

Food Poisoning- Organism causing Food Poisoning

Food poisoning is a foodborne illness, caused by eating contaminated, spoiled, or toxic food. The most common symptoms of food poisoning include nausea, vomiting, and diarrhea.

In addition to bacteria, the microorganisms which cause food poisoning include viruses and protozoans. The symptoms of food poisoning and means of prevention differ by the type of microorganism, but these microorganisms can be categorized per the following by the type of food poisoning caused.

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- ※1 : Causes illness via bacteria multiplying in food which get eaten together with the food.
- ※2 : Causes illness via bacteria multiplying in large amounts in food and producing toxins which get eaten together with the food.
- ※3 : Bacteria which can cause illness even in small amounts.

2. Infection

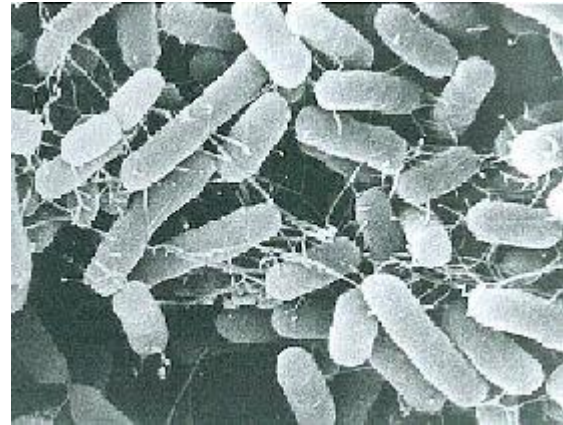
Illness occurs as a result of the consumption of food and water contaminated with enteropathogenic bacteria or viruses. It is necessary that the cells of enteropathogenic bacteria and viruses remain alive in the food or water during consumption. Viable cells, even if present in small numbers, have the potential to establish and multiply in the digestive tract to cause the illness. Salmonellosis and hepatitis A are examples.

Salmonella

Characteristics

A vast variety of salmonella species are found in the digestive tracts of animals such as chickens, pigs, and cows, as well as in rivers and sewers, with over 2,500 serotypes known.

It was once believed that a large number of salmonella bacteria were required to cause illness, but it has recently been found that even small amounts of salmonella can cause infection and illness. Salmonella causes infection through intake of contaminated food and is characterized by the high fevers it causes.



Which foods can cause salmonella infection?

The following foods can easily cause salmonella infection when made using meat and eggs contaminated with salmonella. Eggs (including egg products), beef liver sashimi, cooked meats (especially chicken), eel, and turtle, and etc. In addition, contamination of food may also occur via rats and pets.

What are the symptoms of salmonella infection?

The primary symptoms of infection are stomach pain, diarrhea, vomiting, and fever (38-40° C) after an incubation period of 6 to 72 hours.

What are the key points to preventing salmonella infection?

1. Always wash and disinfect hands and cookware whenever they come in contact with meat and eggs (preventing secondary contamination).
2. Only purchase fresh eggs and store them in a refrigerator after purchase.
3. If you choose to eat raw eggs, be sure to consume them before the displayed expiration date.
4. Immediately cook and eat eggs after cracking them open. Note that eggs which have been cracked open should never be left to sit for any period of time.
5. Keep meat and other goods prone to salmonella at low temperatures.
6. When cooking food, ensure that it is heated sufficiently to ensure that heat penetrates to the core of the food.
7. Strictly enforce stool tests.
8. Take measures to exterminate rats, cockroaches, flies, and other pests.

Shigella

Sources Contact with an infected person or consumption of contaminated food or water. *Shigella* foodborne outbreaks are most often associated with contamination by a sick food handler.

Incubation period 1 to 7 days (usually 1 to 2 days)

Symptoms Sudden stomach cramping, fever, diarrhea that may be bloody or contains mucus, nausea, and feeling the need to pass stool even when the bowels are empty.

Duration of illness 5 to 7 days

Who's at risk? Children, especially toddlers aged 2-4, though anyone can be infected with Shigella.

