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2-1-1998

## An Overview of Escherichia coli 0157:H7

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### Recommended Citation

Namminga, Kelly and Epperson, William, "An Overview of Escherichia coli 0157:H7" (1998). *Extension Extra*. Paper 428.  
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# Extension Extra

ExEx 14045  
February 1998  
Food Safety

COLLEGE OF AGRICULTURE & BIOLOGICAL SCIENCES / SOUTH DAKOTA STATE UNIVERSITY / USDA

## An Overview of *Escherichia coli* O157:H7

by Kelly Namminga, SDSU nutrition and food science graduate student,  
with review by William Epperson, DVM, SDSU Extension veterinarian

### What is *Escherichia coli* O157: H7?

*Escherichia coli* (*E. coli*) bacteria inhabit the intestinal tract of humans and animals. Normally, they are beneficial, suppressing the growth of harmful bacteria and producing vitamins. Of the hundreds of strains of *E. coli* (referred to as serotypes), very few cause disease in humans.

*E. coli* O157: H7 (O157) is one of those disease-causing strains classified as a foodborne pathogen. The letter/number combination O157: H7 refers to characteristics of the organism that distinguish it from other *E. coli* serotypes. O157 *E. coli* organisms have the ability to attach to the intestinal wall and produce toxins that are very closely related to those produced by *Shigella dysenteriae*, another foodborne organism capable of causing gastrointestinal diseases (food poisoning). The O157 pathogen has become very significant among foodborne pathogens because of its low infectious dose and the severity of the infection that affects all age groups. Fewer *E. coli* bacteria are needed to cause foodborne illness than other foodborne pathogens such as *Salmonella*.

### When was *Escherichia coli* O157: H7 discovered?

The O157 pathogen was recognized in 1982 after the investigation of two outbreaks of a bloody diarrhea syndrome. The outbreaks were traced to undercooked hamburgers served from a fast food chain. Since 1983, an increasing number of O157 infections have been reported in the United States. The actual incidence of infection is not increasing; instead, improved surveillance is prompting increased reporting of outbreaks. In 1993, only 12 states had mandatory

reporting laws for O157 infections. By mid-1996, 42 states required reporting of O157 infections. In the 11 years from 1982 to 1993, 32 total outbreaks were documented. In 1994 and 1995, 32 outbreaks were reported each year; 29 outbreaks were reported in 1996.

The actual prevalence of the disease may still be underestimated. The organism is difficult to identify if testing is not done during early onset of infection. Individuals with mild cases of illness may not consult a physician, and therefore, the illness goes unreported.

### What are some symptoms of *Escherichia coli* O157: H7 infection?

The most common symptom of O157 infection is bloody diarrhea. About 10 to 20 percent of patients with bloody diarrhea can develop more severe diseases -- hemorrhagic colitis, hemolytic uremic syndrome (HUS), or thrombotic thrombocytopenic purpura (TTP).

Hemorrhagic colitis is characterized by severe abdominal cramps, bloody stools, little or no fever, and evidence of erosion and hemorrhage of the colon. Initial symptoms usually occur 1 to 2 days after ingestion of contaminated food. The illness can last 6 to 8 days and can be severe enough to result in hospitalization.

Less than 10% of cases with bloody diarrhea will develop HUS. HUS causes hemolytic anemia (destruction of red blood cells), affects the central nervous system, and causes renal (kidney) failure. Renal failure is the most significant symptom of HUS. About half of patients with HUS require dialysis. Three to five percent of HUS cases are fatal.

TTP has symptoms similar to HUS; however, the most significant is severe neurologic damage. Complications can include seizures, stroke, or coma. Renal damage is less severe than with HUS. This disease is primarily found in adults, particularly the elderly. The mortality rate of TTP can be as high as 50 percent.

### **How is *Escherichia coli* O157: H7 transmitted?**

The O157 organism is acquired by humans through the ingestion of contaminated food and water or through person-to-person contact. A majority of O157 outbreaks originated from beef products, particularly ground beef. Insufficient cooking times and temperatures have been most often associated with these outbreaks.

Other foods associated with O157 outbreaks include venison, raw (unpasteurized) milk, apple juice or cider, lettuce, and alfalfa sprouts. Outbreaks where contaminated water (including swimming pool water) was involved have also occurred. Transmission from one person to another can occur via the fecal-oral route. This method of transmission is usually the greatest problem in day care centers but can occur in other facilities such as nursing homes and among family members caring for an ill person.

