

Food borne infections

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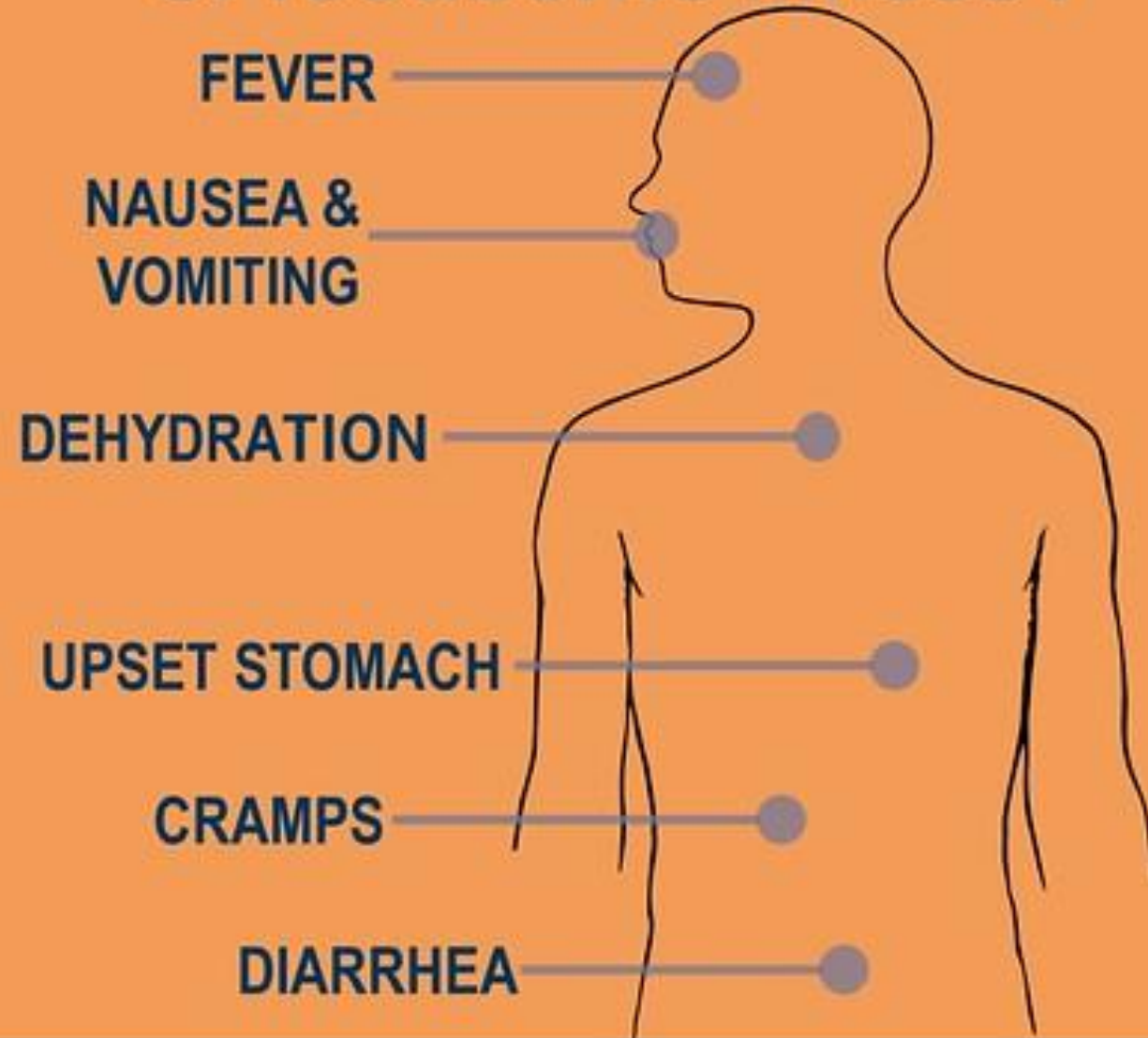
FOOD BORNE INFECTION

Food-borne infections - caused by consuming foods or liquids contaminated with bacteria, viruses, or parasites. These pathogens cause infection by:

- Invading and multiplying in the lining of the intestines and/or other tissues

- Invading and multiplying in the intestinal tract and releasing a toxin (bacteria only)

What are the **SYMPTOMS** of foodborne illness?