What to do Drink plenty of fluids and get rest. Stay home from school or work to avoid spreading the bacteria to others. If you cannot drink enough fluids to prevent dehydration or have bloody diarrhea, call your doctor.

Prevention

- Wash hands with soap carefully and frequently, especially after going to the bathroom, after changing diapers, and before preparing foods or beverages.
- Stay home from healthcare, food service, or childcare jobs while sick or until your health department says it's safe to return.
- Keep children with diarrhea out of child care settings and school while they are ill.
- Dispose of soiled diapers properly.
- Disinfect diaper changing areas after using them.
- Supervise handwashing of toddlers and small children after they use the toilet.
- Do not prepare food for others while ill with diarrhea
- Avoid swallowing water from ponds, lakes, or untreated pools.
- Avoid having sex (vaginal, anal, or oral) for one week after you no longer have diarrhea.
- When traveling in developing countries, drink only treated or boiled water, and eat only cooked hot foods or fruits you peel yourself.

E. coli

Sources

- Contaminated food, especially undercooked ground beef, unpasteurized (raw) milk and juice, soft cheeses made from raw milk, and raw fruits and vegetables (such as lettuce, other leafy greens, and sprouts).
- Contaminated water, including drinking untreated water and swimming in contaminated water.
- Animals and their environment, particularly cows, sheep, and goats.
- Feces of infected people.

Incubation period 3 to 4 days for most people, can be 1 to 10 days

Symptoms

- Severe diarrhea that is often bloody, severe stomach pain, and vomiting. Usually little or no fever is present.

- Symptoms of hemolytic uremic syndrome (HUS) include decreased urine production, dark or tea-colored urine, and losing pink color in cheeks and inside the lower eyelids.

Duration of illness 5 to 10 days. Most people will be better in 5 to 7 days. If HUS develops, it usually occurs after about 1 week.

What to do Drink plenty of fluids and get rest. If you cannot drink enough fluids to prevent dehydration or if your symptoms are severe (including bloody diarrhea or severe stomach pain), call your doctor.

- Prevention**
- Avoid eating high-risk foods, especially undercooked ground beef, unpasteurized milk or juice, soft cheeses made from unpasteurized milk, or sprouts.
 - Use a food thermometer to make sure that ground beef has reached a safe internal temperature of 160° F.
 - Wash hands before, during, and after preparing food, after diapering infants, and after contact with cows, sheep, or goats, their food or treats, or their living environment.

Vibrio Species Causing Vibriosis

Sources	Most people become infected by eating raw or undercooked shellfish, particularly oysters. Certain <i>Vibrio</i> species can also cause a skin infection when an open wound is exposed to salt water or brackish water. Brackish water is a mixture of fresh water and salt water. It is often found where rivers meet the sea.
Incubation period	<ul style="list-style-type: none"> • Vibrio wound infection: 1–7 days • Gastrointestinal illness: 2–48 hours
Symptoms	<ul style="list-style-type: none"> • In healthy people: Diarrhea, vomiting, abdominal pain • In high-risk people: Sudden chills, fever, shock, skin lesions
Duration of illness	3 days, when spread through food. Duration of wound infections is variable.
What to do	If you have symptoms within a few days after eating raw or undercooked seafood, especially oysters, or develop a skin infection after being exposed to salt water or brackish water, contact your doctor. Don't chance it! Some <i>Vibrio</i> species, such as <i>Vibrio vulnificus</i> , can cause particularly severe and life-threatening infections.