### **Who is at risk for illness from *Escherichia coli* O157: H7?**

Illness from O157 can occur in individuals of any age. Those with the greatest risk include the very young (children under 5 years of age), the elderly (greater than 65 years of age), those who are immunocompromised or already ill, those who have had a gastrectomy, or those who have recently taken antibiotics.

Some investigators have suggested that producers, veterinarians, and others who work with livestock may have a greater risk of being infected with O157. Currently, there is no evidence that these individuals are at any greater risk than the rest of the population. Perhaps exposure to low levels of the organism over long periods of time may build natural immunity and make these individuals less likely to become ill. However, individuals involved with livestock should practice good personal hygiene.

### **Where can *Escherichia coli* O157: H7 be found?**

Ground beef and milk are implicated as significant sources of O157 contamination, but when the organism comes in contact with these products can not be precisely fixed. The O157 pathogen is found in the feces of a low proportion of cattle. Since cattle live in a natural outdoor environment, some fecal contamination of the hair and skin may occur. When the animal is processed for food, the skin is removed and contamination of the carcass with the O157 organism may occur. This

contamination may be so slight that it is overlooked by processing plant and federal inspectors. When the meat is further processed, and, in particular, ground for hamburger, the bacteria may spread throughout a larger volume of product.

Sheep also have been identified as O157 reservoirs. Deer are also O157 reservoirs, and it is believed that the organism can be passed between deer and cattle.

Results of a USDA study indicate that O157 infection in swine is very low to nonexistent. The study found that 4,229 fecal samples collected from 152 swine operations in the top six swine producing states were negative for O157, suggesting that swine are not significant carriers of O157.

### **How can *Escherichia coli* O157: H7 be controlled?**

The severity of diseases caused by O157, the low infectious doses of the organism, and uncertainties about when O157 enters human foods increase the need for vigilance in food preparation. It is particularly important not to overlook elimination strategies for food products that are consumed uncooked, such as fruits, vegetables, sausages and jerky.

#### **Present Control Methods**

The best assurance against infection of O157 is to practice preventative measures at home.

- Cook raw hamburger to the proper internal temperature (160°F, or until juices no longer run pink). In a restaurant, make sure a hamburger is thoroughly cooked before eating it. If a hamburger is undercooked, do not be afraid to return it.
- Avoid drinking milk, apple juice, or cider that is unpasteurized.
- Wash hands after handling raw meat products to prevent contamination of other foods.
- Wash hands thoroughly and frequently to help prevent person to person transmission. This is a particularly important practice to teach children.
- Drink water from appropriate public or well sources, not from untreated streams or lakes.

#### **Long-Term Control Methods**

Microbiological surveys conducted on beef carcasses and ground beef in slaughter and processing plants have shown that very few carcasses are contaminated with O157. However, this is not an absolute assurance of safety for food products. Long-term O157 prevention strategies are being developed and implemented by beef producers, processors, and retailers.

The Hazard Analysis Critical Control Point (HACCP) system is a means for developing food safety programs. This system consists of identifying hazards that can create food safety problems and developing steps to prevent, control, or eliminate these hazards in each phase of the food production process. The Food Safety and Inspection Service (FSIS) of the USDA has established new requirements for slaughter and processing plants in the U.S. Plants will be required to adopt and implement HACCP systems over a three-year period beginning in 1998. Large plants are required to have a program in place by January 1998, medium plants by January 1999, and small plants by January 2000.

Many decontamination processes have been developed for beef carcasses and are being established in beef processing plants. These processes include carcass washing with organic acid, steam vacuuming, steam pasteurization, and the use of antimicrobial agents such as chlorinated water. One or more methods to reduce microbial contamination are used on a majority of beef carcasses. The Food and Drug Administration (FDA) has recently approved irradiation (cold pasteurization) of beef for pathogen reduction.

Other sources of O157 infection are not affected by these efforts. Continuing vigilance and safe food preparation must be practiced.

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*This publication was produced with funding from the USDA-CSREES project:  
The National Support and Coordination of CES Food Handler Education Programs.  
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ExEx 14045: 150 copies printed by CES at a cost of 6 cents each. February 1998. pdf December 2002.