



# HEALTH

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## Bacterial Food-Borne Illness

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### Quick Facts...

Bacterial food-borne illness is the result of mishandling food. It includes food infection and food intoxication.

*Salmonella*, *Campylobacter*, *E. coli* and *Listeria* bacteria in food cause food infection.

*Staphylococcus* and *Clostridium botulinum* bacteria produce a toxin (or poison) as a by-product of growth and multiplication in food and cause food intoxication.

*Clostridium perfringens* can multiply in foods to sufficient numbers to cause food poisoning.

Sanitation and proper heating and refrigeration practices will help prevent food-borne illness.

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Food-borne infection is caused by bacteria in food. If bacteria become numerous and the food is eaten, bacteria may continue to grow in intestines and cause illness. *Salmonella*, *Campylobacter*, hemorrhagic *E. coli* and *Listeria* all cause infections.

Food intoxication results from consumption of toxins (or poisons) produced in food by bacterial growth. Toxins, not bacteria, cause illness. Toxins may not alter the appearance, odor or flavor of food. Common kinds of bacteria involved are *Staphylococcus aureus* and *Clostridium botulinum*. (See fact sheet 9.305, *Botulism*, for more information on its prevention.) In the case of *Clostridium perfringens*, illness is caused by toxins released in the gut when large numbers of vegetative cells are eaten.

### Salmonellosis

Salmonellosis is a form of food infection that may result when foods containing *Salmonella* bacteria are consumed. Once eaten, the bacteria may continue to live and grow in the intestine, set up an infection and cause illness. The possibility and severity of the illness depends in large part on the size of the dose, the resistance of the host and the type of organism causing the illness.

The bacteria are spread through indirect or direct contact with the intestinal contents or excrement of animals, including humans. For example, they may be spread to food by hands that are not washed after using the toilet. They also may be spread to raw meat during processing so that it is contaminated when brought into the kitchen. Because of this, it is important to make sure hands and working surfaces are thoroughly washed after contact with raw meat, fish and poultry before working with foods that require no further cooking.

*Salmonella* bacteria thrive at temperatures between 40 and 140 degrees F. They are readily destroyed by cooking to 165 F and do not grow at refrigerator or freezer temperatures. They do survive refrigeration and freezing, however, and will begin to grow again once warmed to room temperature.

Symptoms of salmonellosis include headache, diarrhea, abdominal pain, nausea, chills, fever and vomiting. These usually occur within 12 to 36 hours after eating contaminated food and may last two to seven days. Arthritis symptoms may follow three to four weeks after onset of acute symptoms. Infants, the elderly or people already ill have the least resistance to disease effects.

Foods commonly involved include eggs or any egg-based food, salads (such as tuna, chicken or potato), poultry, pork, processed meats, meat pies, fish, cream desserts and fillings, sandwich fillings, and milk products. These foods may be contaminated at any of the many points where the food is handled or processed from the time of slaughter or harvest until it is eaten.

## Campylobacteriosis

*Preventive measures for campylobacter infections include pasteurizing milk; avoiding post-pasteurization contamination; cooking raw meat, poultry and fish; and preventing cross-contamination between raw and cooked or ready-to-eat foods.*

Campylobacteriosis or campylobacter enteritis is caused by consuming food or water contaminated with the bacteria *Campylobacter jejuni*. Considered a pathogen principally of veterinary significance until recently, this bacteria is now thought to be responsible for 2.5 times more food poisoning outbreaks per year than *Salmonella*.

*C. jejuni* commonly is found in the intestinal tracts of healthy animals (especially chickens) and in untreated surface water. Raw and inadequately cooked foods of animal origin and non-chlorinated water are the most common sources of human infection (e.g., raw milk, undercooked chicken, raw hamburger, raw shellfish). The organism grows best in a reduced oxygen environment, is easily killed by heat (120 F), is inhibited by acid, salt and drying, and will not multiply at temperatures below 85 F.

Diarrhea, nausea, abdominal cramps, muscle pain, headache and fever are common symptoms. Onset usually occurs two to five days after eating contaminated food. Duration is two to seven days, but can be weeks with such complications as urinary tract infections and reactive arthritis. Meningitis, recurrent colitis, acute cholecystitis, and Guillain-Barre syndrome are rare complications. Deaths, also rare, have been reported.

## Listeriosis

*Preventive measures for listeriosis include maintaining good sanitation, pasteurizing milk, avoiding post-pasteurization contamination and cooking foods thoroughly.*

Prior to the 1980s, listeriosis, the disease caused by *Listeria monocytogenes*, was primarily of veterinary concern, where it was associated with abortions and encephalitis in sheep and cattle. As a result of its wide distribution in the environment, its ability to survive for long periods under adverse conditions, and its ability to grow at refrigeration temperatures, *Listeria* has since become recognized as an important food-borne pathogen. *L. monocytogenes* is frequently carried by humans and animals. The organism grows in the pH range of 5.0 to 9.5. It is salt tolerant and relatively resistant to drying, but easily destroyed by heat. (It grows between 34 F and 113 F).