Prevention	<ul style="list-style-type: none"> • 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 to seawater or raw seafood or its juices. <p>If you are in a group more likely to get a <i>Vibrio</i> infection, such as people with liver disease:</p> <ul style="list-style-type: none"> • 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.
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1. Intoxication

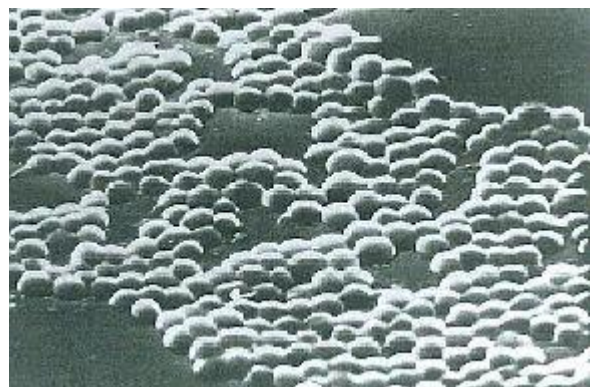
Illness occurs as a consequence of ingesting a preformed bacterial or mold toxin because of its growth in a food. A toxin has to be present in the contaminated food. Once the microorganisms have grown and produced toxin in a food, there is no need of viable cells during consumption of the food for illness to occur. Staph food poisoning is an example.

Staphylococcus aureus

Characteristics

The name Staphylococcus, meaning "grape-cluster berry," is derived from the bacteria's grape-like appearance under the microscope. Staphylococcus aureus is a common suppurative disease which is not only a cause of food poisoning but also often found in boils, pimples, and athlete's foot.

Accordingly, Staphylococcus aureus is frequently detected in the throats and noses of even healthy people and can also



commonly be found close at hand on the skin, in the lungs, and adhering to dust from animals.

Staphylococcus aureus generates a toxin called enterotoxin when it multiplies in food. When eaten with food, this toxin causes harm in humans. Staphylococcus aureus itself is weak to cooking but its toxins do not disintegrate even if heated at 100° C for 20 minutes. This bacteria can also reproduce even in environments without oxygen and generate its toxins even if a certain amount of salt is present.

Which foods can cause Staphylococcus aureus infection?

Many foods can result in infection from Staphylococcus aureus, including cooked foods such as sushi, meat, eggs, and milk as well as confections.

What are the symptoms of Staphylococcus aureus infection?

The incubation period for Staphylococcus aureus is 30 minutes to 6 hours (with an average of 3 hours). Primary symptoms are nausea, vomiting, and stomach ache. Staphylococcus aureus may also be accompanied by diarrhea and usually does not cause high fever.

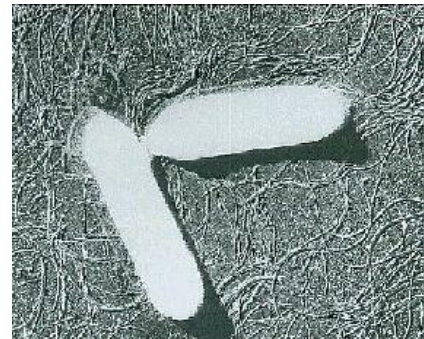
What are the key points to preventing Staphylococcus aureus infection?

1. Persons with cuts or abscesses on their hands should not come in direct contact with or prepare food.
2. Thoroughly wash and disinfect hands.
3. Store food at 10° C or less to prevent bacteria from multiplying.
4. Wear a hat and mask when preparing food.

Clostridium botulinum

Characteristics

Clostridium botulinum are an anaerobic bacteria commonly found in soils, mud and sand of seas, lakes, and rivers. Clostridium botulinum forms spores that are strongly resistant against heat. When exposed to hypoxic (*low oxygen*) conditions, the spores of clostridium botulinum germinate and increase, resulting in production of a neurotoxin. This neurotoxin reportedly has the strongest toxicity of currently known toxins in nature and is classified into seven types labeled A to G.



Types of botulism

Botulisms are classified into types, including (*foodborne*) **botulism** caused by consumption of foods containing toxins produced by botulinum growing in the food, and also, **infant botulinum**, occurring in infants.

Botulism is characterized by neurologic symptoms including nausea, vomiting, blurred vision, speech disorders and swallowing disorders, which appear 8 to 36 hours after intake of a food in which botulinum toxin has been produced. If symptoms are serious, the victim may die due to respiratory paralysis.

