Escherichia coli O157:H7—Harbinger of Change in Food Safety and Tradition in the Industrialized World

The industrialized world has been forced to change many traditions in the way that we enjoy, handle, and think about our food supply. One small pathogen, Escherichia coli O157:H7, has had a tremendous influence on the United States government, industry, and general public. During the last two weeks of August this year, it resulted in one of the largest food recalls in history and captured the attention of the national news media. The pathogen has singlehandedly reopened the public debate on the use of irradiation to reduce pathogens in food.

The Scientific Status Summary, “Foodborne Disease Significance of Escherichia coli O157:H7 and Other Enterohemorrhagic E. coli” (pages 69–76) prepared for IFT’s Expert Panel on Food Safety and Nutrition by Robert L. Buchanan and Michael P. Doyle, describes the low infectious dose, severe disease consequences, and acid tolerance that have allowed E. coli O157:H7 to emerge as a threat in unexpected new places.

Not too long ago, calls for stricter government standards were met with the often-repeated response that microorganisms are ubiquitous and the consumer has the responsibility to handle and prepare food carefully. The consumer still has that responsibility, but it is shared more equitably by others in the farm-to-table chain of production, marketing, and preparation.

The 1993 Western states outbreak of E. coli O157:H7 attributed to undercooked hamburgers served at a fast-food chain was the turning point. The outbreak sickened hundreds and was responsible for four deaths. It certainly was not the first outbreak of foodborne illness that the United States had experienced, but it was a particularly difficult one for the public to accept; children were affected, and the food source was the traditional American hamburger.

A number of things have changed since then:

**USDA.** The U.S. Department of Agriculture declared E. coli O157:H7 an adulterant in raw ground beef in 1994; initiated a monitoring program for E. coli O157:H7 in raw ground beef in 1994 (testing confirmed that contamination occurs sporadically and at low levels); mandated safe food handling labels for raw meat and poultry products in 1994; finalized the Hazard Analysis and Critical Control Point (HACCP) Systems/Pathogen Reduction regulation, requiring many companies to address enterohemorrhagic E. coli (EHEC) when identifying hazards in their HACCP plans (1996); created the Emergency Response Division for outbreak investigations and tracebacks in 1996; with the Food and Drug Administration (FDA), increased retail time/temperature cooking requirements for ground beef (Food Code); increased efforts to educate consumers to use a thermometer and cook hamburger to an internal temperature of 160°F; and proposed new legislation that would give USDA mandatory recall authority in public health emergencies, such as those involving EHEC.

**Food Science.** The traditional barriers of time/temperature and acid must be reevaluated. Many of the pathogen’s attributes, addressed so well in the status summary by Buchanan and Doyle, are defying food safety conventions.

**Public Health.** The 1996 outbreak surveillance data from the Centers for Disease Control and Prevention (CDC) indicate that there were only a few clusters of illness associated with contaminated beef. There has been a shift to other sources of contaminated foods, such as alfalfa sprouts, unpasteurized apple juice, and lettuce. The traditional roadside apple cider stand will certainly be affected, and the health benefits of fresh juice and sprouts must now be weighed against the possibility of EHEC infection.

In 1995, CDC, USDA, and FDA initiated the FoodNet active site surveillance program. Preliminary data for 1996 linked sporadic illness to hamburger prepared at home. These data are consistent with the recent outbreak in Colorado, where backyard barbeques and picnics around July 4 resulted in a recognized cluster of illnesses.

Increasingly, epidemics are recognized by another component of FoodNet, molecular fingerprinting. The USDA Outbreak Support Laboratory (Athens, Ga.) was able to fingerprint and match hamburger isolates to the human isolates from Colorado. This information and the subsequent traceback and recall of frozen beef patties may have averted a larger outbreak.

**Farming.** There is a growing recognition that fruits and vegetables are raw agricultural products that are ready-to-eat and must be treated accordingly. The tradition of recycling manure for vegetable gardening has caused E. coli O157:H7 illness; the pathogen can survive longer than the traditional 60-day holding period. Harvesters of produce for raw consumption might well be thought of as food handlers. The produce industry has responded with guidelines for increased worker sanitation as well as training.

**International.** E. coli O157:H7 disease is not unique to the United States. In 1996 alone, the largest reported outbreak, linked to radish sprouts, occurred among school children in Japan. An outbreak in Scotland resulted in the death of 19 people, predominately pensioners receiving meals catered by the local butcher. In Canada, the traditional school day trip to a dairy farm is associated with EHEC infections. In May 1997, a World Health Organization (Geneva, Switzerland) expert consultation on EHEC prevention and control recommended preventive approaches such as HACCP, applied from farm to table.

What Does the Future Hold? E. coli O157:H7 has been a driving force for change in many areas and has shaken tradition; but it remains an enigma. Where did it come from? What happened in 1982? Now that it is here, can it be eradicated?