Contents included in this file

- CAUSATIVE AGENTS
- FOODS INVOLVED
- SYMPTOMS
- PREVENTIVE MEASURES

Bacterial species	Common foods that may be contaminated
<i>Bacillus cereus</i>	Cooked rice, meat
<i>Campylobacter</i> spp.	Poultry, unpasteurised milk
<i>Clostridium botulinum</i>	Fish, meat
<i>Clostridium perfringens</i>	Cooked meat, poultry
<i>Escherichia coli</i>	Meat, raw milk
<i>Listeria monocytogenes</i>	Pâté, soft cheeses
Salmonellae	Meat, poultry, eggs
<i>Shigella</i> spp.	Eggs, salads
<i>Staphylococcus aureus</i>	Ham, poultry, dairy products
<i>Yersinia enterocolitica</i>	Milk, poultry

Food poisoning: bugs inducing "Eating Contaminated Stuff Causes Very Big Smelly Vomit":

E. coli O157-H7 [undercooked meat, esp. hamburgers]

Clostridium botulinum [canned foods]

Salmonella [poultry, meat, eggs]

Vibrio parahaemolyticus [seafood]

Bacillus cereus [reheated rice]

Staphylococcus aureus [meats, mayo, custard]

Clostridium perfringens [reheated meat]

Vibrio vulnificus [seafood]



Escherichia coli (abbreviated as *E. coli*) are bacteria found in the environment, foods, and intestines of people and animals. *E. coli* are a large and diverse group of bacteria. Although most strains of *E. coli* are harmless, others can make you sick. *E. COLI* *Escherichia coli* is a major bacteria species and can live in human intestines. Some kinds of *E. coli* can cause diarrhea, while others cause urinary tract infections, respiratory illness and pneumonia, and other illnesses. *E. coli* can enter your body through contaminated food or water, or through contact with animals or person and is often involved in major foodborne outbreaks around the world.

E. coli consists of a diverse group of bacteria. Pathogenic *E. coli* strains are categorized into pathotypes. Six pathotypes are associated with diarrhea and collectively are referred to as diarrheagenic *E. coli*.

- Shiga toxin-producing *E. coli* (STEC)—STEC may also be referred to as Verocytotoxin-producing *E. coli* (VTEC) or enterohemorrhagic *E. coli* (EHEC). This pathotype is the one most commonly heard about in the news in association with foodborne outbreaks.

- Enterotoxigenic *E. coli* (ETEC)

- Enteropathogenic *E. coli* (EPEC)

- Enteroaggregative *E. coli* (EAEC)

- Enteroinvasive *E. coli* (EIEC)

- Diffusely adherent *E. coli* (DAEC)

Symptoms

Symptoms of intestinal infection include diarrhea, abdominal pain, and fever.

More severe cases can lead to bloody diarrhea, dehydration, or even kidney failure.

People with weakened immune systems, pregnant women, young children, and older adults are at increased risk for developing these complications.

Symptoms of intestinal infection generally begin between 1 and 10 days after a person infected with *E. coli*. This is known as the incubation period. Once symptoms appear, they usually last around 5 to 10 days.

Symptoms can include:

- abdominal cramping
- sudden, severe watery diarrhea that may change to bloody stools
- gas
- loss of appetite or nausea
- vomiting (uncommon)
- fatigue
- fever



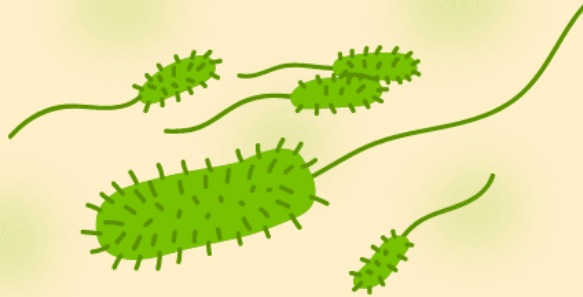
Symptoms of a severe *E. coli* infection may include:

- bloody urine
- decreased urine output
- pale skin
- bruising
- dehydration

Preventive measure: Protect yourself and others—Avoid illness from *E. coli* by practicing safe food handling, cooking meats thoroughly and avoiding unpasteurized—raw—milk and unpasteurized juices such as fresh apple cider.