Infant botulinum is found in infants less than one year of age. If an infant ingests botulinum spores, the bacteria increase in the intestinal tract producing toxins which may result in symptoms of poisoning caused by absorption of the toxins. Infant botulinum symptoms include: paralysis due to muscular relaxation, constipation for several days, and weakness due to degraded muscular strength of the whole body, difficult or poor milk feeding, and weakened crying.

Which foods can cause clostridium botulinum?

In general, foods in hypoxic (*low oxygen*) states are likely to cause the disease. These conditions can occur in bottled, canned, container-packed and preserved foods (especially homemade foods preserved in bottles and cans). In Japan, food poisoning by fermented fish products or "izushi", which were mainly produced in the Hokkaido and Tohoku regions, was reported until around 1997. Incidents of "izushi" caused botulism have become rare to non-existent as home-preserved foods become less common.

However, food poisoning has occurred in packed foods (especially those that look like retort [*pouch packaging made from plastic and metal foils*], which may not have been heat-treated at 120° C for four minutes), bottled and homemade canned foods. If clostridium botulinum increases inside a food package, the package may expand or bulge and opening it may give out a foul smell.

Honey was sometimes a source of infant botulinum. The cases derived from honey have decreased since October 1987, when the then Ministry of Health and Welfare gave a notice that honey should not be given to infants less than one year of age. Other than honey, there have been few cases where any food causing poisoning was identified. Homemade vegetable soup was thought to be the source of infection in one case found in Tokyo.

What are the key points to preventing botulism?

Because the spores of clostridium botulinum are broadly distributed in soil, it is difficult to prevent contamination of raw food material. In order to prevent botulism, it is important to restrict the growth of the bacteria within foods.

Key points to preventing food poisoning by clostridium botulinum

1. Retort pouch foods and most canned foods are heat-treated at 120° C for four minutes and thus can be stored at room temperatures. However, commercially distributed products can have confusing appearances. Products that have no indication of "Disinfected by pressurizing and heating after stored and sealed in air-tight container" and products that have warnings such as "Keep refrigerated", or "Keep at 10° C or less" should be kept refrigerated and consumed before their expiration dates.
2. If vacuum packs or cans look expanded or bulging, or the food gives out a foul smell (smell of butyric acid), be sure not to eat it!

3. Since clostridium botulinum spores are heat resistant, heating at 120° C for at least four minutes (or at 100° C for at least six hours) is required to completely annihilate them. Therefore, it is dangerous to preserve homemade canned, vacuum-packed and bottled foods and "izushi" without sufficiently washing the raw material and taking full caution in utilizing proper disinfecting temperatures and storage methods. For storage, allow refrigeration at 3° C or less or freezing at -18° C or less.
4. Heating foods immediately before eating can be effective because botulinum toxin, which is the direct cause of the food poisoning symptoms, becomes deactivated by heating at 80° C for 30 minutes (or at 100° C for several minutes).
5. To prevent infant botulinum, avoid giving infants less than one year of age foods that can potentially become contaminated by spores of clostridium botulinum, including honey, etc.

Viral food poisoning

Norovirus

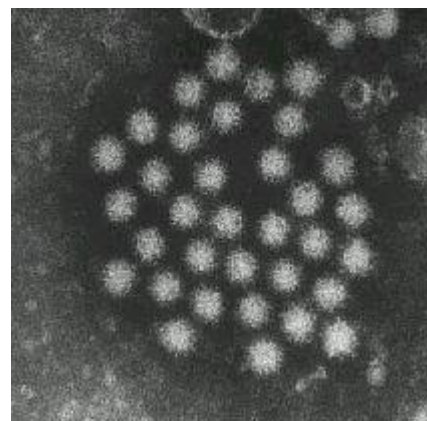
Infectious gastroenteritis and food poisoning caused by norovirus tend to occur frequently in winter. Particular care must be taken when norovirus occurs in facilities such as nurseries, schools, and welfare facilities as it can lead to mass outbreaks.

What is norovirus?

