

Bacteria

- Microbial Pathogens in Food and the Illnesses they Cause

Illness	Organism	Foods Involved	Types of Illness	Description of Symptoms	When to symptoms first appear?	How long do symptoms last?	Prevention Strategies
E. coli Infection, (Gastroenteritis, Uremia, or Hemolytic Uremic 4 Syndrome)	<i>E. coli</i> O157:H7 or non-Shiga toxin-producing <i>E. coli</i>	Undercooked ground beef; unpasteurized milk or apple cider, lettuce, unsanitary water	Toxin-mediated infection	Short-term effects: Diarrhea, watery-bloody, abdominal cramps, vomiting, mild/ no fever. Possible complications: Hemolytic Uremic Syndrome - Acute or chronic renal failure, Uremia (symptoms caused by accumulation of nitrogen-containing wastes in the body), kidney failure, and death.	3-8 days; average 3-4 days	2-9 days, unless kidney failure	Pasteurization, thorough cooking Maintain refrigerated temperatures.
Salmonellosis Gastroenteritis (S. enteritis) most common form	<i>Salmonella</i> Typhimurium and <i>S. Enteritidis</i>	Undercooked poultry, fish, shrimp, eggs; unpasteurized milk, produce	Infection	Short-term effects: Nausea, vomiting, fever, abdominal pain, chills, headache, diarrhea, dehydration. Possible complications: Persons with diarrhea usually recover completely, although it may be several months before their bowel habits are entirely normal. A small number of individuals will develop Reiter's syndrome (pains in their joints, irritation of the eyes, and painful urination) that can last for months or years, and can lead to chronic arthritis. In rare cases, the organism may enter the bloodstream and produce more severe illnesses such as arterial infections (i.e., infected aneurysms), endocarditis, and arthritis.	6-48 hours; average 12-36 hours	1-2 days; sometimes longer	Pasteurization, thorough cooking. Maintain refrigerated temperatures. Good hand washing especially when handling eggs and poultry.

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Listeriosis	<i>Listeria monocytogenes</i>	Unpasteurized milk and dairy products, raw vegetables, undercooked poultry and meats, ready-to-eat foods	Infection	Short-term effects: Nausea, vomiting, persistent fever, abdominal pain, chills, headache, diarrhea, dehydration, spontaneous abortions; stillbirth. Possible complications: Infants who survive listeriosis may suffer long-term neurological damage and delayed development.	3 to 70 days; average 3 weeks	Depends upon treatment	Pasteurization, thorough cooking. Cleaning and sanitizing in processing and storage areas. Pregnant women should avoid consumption of soft cheeses, deli meats, and cold salads from salad bars.
Campylobacteriosis	<i>Campylobacter jejuni</i>	Raw poultry, unpasteurized milk	Infection	Short-term effects: Diarrhea, fever, abdominal pain, nausea, headache and muscle pain. Possible complications: Some patients will get a reactive arthritis called Reiter's syndrome after a campylobacter enteritis infection. About 1 in 1,000 patients with campylobacter enteritis develop a nerve problem that results in paralysis, called Guillain-Barre syndrome. Paralysis associated with Guillain-Barre syndrome is usually temporary.	2-5 days	7-10 days, but relapses may occur in about 25% of cases.	Pasteurization, thorough cooking. Maintain refrigerated temperatures.
Bacillary dysentery (shigellosis)	<i>Shigella spp.</i>	Salads (potato, tuna, shrimp, macaroni, and chicken), raw vegetables, milk and dairy products, and poultry	Toxin-mediated infection	Short-term effects: Acute abdominal pain or cramping, cramps, Watery diarrhea, Vomiting, Nausea, Acute fever, Blood, mucus, or pus in stool. Possible complications: Severe dehydration, Neurologic symptoms including seizures (in children), Hemolytic-uremic syndrome (HUS), a form of kidney failure with anemia and clotting problems Reiter's syndrome, which involves eye pain and redness, joint pain, and pain with urination.	12 to 50 hours	2-3 days	Proper handling, storage, and preparation of food, in addition to good sanitation, are principles of prevention for this disease. Hand washing is the most effective preventive measure. Pasteurization, thorough cooking.