What is Salmonella?



a bacteria that can produce a diarrheal illness



typically caused by contaminated food



also caused by contact with infected animals



it runs its course in a few days

SALMONELLA



SALMONELLA

Salmonella species are Gram-negative, flagellated facultatively anaerobic bacilli

Salmonellosis in humans usually takes the form of a self-limiting food poisoning (gastroenteritis), but occasionally manifests as a serious systemic infection (enteric fever) which requires prompt antibiotic treatment.

Salmonella causes two kinds of illness:

(1) Salmonellosis—usually characterized by nausea, vomiting, diarrhea, cramps, and fever, with symptoms generally lasting a couple of days and tapering off within a week.

(2) Enteric fever—high fever, diarrhea or constipation, aches, headache, and drowsiness. Enteric fever includes typhoid fever and paratyphoid fever. Up to 10% of people with enteric fever who don't get treatment may die. Enteric fever usually is associated with sewage-contaminated drinking water.

Salmonella strains sometimes cause infection in urine, blood, bones, joints, or the nervous system (spinal fluid and brain), and can cause severe disease.

Sources: Many kinds of food can become contaminated, from meats and eggs to fruits and vegetables, spices and nuts.

Contaminated food is the major mode of transmission for non-typhoidal salmonellae because salmonellosis is a zoonosis and has an enormous animal reservoir. The most common animal reservoirs are chickens, turkeys, pigs, and cows; dozens of other domestic and wild animals also harbor these organisms. Because of the ability of salmonellae to survive in meats and animal products that are not thoroughly cooked, animal products are the main vehicle of transmission.

Preventive measures:

Cooking foods thoroughly, good handwashing, keeping raw foods separated from cooked foods, and keeping foods at correct temperatures are good ways to avoid salmonella. Get vaccinated against typhoid fever if traveling to an area of the world with typhoid fever.

Those diseases are controlled by hygienic slaughtering practices and thorough cooking and refrigeration of food.



SALMONELLA

CAMPYLOBACTER



Campylobacter jejuni

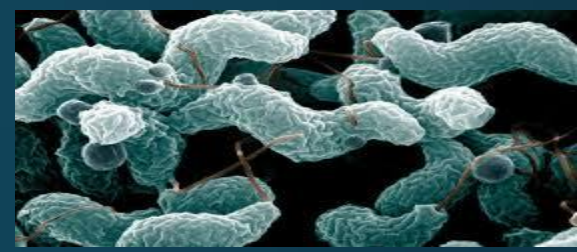
Campylobacter jejuni is a gram-negative, microaerophilic, thermophilic rod that grows best at 42°C (107°F) and low oxygen concentrations. [5, 22] These characteristics are adaptations for growth in its normal habitat—the intestines of warm-blooded birds and mammals.

Causes:

Campylobacter can enter in to the body through contaminated water, unpasteurized milk or cheese, and raw or undercooked poultry (and sometimes other kinds of meats and seafood).

Symptoms:

If an individual is infected, gastrointestinal symptoms—nausea, vomiting, diarrhea (sometimes bloody), cramps—as well as a fever typically appear within 2 to 5 days and may last up to 10 days. In some cases, Campylobacter may spread to the bloodstream and cause a life-threatening infection.



Campylobacter jejuni

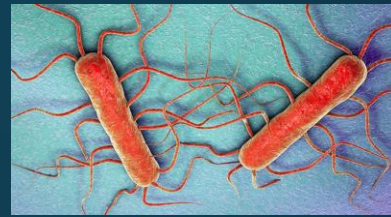
Prevention:

Protect yourself and others

Good handling and good handwashing, and avoid raw or unpasteurized milk and cheese.

To avoid *Campylobacter*, cook meat (especially poultry) thoroughly, practice safe food handling

LISTERIA

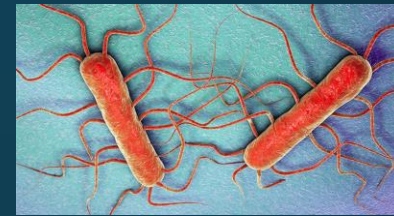


Listeria monocytogenes

The gram-positive bacterium *Listeria monocytogenes* is an ubiquitous, intracellular pathogen

- Bacterial infection caused by *Listeria monocytogenes* is called listeriosis.
- These bacteria are widespread in nature, being found in soil, decaying vegetation and the bowels of many mammals.
- *Listeria* infection is mainly spread by eating contaminated foods. Unlike most bacteria, *Listeria* can multiply in refrigerated foods, if they have been contaminated. Contact with infected farm animals, particularly stillborn animals, can also spread the infection.

