Can a food solution influence long-term eating behavior?

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The Obesity Conundrum – is there a food solution?
IFT Summit Conference, New Orleans, 2/16-17/04
Obesity Conundrum Two

- How do people make food choices?
- What are the current dietary trends?
- Do healthier diets cost more?
- What is the satiating power of liquid and/or energy dense foods?
- Is the food industry to blame?
- Is there a food solution?
- What are the gaps in research/policy?
First question:
How do people make food choices?
Food choices – the traditional view

Brain controls behavior

Poor dietary choices lead to adverse health outcomes

Genetics

Physiology Metabolism

Eating behaviors

Environment

Culture

Food choices + amounts eaten

Behavioral sciences

Social sciences

Basic sciences

Nutritional epidemiology

Health outcomes
Food choices: the consumer view

Cost
Taste
Energy density
Convenience
Health
Variety
Physiology Metabolism
Obesity

Food purchases

Drewnowski EB 2002
• Obesity is one of the most daunting health challenges of the 21st century
• Although genetic factors clearly play an important role, the dramatic rise in obesity rates must be due to changes in the environment
• Abundant choices of relatively inexpensive, calorically-dense foods that are convenient, and taste good
What are the current dietary trends?
The US public does not follow the Food Guide Pyramid - what to do?

Source: Frazao, ERS/USDA 2002

- Added sugars
- Added fats
- Grains

The Dietary Guidelines recommend limiting consumption of added sugars to no more than 12 teaspoons a day for a 2,200-calorie diet. The Dietary Guidelines recommend that fats account for no more than 30 percent of daily energy intake—about 73 grams of added and naturally occurring fat for a 2,200-calorie diet.
Consumption of cereals, added sugars and fats has gone up (lb per capita)

Note that the major increases was in the cereals category

Source: ERS/USDA FoodReview 2002
Corn sweeteners have overtaken cane and beet sugar (lb per capita)

Sucrose = 50% fructose; 50% glucose;  HFCS =  55% fructose; 45% glucose
Source: ERS/USDA FoodReview 2002
Less red meat, fewer eggs, and more poultry and fish (lb per capita, edible weight)

Source: ERS/USDA FoodReview 2002
Oranges, apples, and bananas account for 50% of all fruit servings (lb per capita)

Source: ERS/USDA FoodReview 2002
Iceberg lettuce, frozen potatoes, and potato chips account for 33% of vegetable servings

(lb per capita)

- **Potatoes**
- **Starchy**
- **Tomatoes cnd**
- **Fresh veg**
- **Leafy veg**
- **Iceberg**

Starchy vegetables: corn, carrots, peas, sweet potatoes, beans
Fresh vegetables: tomatoes, onions, cucumbers, peppers, cabbage, celery
Dark green leafy: Leaf lettuce, broccoli, spinach, squash

Source: ERS/USDA FoodReview 2002
Too few fresh vegetables, too little variety
(lb per capita)

Source: ERS/USDA FoodReview 2002
Cost

What do different foods cost per calorie?
Almost 40% of energy in the US diet is provided by added sugars and added fats.

- The key difference between added and natural sugars and fats is not nutritional but economic.
- Added sugars and added fats are far cheaper.

Source: Drewnowski, Fat and sugar: an economic analysis J Nutr 2003
At world prices, sugar provides 20,000 kcal per dollar.
Fats and oils provide another 20,000 kcal per dollar.
Nutritionists equate 3,500 kcal with 1 lb of body weight.
The “economic cost” of gaining 1 lb body wt is 12 cents.
Provided that you consume sugar and fat – and people do.

