



European Foodborne Illness Outbreak (05/11): What is making people sick?

Image: *E. coli* O104:H4^a

(June 8, 2011) A deadly outbreak linked to a pathogenic strain of *E. coli* has killed 26 people, made more than 2,200 people ill, and appears to be centered in northern Germany near Hamburg. Beginning May 2, 2011, public health officials in Germany noted an alarming rise in a severe illness called hemolytic uremic syndrome .¹

What is hemolytic uremic syndrome? Hemolytic uremic syndrome (HUS) is an uncommon disease that occurs in 5 to 15% of individuals, especially children, who are infected by a pathogenic form of the *Escherichia coli* (*E. coli*) bacterium, usually O157:H7. This organism releases toxins into the gut that are absorbed into the bloodstream and transported by white blood cells (leukocytes) to the kidneys. This results in acute renal injury. There may also be damage to the brain with seizures and even coma, the pancreas with pancreatitis and occasionally diabetes mellitus, and other organs. Typical HUS mainly affects young children between one and 10 years. Occasionally, adults may be affected by typical HUS. The onset of HUS is preceded by an illness characterized by vomiting, abdominal pain, fever, and, usually, bloody diarrhea.²

In the current illness outbreak, it is primarily adult women who have been sickened and 674 have developed HUS, an infection rate of 31-38% (far higher than the normal rate).

What is causing illness? In this outbreak, HUS is being caused by an infection with a type of pathogenic *E. coli* known as *E. coli* O104:H4.² This strain of *E. coli* causes an illness similar to infection with *E. coli* O157:H7, however the infection seems to be more severe as this strain of bacteria is very effective at attaching to the lining of the small intestine, growing, and producing the virulent toxin.

Escherichia coli (abbreviated as *E. coli*) are a large and diverse group of bacteria. Although most strains of *E. coli* are harmless, others can make you sick. Some kinds of *E. coli* cause disease by making a toxin called Shiga toxin. The bacteria that make these toxins are called "Shiga toxin-producing" *E. coli*, or STEC for short. The most commonly identified STEC in North America is *E. coli* O157:H7 (often shortened to *E. coli* O157 or even just "O157").³ In addition to *E. coli* O157, many other kinds of STEC cause disease, especially O26, O111, and O103. The type of bacteria under investigation in this outbreak, *E. coli* O104:H4 is very rare and has never been linked to an outbreak of illness in the United States.

What food is to blame? German health authorities are investigating the outbreak but have not confirmed a source. They suspect that the source is contaminated food, possibly raw vegetables. An organic farm in northern Germany has been the target of the investigation. Various food items including cucumbers, lettuce, tomatoes and sprouted seeds have been analyzed as possible carriers of the pathogen.

The problem with sprouts. Sprouts (sprouted seeds) may be regarded as a health-food, but actually they are scarier than raw meat in terms of the risk of microbial contamination. Seeds are sprouted by

placing germinating seeds in a warm, moist environment. Under these conditions, bacteria contaminating the seed are placed in an ideal growth environment. In contrast, our meat and poultry processing industries have standards in place to limit the growth of potential contaminants during processing. Work in my laboratory at UW-Madison several years ago, and in other laboratories, has shown that there can be a million-fold increase in pathogens on artificially-contaminated alfalfa seeds during the sprouting process.



Image: alfalfa sprouts^b

The Food and Drug Administration (FDA) requires sprout growers (sprouters) to implement at least one approved antimicrobial seed treatment aimed at pathogen reduction prior to the seeds being sprouted.⁴ The most common treatment is 20,000 ppm calcium hypochlorite (active chlorine). In contrast, an effective kitchen sanitizer is 100 ppm chlorine (1 Tablespoon bleach per gallon of water) and swimming pool water will contain 10 ppm chlorine.

In our work we artificially contaminated alfalfa seeds with low levels of pathogens and then studied the effectiveness of intervention treatments at reducing pathogen prior to sprouting (and hopefully greatly reduce the risk). Our work, and the work of others, confirmed that even approved antimicrobial interventions are not effective at eliminating pathogens which may contaminate seeds for sprouting. Contamination on sprouts is often under the seed coat or 'embedded' in the germ and sanitizers or antimicrobial treatments are not able to reach the pathogens 'hiding' there. As few as one or two pathogens which somehow survive the intervention can grow into millions of cells by the end of the sprouting process.

Consumers sprouting seeds at home would face even greater challenges. Standard home-based treatments that may be applied to seeds before sprouting: often 100 ppm chlorine (dilute bleach solution) or a 5% acetic acid solution (vinegar) are even less effective than the standard industry treatments and would provide little, if any, protection.

As a result, the FDA issued a warning in 1999 which stated

Warning: Consumers who are concerned about their health will not consume raw, sprouted seeds.

These words are certainly as important today as they were over 10 years ago.

What about washing produce, won't that help? The outbreak of illness in Europe has not been conclusively linked to any one food and, other than to state that fresh produce appears to be involved, we do not yet know the contaminated food source. The FDA and other government agencies continue to advocate washing as an important food-safety step before consuming fresh produce. Part of our core teaching messages include the instruction to **Clean** – hands and surfaces often, and also fruits and vegetables before eating them. These can be important food safety behaviors, however, we can not rely on washing to remove microbial contamination from fresh produce. When washing fresh produce, we use only clean water (no soap), scrubbing firm produce like melons and potatoes and gently rinsing berries and other soft items. An acid 'dip', using lemon juice or vinegar as recommended by some books

or magazines, has not been shown to be effective. A dilute chlorine 'dip' is not necessary and would only be recommended for melons before slicing (1/2 to 1 Tablespoon bleach per gallon of water).



Seven tips for cleaning fruits, vegetables. Since the fresh produce season is upon us, the FDA recently issued tips for cleaning fruits and vegetables.⁵ The FDA says to choose produce that isn't bruised or damaged, and make sure that pre-cut items—such as bags of lettuce or watermelon slices—are either refrigerated or on ice both in the store and at home. In addition, the FDA advocates the following seven steps:

Image: washing tomatoes^c

- Wash your hands for 20 seconds with warm water and soap before and after preparing fresh produce.
- Cut away any damaged or bruised areas before preparing or eating.
- Gently rub produce while holding under plain running water. There's no need to use soap or a produce wash.
- Wash produce BEFORE you peel it, so dirt and bacteria aren't transferred from the knife onto the fruit or vegetable.
- Use a clean vegetable brush to scrub firm produce, such as melons and cucumbers.
- Dry produce with a clean cloth or paper towel to further reduce bacteria that may be present.
- Throw away the outermost leaves of a head of lettuce or cabbage.

And above all, enjoy a health and food-safe summer.

Text Sources:

¹wwwnc.cdc.gov/travel/notices/outbreak-notice/2011-germany-europe-e-coli.htm

²children.webmd.com/hemolytic-uremic-syndrome

³www.cdc.gov/nczved/divisions/dfbmd/diseases/ecoli_o157h7/

⁴www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/ProduceandPlanProducts/ucm120244.htm

⁵www.fda.gov/ForConsumers/ConsumerUpdates/ucm256215.htm

Image Sources:

^a ecolio104h4.com/

^b www.vitaminhaifa.com/alfalfa-sprouts-those-white-and-green-stringy-things.html

^c www.thedailygreen.com/healthy-eating/eat-safe/preventing-food-illness-44061008

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