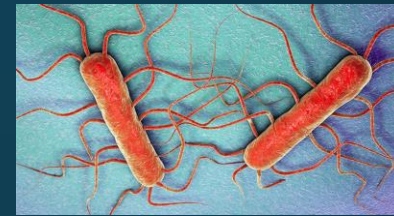
Although foodborne listeriosis is not common, it is one of the leading causes of death from foodborne illness.



Listeria monocytogenes

Listeria can cause two forms of disease in humans:

- (1) One can range from mild to intense symptoms of nausea, vomiting, aches, fever, and, sometimes, diarrhea, and usually resolves itself.
- (2) Invasive Listeriosis is a more deadly form that occurs when the infection invades beyond the gut to sites like the blood or brain. This can cause blood infection, meningitis—infection around the brain—and other potentially fatal problems. In pregnant women, Listeria infection can cause miscarriage, stillbirth, preterm labor, and severe illness or death in the newborn



Listeria monocytogenes

Foods associated with the spread of *Listeria* include:

- unpackaged ready-to-eat cold meats and packaged sliced ready-to-eat cold meats. For example from delicatessen counters, sandwich bars or supermarkets
- cold cooked ready-to-eat chicken purchased whole, in portions or diced
- refrigerated pâté or meat spreads
- pre-prepared or pre-packaged fruit or vegetable salads, for example salad bars or smorgasbords
- chilled seafood, including:
 - raw seafood, for example oysters, sashimi or sushi
 - smoked ready-to-eat seafood
 - cooked peeled prawns, for example prawn cocktails, sandwich fillings and prawn salads
- soft, semi-soft and surface ripened cheeses, either pre-packaged or from the delicatessen. For example, brie, camembert, ricotta, feta and blue
- soft serve ice cream
- other unpasteurised dairy products (for example raw goat's milk).

Signs and symptoms:

People are probably frequently exposed to *Listeria*, with only mild illness resulting. However, infection is more serious when it occurs in newborn babies, the elderly, immune suppressed people and pregnant women.

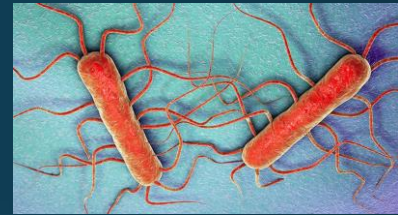
Symptoms may include:

- sudden onset of fever
- headache
- backache
- nausea, vomiting
- neck stiffness
- gradual onset of confusion, decreased alertness.

Pregnant women may have relatively mild symptoms (fever and aches) and make a quick recovery.

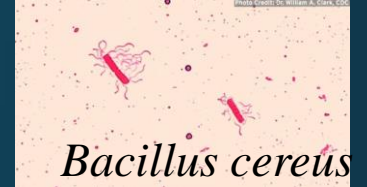
However, they may transfer the infection to their unborn child who may be stillborn or born very ill.

Prevention: Protect yourself and others—Good handwashing, keeping your refrigerator clean and at 40° F, separating raw foods from cooked foods, and avoiding unpasteurized—raw—milk and cheese are good ways to stay away from *Listeria*.



Listeria monocytogenes

Bacillus cereus



Bacillus cereus is a toxin-producing facultatively anaerobic gram-positive bacteria. The bacteria is commonly found in the environment, is often found in soil and vegetation, and can be present in foods. It can quickly multiply at room temperature. There are two main types of an intestinal illness caused by *B. cereus*. One is diarrheal, and one leads more to nausea/vomiting. *B. cereus* has also been implicated in infections of the eye, respiratory tract, and in wounds. The pathogenicity of *B. cereus*, whether intestinal or nonintestinal, is intimately associated with the production of tissue-destructive exoenzymes. Among these secreted toxins are four hemolysins, three distinct phospholipases, an emesis-inducing toxin, and proteases.