Listeriosis primarily affects newborn infants, pregnant women, the elderly and those with compromised immune systems. In a healthy non-pregnant person, listeriosis may occur as a mild illness with fever, headaches, nausea and vomiting. Among pregnant women, intrauterine or cervical infections may result in spontaneous abortion or still birth. Infants born alive may develop meningitis. The mortality rate in diagnosed cases is 20 to 35 percent. The incubation period is a few days to three weeks. Recent cases have involved cole slaw, raw milk and cheeses made with raw milk.

## Staphylococcal Intoxication

*Foods commonly involved in staphylococcal intoxication include protein foods such as ham, processed meats, tuna, chicken, sandwich fillings, cream fillings, potato and meat salads, custards, milk products and creamed potatoes. Foods that are handled frequently during preparation are prime targets for staphylococci contamination.*

*Staphylococcus* bacteria are found on the skin and in the nose and throat of most people; people with colds and sinus infections are special carriers. Infected wounds, pimples, boils and acne are generally rich sources. *Staphylococcus* also are widespread in untreated water, raw milk and sewage.

When *Staphylococcus* get into warm food and multiply, they produce a toxin or poison that causes illness. The toxin is not detectable by taste or smell. While the bacteria itself can be killed by temperatures of 120 F, its toxin is heat resistant; therefore, it is important to keep the staph organism from growing. Keep food clean to prevent its contamination, keep it either hot (above 140 F) or cold (below 40 F) during serving time, and as quickly as possible refrigerate or freeze leftovers and foods to be served later. (See Figure 1.)

Symptoms include abdominal cramps, vomiting, severe diarrhea and exhaustion. These usually appear within one to eight hours after eating staph-infected food and last one or two days. The illness seldom is fatal.

Foods commonly involved in clostridium illnesses include cooked, cooled, or reheated meats, poultry, stews, meat pies, casseroles and gravies. Holding foods at warm (110 F) rather than hot (140 F) temperatures and cooling foods too slowly are the primary causes of perfringens contamination.

Preventive strategies for *E. coli* infections include thorough washing and other measures to reduce the presence of the microorganism on raw food, thorough cooking of raw animal products, and avoiding recontamination of cooked meat with raw meat. To be safe, cook ground meats to 160 F.

## References

Buchanan, R.L., and Doyle, M.P. Foodborne disease significance of *Escherichia coli* O157:H7 and other enterohemorrhagic *Escherichia coli*. *Food Technology*, 51(10)69-76, 1997.

USDA. Food Safety Inspection Service. A Margin of Safety: The HACCP Approach to Food Safety Education. Government Printing Office, Washington, D.C. June, 1989.

## Clostridium Perfringens Food-Borne Illness

*Clostridium perfringens* belong to the same genus as the botulinum organism. However, the disease produced by *C. perfringens* is not as severe as botulism and few deaths have occurred. Spores are found in soil, nonpotable water, unprocessed foods and the intestinal tract of animals and humans. Meat and poultry are frequently contaminated with these spores from one or more sources during processing.

Spores of some strains are so heat resistant that they survive boiling for four or more hours. Furthermore, cooking drives off oxygen, kills competitive organisms and heat-shocks the spores, all of which promote germination.

Once the spores have germinated, a warm, moist, protein-rich environment with little or no oxygen is necessary for growth. If such conditions exist (i.e., holding meats at warm room temperature for several hours or cooling large pots of gravy or meat too slowly in the refrigerator), sufficient numbers of vegetative cells may be produced to cause illness.

Symptoms occur within eight to 24 hours after contaminated food is eaten. They include acute abdominal pain and diarrhea. Nausea, vomiting and fever are less common. Recovery usually is within one to two days, but symptoms may persist for one or two weeks.

## *E. Coli* Hemorrhagic Colitis

*Escherichia coli* belong to a family of microorganisms called coliforms. Many strains of *E. Coli* live peacefully in the gut, helping keep the growth of more harmful microorganisms in check. However, one strain, *E. coli* O157:H7, causes a distinctive and sometimes deadly disease.

Symptoms begin with nonbloody diarrhea one to five days after eating contaminated food, and progress to bloody diarrhea, severe abdominal pain and moderate dehydration. In young children, hemolytic uremic syndrome (HUS) is a serious complication that can lead to renal failure and death. In adults, the complications sometimes lead to thrombocytopenic purpura (TPP), characterized by cerebral nervous system deterioration, seizures and strokes.

Ground beef is the food most associated with *E. coli* O157:H7 outbreaks, but other foods also have been implicated. These include raw milk, unpasteurized apple juice and cider, dry-cured salami, homemade venison jerky, sprouts, and untreated water. Infected food handlers and diapered infants with the disease likely help spread the bacteria.

