macro-brewed beers. In all groups the micro brewed beers were associated with considerably more sensory attributes than the macro-brewed beers.

Significance: It can be concluded that both the female and male groups found discernable differences between the micro and macro brewed beers, however they placed emphasis on different aspects of the beer. This research allows the brewing industry to develop products that are acceptable to female consumers.
product in the category as well as to identify new product opportunities. Learning and insights from this approach can be used to form hypotheses to further validate with a larger group of consumers.

P06-095 Sensory Properties of Arabica Coffee Grown Within Various Microclimates of the Same Region of Colombia
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Introduction: Several studies have been conducted to understand the different compounds responsible for coffee aroma and flavor. Since the high number of compounds and complex interactions existing among them, descriptive sensory analysis is a key tool to understand the sensory properties of coffee beverages. Moreover coffee quality depends on factors such as the processing after the harvesting phase, geographical origin, and climatic factors. The objectives of this study were to provide a sensory profile for Arabica coffee samples from a limited area (Pitalito, Huila, Colombia) and to determine similarities or differences among samples from the same sub-regions.

Method: Thirteen medium roasted brewed Arabica coffee samples, originated from different farms in different areas of the region of Huila, Colombia, were evaluated using descriptive sensory analysis. Six highly trained descriptive panelists from the Sensory Analysis Center at Kansas State University evaluated the samples for aroma, flavor, and aftertaste. A terminology consisting of 92 terms was developed prior the evaluation. Samples were individually evaluated by panelists and ten 2 h sessions were necessary for the evaluation phase.

Results: Overall, samples did not show large difference in their sensory properties although some differences were detected. Moreover, results did not show effects based on sub geographical area, different farming practices or storage methods. Coffees produced in the region were similar, but effects such as different growing altitudes, geographical area, different agriculture practices, or storage methods adopted by the farms were not directly related to sensory differences in the samples. The small differences detected can be rather be influenced by specific and unique combinations of these different aspects.

Significance: This study suggests that impact of microclimates and processing conditions for coffee is extremely complex and further work is needed to identify the small variables that can impact ultimate coffee flavor. Moreover, the fact that all of the samples were classified as high quality specialty coffee and lacking defects may have contributed to the small difference in the sample set. This may have a practical impact on the industry when homogeneity of sensory characteristics of coffee grown in different, close subregions is required by the market.

P06-096 Consumer Preference Study of Microgreens as a Healthy Food/Snack Ingredient
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Introduction: As an emerging food specialty product, microgreens, in scientific communities, are noted for highly nutritious. Commercially, however, they usually appear in upscale eateries as salad ingredient or to heighten the eye-appeal of the main dish. Owing to their high nutritional value, visual attractiveness, and diverse flavors, microgreens have the potential to be an excellent ingredient in a meal or a healthy snack. Unfortunately, many consumers, particularly children and adolescents, are not familiar with microgreens. Scientific information pertaining to consumer preferences of microgreens is needed.

Method: These pathways alteration may give a new insight for the development of adverse outcome pathway approach for the risk assessment of AA.

Significance: This study demonstrated that microgreens could be an attractive meal accompaniment and a healthy addition to regular vegetables, especially for children and youth.
**P06-099**

**Reducing Formation of Polycyclic Aromatic Hydrocarbons by Effective Discharging of Molten Fat From Pork During Char-Broiling**

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**Introduction:**
Polycyclic aromatic hydrocarbons (PAHs) formed during cooking have been listed as carcinogenic by the IARC. And, a large amount of PAHs are formed during char-broiling, therefore reducing them in this process would be very important. Specifically, the direct contact of molten fat from meat with burning charcoal is known for the major cause of forming PAHs during char-broiling. The objectives of this study were (1) to change the structure of a char-broil grill for reducing the formation of PAHs during char-broiling, and (2) and investigate its effectiveness after changing its structure.

**Method:**
Flat stainless-steel char-broil grill (GF, control group) and inclined stainless-steel char-broil grill (GI) were made. By using GI, molten fat from pork was discharged into the drip pan, effectively. Meat samples (pork, blade shoulder, 9x6x1 cube cm) were prepared by char-broiling for 16 min after the temperature of grill surface reached 200°C. In order to measure 4 kinds of PAHs (benz[a]anthracene; BaA, chrysene; CRY, benzo[b]fluoranthene; BbF, and benzo[k]fluoranthene; BaK) in the meat samples by GC/MS, HP-5MS UI column (30 m×0.25 mm×0.25 µm) was used. Also, helium was used as a carrier gas (1.5 mL/min).
Injection temperature was 320°C and injection volume was 1 µL (splitless). The following oven temperature was 80°C (hold time 1 min), increased by 4°C/min to 245°C, and increased by 30°C/min to 270°C. (hold time 10 min). And post run was done at 310°C for 10 min.