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Staphylococcal Food Poisoning	<i>Staphylococcus aureus</i>	Reheated foods: ham, poultry, eggs or other high protein foods; Custards, cream filled pastries, salad dressings	Intoxication	Short-term effects: Nausea, retching, vomiting, abdominal cramps, diarrhea, headache. Possible complications: Dehydration can develop.	1-7 hours; average 2-4 hours	1-2 days	Pasteurization, thorough cooking. Maintain refrigerated temperatures to prevent growth and toxin formation in foods.
Perfringens food poisoning	<i>Clostridium perfringens</i>	Temperature abused meats, meat products, and gravy	Toxin-mediated infection	Short-term effects: Intense abdominal cramps and diarrhea. Possible complications: Necrotic enteritis, septicemia (rare in U.S.).	8-22 hours	24 hours	Pasteurization, thorough cooking to kill vegetative cells. Refrigerated temperatures required to prevent germination of heat resistant spores.
Botulism	<i>Clostridium botulinum</i>	Under-processed low acid canned foods, luncheon meats, ham, sausage, stuffed eggplant, lobster, and smoked And salted fish. Chopped garlic or onions in oil at room temperature	Intoxication	Short-term effects: Difficulty swallowing and speaking, progressive weakness with paralysis, nausea, vomiting, abdominal cramps, dry mouth, double vision, breathing difficulty that may lead to respiratory failure, breathing, absent temporarily, no fever usually. Possible complications: Pneumonia infection, respiratory distress, weakness, nervous system dysfunction for > year.	12-36 hours	May last for several weeks and then slowly go away in the following months	Adequate thermal processing of canned low acid foods to destroy spores. Maintain aerobic atmosphere surrounding cooked foods and refrigeration temperatures to prevent germination of spores.

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Molds

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Aflatoxin intoxication (aflatoxicosis)	<i>Aspergillus flavus</i> and <i>A. parasiticus</i>	Corn and corn products, peanuts and peanut products, cottonseed, milk, and tree nuts such as Brazil nuts, pecans, pistachio nuts, and walnuts.	Intoxication	Short-term effects: Aflatoxicosis when moderate to high levels are consumed. Acute episodes may include hemorrhage, liver damage, edema, alteration in digestion, absorption and/or metabolism of nutrients, and possibly death. Possible complications: Chronic aflatoxicosis results from ingestion of low to moderate levels of aflatoxins. Effects are often difficult to recognize. Common symptoms are impaired food conversion and slower rates of growth. Epidemiological studies suggest an association between liver cancer incidence and aflatoxin content of the diet.	>8 h after high level exposure. Months or years after chronic short term exposure.	Short term symptoms end soon after toxin is no longer consumed. Continuing effects after long term consumption at low levels is unknown.	Reduce aflatoxin intake by buying only major brands of nuts and nut butters and discarding any nuts that look moldy, discolored or shriveled.
Patulin intoxication	<i>Penicillium</i> , <i>Aspergillus</i> and <i>Byssochlamys</i> . In particular, <i>P. expansum</i>	Apples, pears, grapes, and fruit juices	Intoxication	No direct evidence of human illness from patulin but animal studies show it toxic, mutagenic, carcinogenic, and teratogenic. Symptoms are epithelial degeneration, hemorrhage, ulceration of gastric mucosa, neutrophil and mononuclear cell infiltration.	Unknown in humans	Unknown in humans	Removal of decayed fruit before juice pressing.

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Parasites

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Cryptosporidiosis	<i>Cryptosporidium parvum</i> protozoa	Contaminated drinking water, salads, raw fruits and vegetables, raw milk, unpasteurized apple cider, ready-to-eat foods	Infection	Short-term effects: Watery diarrhea several times a day, Abdominal cramping, Nausea, Weight loss.	2-10 days	Up to a month, longer in immune suppressed populations	Water disinfection. Pasteurization, thorough cooking. Proper food handling and hand washing.
Cyclosporiasis	<i>Cyclospora cayetanensis</i>	Contaminated drinking water, fruits and vegetables, ready-to-eat foods	Infection	Short-term effects: Watery diarrhea, with frequent, sometimes explosive, bowel movements, loss of appetite and weight, increased gas, stomach cramps, nausea, vomiting, muscle aches, low-grade fever, and fatigue. Possible complications: Severe malabsorption of nutrients, wasting syndrome, inflammation of the pancreas.	7 days	Few days to a month or longer. If untreated. Relapses possible	Water disinfection. Pasteurization, thorough cooking. Proper food handling and hand washing.
Toxoplasmosis	<i>Toxoplasma gondii</i> protozoa	Undercooked pork, venison, lamb, hamburger	Infection	Short-term effects: enlarged lymph nodes in the head and neck, headache, sore throat, muscle pain. Possible complications: in children may cause inflammation of the retina.	1 to 2 weeks	2 weeks to 1 month	Pasteurization, thorough cooking. Proper food handling and hand washing. Avoid contamination from pets.

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Viruses

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Hepatitis A	Hepatitis A virus	Ice, water, shellfish, produce, dairy products	Infection	Short-term effects: Sudden onset of fever, general discomfort, fatigue, headache, jaundice. Possible complications: Dehydration.	10-50 days	1-2 weeks; months with jaundice	Pasteurization, thorough cooking. Proper food handling and hand washing, safe water supplies.
Norwalk illness	Norwalk-like viral agents	Water, raw or undercooked shellfish, produce, contaminated water	Infection	Short-term effects: Nausea, vomiting, abdominal cramps, mild fever. Possible complications: Dehydration.	Average 1-2 days; 10-50 days	1-3 days	Pasteurization, thorough cooking. Proper food handling and hand washing, safe water supplies.

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