## Preventing Food-Borne Illness

Food-borne illness can be prevented. The following food handling practices have been identified by the Food Safety Inspection Service of USDA as essential in preventing bacterial food-borne illness.

### Purchase and Storage

- Keep packages of raw meat and poultry separate from other foods, particularly foods to be eaten without further cooking. Use plastic bags or other packaging to prevent raw juices from dripping on other foods or refrigerator surfaces.
- Buy products labeled “keep refrigerated” only if they are stored in a refrigerated case. Refrigerate promptly.
- Buy dated products before the label sell-by, use-by or pull-by date has expired.

### Preparation

- Wash hands (gloved or not) with soap and water for 20 seconds before preparing foods and after handling raw meat or poultry, touching animals, using the bathroom, changing diapers, smoking or blowing your nose.

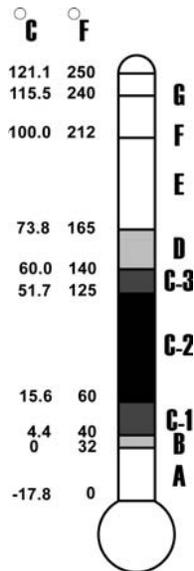


Figure 1: Temperature of food for control of bacteria.

A. Freezing temperatures stop growth of bacteria, but may allow bacteria to survive. Set freezer to 0 F.

B. Cold temperatures permit slow growth of some bacteria. Do not store raw meats for more than five days or poultry, fish or ground meat for more than two days in the refrigerator.

#### C. DANGER ZONE.

C-1. Some growth of food poisoning bacteria may occur.

C-2. Temperatures in this zone allow rapid growth of bacteria and production of toxins by some bacteria. Do not hold foods in this zone for more than two hours.

C-3. Some bacterial growth may occur. Many bacteria survive.

D. Warming temperatures prevent growth but allow survival of some bacteria.

E. Cooking temperatures destroy most bacteria. Time required to kill bacteria decreases as temperature increases.

F. Canning temperatures for fruits, tomatoes and pickles in water-bath canner.

G. Canning temperatures for low-acid vegetables, meat and poultry in pressure canner.

- Thaw only in refrigerator, under cold water changed every 30 minutes, or in the microwave (followed by immediate cooking).
- Scrub containers and utensils used in handling uncooked foods with hot, soapy water before using with ready-to-serve foods. Use separate cutting boards to help prevent contamination between raw and cooked foods.
- Stuff raw products immediately before cooking, never the night before.
- Don't taste raw meat, poultry, eggs, fish or shellfish. Use pasteurized milk and milk products.
- Do not eat raw eggs. This includes milk shakes with raw eggs, Caesar salad, Hollandaise sauce, and other foods like homemade mayonnaise, ice cream or eggnog made from recipes that call for uncooked eggs.
- Use a meat thermometer to judge safe internal temperature of meat and poultry over 2 inches thick (160 F or higher for meat, 180 F or higher for poultry). If your microwave has a temperature probe, use it.
- For meat or poultry less than 2 inches thick, look for clear juices as signs of "doneness."
- When using slow cookers or smokers, start with fresh rather than frozen, chunks rather than roasts or large cuts, and recipes that include a liquid. Check internal temperature in three spots to be sure food is thoroughly cooked.
- Avoid interrupted cooking. Never partially cook products, to refrigerate and finish later. Also, don't put food in the oven with a timer set to begin cooking later in the day.
- If microwave cooking instructions on the product label are not appropriate for your microwave, increase microwave time to reach a safe internal temperature. Rotate, stir and/or cover foods to promote even cooking.
- Before tasting, boil all home-canned vegetables and meats 10 minutes plus one minute per 1,000 feet.

#### Serving

- Wash hands with soap and water before serving or eating food. Serve cooked products on clean plates with clean utensils and clean hands.
- Keep hot foods hot (above 140 F) and cold foods cold (below 40 F).
- In environmental temperatures of 90 F or warmer, leave cooked food out no longer than one hour before reheating, refrigerating or freezing. At temperatures below 90 F, leave out no more than two hours.

#### Handling Leftovers

- Wash hands before handling leftovers and use clean utensils and surfaces.
- Remove stuffing before cooling or freezing.
- Refrigerate or freeze cooked leftovers in small, covered shallow containers (2 inches deep or less) within two hours after cooking. Leave airspace around containers to help ensure rapid, even cooling.
- Do not taste old leftovers to determine safety.
- If reheating leftovers, cover and reheat to appropriate temperature before serving (a rolling boil for sauces, soups, gravies, "wet" foods; 165 F for all others).
- If in doubt, throw it out. So they cannot be eaten by people or animals, discard outdated, unsafe or possibly unsafe leftovers in the garbage disposal or in tightly-wrapped packages.

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