Energy density (mJ/kg) and energy cost (cents/10MJ)

10 MJ ~2,500 kcal

Fats/sweets

Log scale!
Energy density (mJ/kg) and energy cost (cents/10MJ)
10 MJ ~2,500 kcal

- Grains
- Fats/sweets

Energy density (MJ/kg) and energy cost (cents/10MJ)
Energy density (mJ/kg) and energy cost (cents/10MJ)

10 MJ ~2,500 kcal

- Grains
- Milk
- Fats/sweets

Energy density (MJ/kg) and energy cost (cents/10MJ)
Energy density (mJ/kg) and energy cost (cents/10MJ)

10 MJ ~2,500 kcal

- Grains
- Milk
- Meat
- Fats/sweets

- Energy density (mJ/kg)
- Energy cost (log cents/10MJ)
Energy density (mJ/kg) and energy cost (cents/10MJ)

10 MJ ~2,500 kcal

- Grains
- Vegetables
- Milk
- Meat
- Fats/sweets

- Nuts
- Cheese
- Ground beef
- Beans
- Potatoes
- Bananas
- Milk
- Fish
- Lettuce
Energy density (mJ/kg) and energy cost (cents/10MJ)

10 MJ ~2,500 kcal

- Grains
- Vegetables
- Fruit
- Milk
- Meat
- Fats/sweets
Energy density (mJ/kg) and energy cost (cents/10MJ)

Drewnowski 2003

Energy density (MJ/kg)

Energy cost (cents/10MJ)

Grains
Vegetables
Fruit
Milk
Meat
Fats/sweets

Truncate at $100 per 10MJ
Retail price increases 1985-2000 were highest for F+V, lowest for sugar and fat (as% base year)

Source: ERS/USDA FoodReview 2002
Do “healthier” diets cost more?
A community study of French adults

- Val-de-Marne data: 361 adult men and 476 women
- For each of the 57 foods in the database
  - Mean cost per kg obtained from the French National Institute for Economic Research (INSEE) corresponding to mean national price for that item
  - Mean cost per kg multiplied by amount consumed
  - Data summed over all foods to yield diet cost
- This gave us estimated diet costs for each person
- We then examined the relationship between diet structure (foods and nutrients) and diet cost

- Darmon, Briend, Drewnowski Public Health Nutrition 2004
- Darmon, Ferguson, Drewnowski, Briend. Rome Nutrition Congress 2003
Energy dense foods = lower energy costs

Drewnowski et al, AJPH 2004
At each level of energy intake, eating more vegetables and fruit was associated with higher diet costs.

Drewnowski, Darmon and Briend, American Journal of Public Health 2004
At each level of energy intake, eating more fats and sweets was associated with lower diet costs.

Drewnowski, Darmon and Briend, American Journal of Public Health 2004
Energy cost (Euros/10MJ) by quintiles of consumption

Drewnowski, Darmon and Briend, American Journal of Public Health 2004

More fats and sweets = Lower cost
Are “healthful” foods simply more expensive?
Drewnowski 2003

- Grains
- Vegetables
- Fruit
- Milk
- Meat
- Fats/sweets

**Energy cost (cents/10MJ)**

- Energy density (MJ/kg)

- “Avoid?”
  - Soft drinks
  - Bread

- “Prudent” choices
  - Lettuce
So why do we behave as if all diets cost the same?
The Atkins diet

Lamb chops
Oysters
Asparagus
Raspberries
Strawberries
Blueberries
Salmon
Lobster
Sprouts
Tradeoffs – taste, cost, and convenience

- Taste
- Cost
- Convenience

- Vegetables
- Fruit
- Fats/sweets
- Fast foods

- Energy density (MJ/kg)
- Energy cost (log cents/10MJ)
- Taste
- Equicost
- Cost
Obesity and “unhealthy” diets are both associated with low incomes and low education.

Could there be a link between dietary energy density and obesity...

...that is mediated by low food costs?
Are energy-dense diets associated with lower diet costs?

An observational study
At each EI level, higher ED = lower cost
Higher dietary ED = higher energy intakes

Source: Darmon, Briend, Drewnowski PHN 2004
Does reducing diet costs lead to energy dense diets?

A hypothesis and a linear programming model
The paradox – it is possible to spend less and get more
But the calories will be refined grains, added sugar and fat
Diet composition after imposing cost constraints: less meat and produce; more added fats

(Val-de-Marne data cited in Drewnowski & Specter, 2004)

Diet cost (Euros/d) for men

Diet cost (Euros/d) for women
The USDA Thrifty Food Plan meets nutritional standards and can be considered a “healthy” diet.