Norovirus is a virus which propagates in the human small intestine. The International Committee on Taxonomy of Viruses chose the name "norovirus" in August 2002; before this time, it was known as "SRSV" (Small Round Structured Virus). The "noro" in "norovirus" is derived from Norwalk Ohio, where the virus was discovered.

Characteristics

Norovirus causes gastroenteritis throughout the year with particular frequency in winter. When heated between 85 and 90° C for several seconds, norovirus loses its infectious capabilities. Epidemiological studies have strongly identified oysters as being part of the virus' transmission route. There have also been many cases where contamination of food by food preparers infected with norovirus have been suspected as the cause. Norovirus is comprised of a 30 to 40 nanometer in diameter spherical shape with a cup-shaped protein enwrapping its genes (RNA which serves as DNA for the virus).



A large variety of norovirus genotypes exist, with each corresponding to a different serotype. In recent years, the development and popularization of a new testing method (PCR) has made it possible to detect norovirus in food, clarifying the relationship between norovirus and food poisoning.

Which foods can cause norovirus infection?

Water and food contaminated with norovirus, and particularly bivalves such as oysters have been widely reported to have caused norovirus. Norovirus cannot multiply inside shellfish. Instead, it is believed that norovirus accumulates inside bivalves when their environment becomes contaminated with the virus. Secondary infection may also be caused by contact with the stool or vomit of infected persons.

When infected persons prepare food after using the bathroom and fail to wash their hands sufficiently, the food can become contaminated with norovirus. When this food is eaten in turn, infection can occur.

What are the symptoms of norovirus infection?

The incubation period for norovirus is 24 to 48 hours. Primary symptoms include nausea, vomiting, diarrhea, stomach pain, and fever. Victims normally recover within three days. Not all persons infected with norovirus show symptoms and some may only suffer symptoms similar to a cold. Persons with lowered immune resistance and infants may be infected after consuming just a few hundred viral particles.

What are the key points to preventing norovirus infection?

1. Thoroughly cook bivalves such as oysters so that the heat penetrates all the way to their center before eating (85 to 95° C for longer than 90 seconds). Parboiling does not sufficiently heat food to remove norovirus' ability to infect people.
2. Thoroughly wash fresh foods (vegetables, fruits, etc.).
3. Wash hands thoroughly after using the toilet, when preparing food, and before eating (see Let's work together and wash our hands).
4. Use only clean towels after washing hands.
[Preventing secondary infection...]<At home, nursery, and school>
5. Avoid coming in contact with the stool and vomit of infected individuals and, if contact is made, thoroughly wash and disinfect affected areas.
6. When cleaning up clothing and other items contaminated by vomit and stool, use vinyl gloves and a mask.
7. Wash clothing and other items contaminated with vomit and stool separately from other items.
8. Soak utensils and rags used to clean up vomit and stool in chlorine bleach before washing them.
9. Wipe floors contaminated with vomit using a cloth soaked in chlorine bleach and let sit for a period of time to disinfect the area.
10. Once affected items have been cleaned up, wash hands thoroughly and gargle.

Viral hepatitis A

Characteristics

Hepatitis type A is an infectious disease caused by the hepatitis A virus. This virus is strong against acids and tolerant to alcohol. Sufficient heating (85°C for one minute or more) is required for inactivation. The virus once ingested through the mouth into the body cannot be inactivated and is discharged through feces.

Which foods can cause viral hepatitis A infection?

Water and food contaminated with norovirus, and particularly bivalves such as oysters have been widely reported to have caused norovirus. Norovirus cannot multiply inside shellfish. Instead, it is believed that norovirus accumulates inside bivalves when their environment becomes contaminated with the virus. Secondary infection may also be caused by contact with the stool or vomit of infected persons.

When infected persons prepare food after using the bathroom and fail to wash their hands sufficiently, the food can become contaminated with norovirus. When this food is eaten in turn, infection can occur.

What are the symptoms of viral hepatitis A infection?