Associated food

B. cereus illness is related to many foods - beef, turkey, rice, beans, vegetables. Specifically, the diarrheal illness is often related to meats, milk, vegetables, and fish. The emetic-type illness is most often associated with rice products, but it has also been associated with other types of starchy products such as potato, pasta, and cheese products. Some food-mixtures (sauces, puddings, soups, casseroles, pastries, and salads, have been associated with food-borne illness in genera

Symptoms include:

Emetic syndrome

- vomiting
- nausea
- sometimes diarrhea

Symptoms usually start 0.5 to 5 hours after ingestion of contaminated food.

Usually, symptoms disappear in 6 to 24 hours.

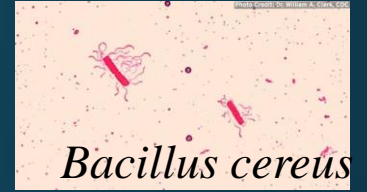
Diarrhoeal syndrome

- diarrhea, sometimes with blood and/or mucus
- nausea, and may also include
- abdominal pain

Symptoms usually start 8 to 16 hours after ingestion of contaminated food.

Usually, symptoms disappear in 12 to 24 hours.





prevention

As *B. cereus* is ubiquitous in the environment, control measures should be focused on preventing growth of *B. cereus* and the formation of emetic toxin in the food.

- Ensure food is maintained either at a temperature above 60°C or refrigerated below 4°C.
- Cool cooked foods that will not be immediately consumed to below 4°C within 6 hours.
- When reheating food, ensure that the temperature reaches at least 74°C.

Vibrio parahaemolyticus



V. parahaemolyticus

Vibrio parahaemolyticus is a marine and estuarine bacterium responsible for sporadic illnesses and outbreaks of gastroenteritis after consumption of raw, inadequately cooked, or cross-contaminated seafood.

The incubation period for *V. parahaemolyticus* ranges from 4 to 48 hours.

Symptoms:

Clinical illness tends to be mild, with gastroenteritis symptoms including nausea, vomiting, abdominal pain and diarrhea. The disease is usually self-limiting. Oral rehydration is typically adequate and tetracycline or ciprofloxacin can be administered in severe cases.

Prevention:

Don't eat raw or undercooked oysters or other shellfish. Cook them before eating. Always wash your hands with soap and water after handling raw shellfish. Avoid contaminating cooked shellfish with raw shellfish and its juices. Stay out of salt water or brackish water if you have a wound (including cuts and scrapes), or cover your wound with a waterproof bandage if there's a possibility it could come into contact with salt water or brackish water, raw seafood, or raw seafood juices. Wash wounds and cuts thoroughly with soap and water if they have been exposed 1 / 2 to seawater or raw seafood or its juices. If you are in a group more likely to get a *Vibrio* infection, such as people with liver disease: Wear clothes and shoes that can protect you from cuts and scrapes when in salt water or brackish water. Wear protective gloves when handling raw seafood.



V. parahaemolyticus

Shigella



Shigellae are Gram-negative, nonmotile, facultatively anaerobic, non-spore-forming rods.

Pathogenesis: Infection is initiated by ingestion of shigellae (usually via fecal-oral contamination). An early symptom, diarrhea (possibly elicited by enterotoxins and/or cytotoxin), may occur as the organisms pass through the small intestine. The hallmarks of shigellosis are bacterial invasion of the colonic epithelium and inflammatory colitis.

Symptoms: Symptoms of shigellosis include abdominal pain, tenesmus, watery diarrhea, and/or dysentery (multiple scanty, bloody, mucoid stools). Other signs may include abdominal tenderness, fever, vomiting, dehydration, and convulsions

Control: The most effective methods for controlling shigellosis are provision of safe and abundant water and effective faeces disposal. Severe dysentery is treated with ampicillin, trimethoprim-sulfamethoxazole, or, in patients over 17 years old, a 4-fluorquinolone such as ciprofloxacin.

Shigellosis is an infectious disease caused by a group of bacteria called *Shigella* (shih-GEHL-uh). Most who are infected with *Shigella* develop diarrhea, fever, and stomach cramps starting a day or two after they are exposed to the bacteria. Shigellosis usually resolves in 5 to 7 days. Some people who are infected may have no symptoms at all, but may still pass the *Shigella* bacteria to others. The spread of *Shigella* can be stopped by frequent and careful handwashing with soap and taking other hygiene measures.