**Results:**
The sum of PAHs concentration value was 61.16 ± 3.17 µg/kg at GF, while that of GI was 7.92 ± 0.21 µg/kg. These results indicated that the sum of PAHs concentration value at GI was reduced compared to that of GF as the molten fat was discharged into the drip pan. In detail, inclined structure of GI prevented the molten fat from direct contacting with the burning charcoal, which has been known for the major cause of forming PAHs by inducing incomplete combustion.

**Significance:**
In conclusion, inclined structure with drip pan of char-broil grill might be a good candidate for reducing PAHs during char-broiling the meat.

**P06-100**

**Estimated Daily Intake of Residual Pesticides Using Food Commodity Intake Data Calculated by KFCIC Software**

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**Introduction:**
Estimation of food commodity intake is important for risk assessment of hazardous substances such as pesticide residues. However, estimation of the food commodity intake is not easy since normal diets are composed of not only commodity-type foods but also mixed and processed foods. Herein, the Korea Food Commodity Intake Calculation (KFCIC) software was used to estimate the food commodity intake using the database that the Korea National Health and Nutrition Examination Survey (KNHANES) developed. KFCIC software has been designed to segregate food consumption data from the KNHANES further into food commodity levels. The purpose of this study was to evaluate risk assessment of pesticide residues using the food commodity intake data as calculated by the KFCIC software.

**Method:**
Several representative food commodities such as rice, potato, apple, peach, cucumber, tomato, and perilla leaf were selected to determine their exposure to pesticide residues. The calculated items were the average values in the database of KNHANES in 2008–2012.

**Results:**
The average daily intakes of rice, potato, apple, peach, cucumber, tomato and perilla leaf were 217.72 g, 19.74 g, 32.05 g, 9.28 g, 11.80 g, 16.80 g and 3.20 g, respectively, while ground into powders separately. The OTA was extracted by 70% methanol aqueous solution, and then quantified by both ELISA assay and the HPLC method.

**Results:**
ELISA results show that seeds had higher OTA contents than skins with exception of Muscadine Carlos skin. Vacuum and room temperature dried skin samples had OTA content lower or close to 10 ng/g dry powder, whereas, freeze dried samples had OTA contents in the range of 10-20 ng/g dry powder. Vacuum dried seeds showed lowest OTA contents, while freeze dried seeds showed highest OTA content. In addition, the OTA was not detected in vacuum and room temperature dried Muscadine Noble seed samples. The OTA content of Chardonnay grape seeds was the highest among all seeds dried by the same methods. The OTA levels detected by HPLC methods were significantly lower than that detected by ELISA method, but the trend is similar to that detected by ELISA method, that is vacuum dried samples showed lowest OTA levels, while freeze dried and room temperature dried samples showed higher OTA levels.

**Significance:**
To ensure the safety, the GP should be dried immediately after pressing by a quick drying method to destroy molds and their spores. The OTA levels of vacuum dried GP samples were all below the maximum OTA level allowed in dried vine fruits including raisins set by EU (10 ng/g). Therefore it should be safe to use vacuum dried GP as food ingredient.

**P06-101**

**Effect of Different Drying Methods on Ochratoxin Content of Grape Pomace**

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**Introduction:**
Value added utilization of grape pomace (GP) has been the interest of many food researchers due to its high contents in fiber and polyphenols. Because the likely contamination by pathogenic fungi and mycotoxin, the safety of the GP needs to be addressed. To ensure the safety of direct using of GP as a food ingredient, this study investigated effect of drying method on ochratoxin (OTA) content of GP.

**Method:**
Pomaces of seven grape cultivars were dehydrated by freeze, room temperature and vacuum drying methods. Seeds and skins of dried samples were manually separated, then ground into powders separately. The OTA was extracted by 70% methanol aqueous solution, and then quantified by both ELISA assay and the HPLC method.

**Results:**
ELISA results show that seeds had higher OTA contents than skins with exception of Muscadine Carlos skin. Vacuum and room temperature dried skin samples had OTA content lower or close to 10 ng/g dry powder, whereas, freeze dried samples had OTA contents in the range of 10-20 ng/g dry powder. Vacuum dried seeds showed lowest OTA contents, while freeze dried seeds showed highest OTA content. In addition, the OTA was not detected in vacuum and room temperature dried Muscadine Noble seed samples. The OTA content of Chardonnay grape seeds was the highest among all seeds dried by the same methods. The OTA levels detected by HPLC methods were significantly lower than that detected by ELISA method, but the trend is similar to that detected by ELISA method, that is vacuum dried samples showed lowest OTA levels, while freeze dried and room temperature dried samples showed higher OTA levels.

**Significance:**
In conclusion, inclined structure with drip pan of char-broil grill might be a good candidate for reducing PAHs during char-broiling the meat.