It was created using a cost constraint ($104/wk/family of 4) in non-linear programming.
What can you get for $100/week for a family of 4. The USDA Thrifty Food Plan: 1999
What are the current trends on food spending?
Energy costs (US cents/d) and estimated per capita energy intakes for high-income nations

Kcal/capita/day (1992)

Cost per 100 kcal (US cents)
Changes in dietary fat (% energy) and the prevalence of overweight

Food expenditures and obesity in the US

data from NHANES (NCHS), DHHS, and ERS, USDA

Food at home
Food away from home (% disposable income)
Obesity in men
Obesity in women (BMI >30)
Is the food industry to blame?
Who made us obese?

• Do we have too much of a good thing – or…
• Is it a criminal offense to provide consumers with a wide choice of inexpensive foods that are convenient and taste good?
• If consumers become obese, to whom does liability attach?
• Is fast food the “tobacco of the 21st century?”
The McDonald's Lawsuit

ASHLEY PELMAN, a child under the age of 18 years, by her Mother and Natural Guardian, ROBERTA PELMAN, individually, JAZLYN BRADLEY, a child under the age of 18 years, by her Father and Natural Guardian, ISRAEL BRADLEY, and ISRAEL BRADLEY, individually, Plaintiffs - against - McDONALD'S CORPORATION, McDonald's RESTAURANTS OF NEW YORK, INC., McDonald's 1865 BRUCKNER BOULEVARD, BRONX, NEW YORK, McDonald's 2630 JEROME AVENUE, BRONX, NEW YORK, Defendants.

02 Civ. 7821 (RWS)

UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF NEW YORK

237 F. Supp. 2d 512; 2003 U.S. Dist. LEXIS 707

January 22, 2003, Decided

January 22, 2003, Filed


N: Complaint was dismissed in its entirety. Leave was granted to replead all claims based on New York City Administrative Code, Ch. 5, 20-700 et seq., which were prejudice.


The Pelman claims pursuant to New York Gen Bus Law §§ 349, 350

Count 1: Deceptive acts (claims of nutritional value, “supersizing”) and deceptive omissions (failure to warn or to disclose nutrient content)

Count 2: Representations targeted at children

Count 3: Inherently dangerous food (cholesterol, fat, salt and sugar)

Count 4: Failure to warn of unhealthy attributes and disease risk

Count 5: Sale of addictive products

Complaint dismissed in its entirety by Justice Sweet; leave granted to replead. Amended complaint dismissed 9/3/2003
What is to be done?
The 2003 WHO Report

- High intake of energy-dense foods promotes weight gain
- Free **sugars** contribute to overall energy density of diets
- Sugar-sweetened **drinks** are energy-dense
- Sugar-sweetened drinks reduce appetite control
- Humans are ill-adapted to liquid foods
- **Energy in fluids** is not well detected by the body

- Consuming energy-dilute whole grains, legumes, vegetables and fruit will reduce energy intakes and stem the global obesity epidemic
Taste and energy density drive eating behavior

- **Taste**
  - Infants respond to sweet solutions at birth
  - Infants select sweeter sucrose over less-sweet lactose
  - Infants learn to consume sweet solutions

- **Energy density (ED)**
  - Children prefer familiar and energy-dense foods
  - Some of those foods are mixtures of sugar and fat
  - Soft drinks are energy-dilute; whole grains are not

Innate preferences for sugar and fat are a fact of life

Are energy-dense foods less satiating?
There should be more studies on the satiating power of foods.

We also need studies on the relationship between diet quality and diet cost.
A new model to explain environmental influences on obesity in the US

What is the connection between obesity and
• Food palatability
• Energy density
• Food costs
• Economic resources
• Sugar and fat content of the diet

Mediated by the social/financial resources and the economics of food choice (Drewnowski and Specter, AJCN 2004)