The incubation period is two to seven weeks (four weeks on average). The symptoms include: diarrhea, fever (initially, pyrexia (raised body temperature) of 38°C or higher that continues for three to four days), malaise (languor), nausea, vomiting, jaundice, and hepatomegaly (enlarged liver). Most infants indicate no symptoms, or slight symptoms even if infected. However, attention should be paid if middle aged and elderly persons who have low immunity are infected and develop the symptoms, as their conditions will be likely to become severe. In most cases, liver function is recovered in a month or two; and if once infected, the person will never be infected again.

What are the key points to preventing viral hepatitis A infection?

1. Wash and disinfect your hands sufficiently after defecation or urination, before cooking, and before having meals.
2. Do not drink raw water in the countries and regions where type-A hepatitis viruses commonly exist. In addition, pay attention to ice and popsicle products made from raw water.
3. Eat well-heated foods.

Others, etc

Cryptosporidium

Characteristics

Cryptosporidium is a protozoan parasite belonging to the order of coccidia, which are sporozoan (parasitic spore-forming protozoan). In 1976, it was first made clear that cryptosporidium was a cause of an infectious disease among humans, with most cases caused by *Cryptosporidium parvum*. *Cryptosporidium* exist in the natural environment (outside a host) in the form of oocysts (thick-walled cyst zygote) and do not

multiply. If orally ingested, the oocysts multiply within the digestive tract and are then discharged in conjunction with feces, which become sources of infections to new individuals. The parasites are resistant to chlorine disinfection with the chlorine levels commonly used in drinking water, and are reported to remain infectious.

Causing foods:

Domestic animals and mammals are reservoir hosts, and additionally, infected human patients become a transmission source of infection by discharging the oocysts through their feces. The paths of infections include oral ingestion of contaminated foods and drinks, or contact with contaminated hands or fingers. In an oral ingestion experiment conducted by volunteers in the United States, researchers found occurrences of infection symptoms by low exposure to some tens of oocysts.

Symptoms:

The incubation period is two to ten days. The main symptoms are diarrhea, stomachaches, vomiting, and fever. Infected patients may recover in several days to two weeks. Even if infected, some patients may show no symptoms, however, infected patients keep discharging oocysts through their feces for several weeks. For immunodeficient patients (whose immune system's ability to fight infectious disease and cancer is compromised or entirely absent) and cancer patients having immunosuppressive therapies, the disease may persist longer, and in some cases, it is reported that the symptoms become severe.

Key points to prevention:

1. Because the oocysts, or the sources of infections, continue to be discharged, even after the symptoms get better or disappear, it is essential to sufficiently wash hands frequently to prevent secondary infections.
2. Boil drinking water for one minute at least. Use boiled water even when you make ice.
 - When you use a water purifier, note that not all water purifiers are completely effective in removing the sources of infection.
 - Since the sources of infection accumulate within the filter cartridge, take cautious measures including replacement of the cartridge in an appropriate manner in accordance with the water purifier instruction manual.
 - Avoid raw foods and heat/cook them before ingesting. Wipe and dry tableware well.
 - If you have an infected patient within your family, have the infected person take a bath last, after other family members, to prevent spread of the infection to other family members.
 - . To prevent the spread of infection through stool - soiled underwear or diapers from an infected person, douse the dirty laundry in boiled water before washing.

Cyclospora

Characteristics

Cyclospora is a protozoan parasite and exists in the natural environment in the form of oocyst (dormant form) like cryptosporidium.

Although its resistance against chlorine, chemicals, and temperatures is unknown, it is thought that disinfection is difficult through the concentrations of chlorine used in drinking water, etc.

Sources of infection:

In general, infections are thought to occur via ingesting of contaminated drinking water in outbreak areas. Infections occur by ingestion of water and foods contaminated by matured oocysts in the outer environment. As the oocysts discharged from the human body through feces are immature, infections never occur directly from recently discharged feces.

Symptoms:

The incubation period is thought to be approximately one week. The main symptom is diarrhea, often accompanied by abdominal discomfort, slight fever, and weight loss