



Parasites and Foodborne Illness

Parasites may be present in food or in water and can be identified as causes of foodborne or waterborne illness in the United States. They range in size, from tiny single-celled organisms to worms visible to the naked eye. Their lifecycle may also vary. While some parasites use a permanent host, others go through a series of developmental phases using different animal or human hosts. The illnesses they can cause range from mild discomfort to debilitating illness and possibly death.

What are parasites?

Parasites are organisms that derive nourishment and protection from other living organisms known as hosts. They may be transmitted from animals to humans, from humans to humans, or from humans to animals. Several parasites have emerged as significant causes of foodborne and waterborne illness. These organisms live and reproduce within the tissues and organs of infected human and animal hosts, and are often excreted in feces.

How are they transmitted?

They may be transmitted from host to host through consumption of contaminated food and water, or by putting anything into your mouth that has touched the stool (feces) of an infected person or animal.

How do they vary?

Parasites are of different types and range in size from tiny, single-celled, microscopic organisms (**protozoa**) to larger, multi-cellular worms (**helminths**) that may be seen without a microscope. The size ranges from 1 to 2 μm (micrometers) to 2 meters long.

What are some common parasites?

Examples of parasites are *Giardia duodenalis*, *Cryptosporidium parvum*, *Cyclospora cayetanensis*, *Toxoplasma gondii*, *Trichinella spiralis*, *Taenia saginata* (beef tapeworm), and *Taenia solium* (pork tapeworm).

***Giardia duodenalis* or *intestinalis* (formerly called *G. lamblia*)**

Giardia duodenalis, cause of giardiasis (GEE-are-DYE-uh-sis), is a one-celled, microscopic parasite that can live in the intestines of animals and people. It is found in every region throughout the world and has become recognized as one of the most common causes of waterborne (and occasionally foodborne) illness in the United States.

How do people get giardiasis?

People get giardiasis the following ways:

- Giardiasis is frequently associated with drinking contaminated water, but some people might get infected by consuming uncooked meat also contaminated with *G. duodenalis* **cysts** (the infective stage of the organism).
- By putting anything into your mouth that has touched contaminated surfaces or the stool of a person or animal with giardiasis.

Symptoms of Giardiasis

Diarrhea, abdominal cramps, gas, and nausea are the most common symptoms. Chronic infection might lead to dehydration and severe weight loss. Some cases may be without symptoms.

When will symptoms appear? What is the duration?

Symptoms will usually appear 1 to 2 weeks after ingestion of a *G. duodenalis* cyst. They may last 2 to 6 weeks in otherwise healthy persons, but there are cases of chronic illnesses lasting months or even years.

Who is at risk for contracting giardiasis?

Those at risk include:

- Day care providers and children attending daycare centers;
- International travelers (traveler's diarrhea);
- Hikers, campers, or any other persons who may drink from untreated or contaminated water supplies, including while swimming in lakes or rivers; and
- Young children, pregnant women, older adults, and persons with weakened immune systems including those with HIV/AIDS infection, cancer, diabetes, kidney disease, and transplant patients, or those individuals undergoing chemotherapy.

How to Prevent Giardiasis

- Wash hands with warm water and soap before handling foods and eating, and after going to the bathroom, changing diapers, and handling animals.
- Make sure infected individuals wash their hands frequently to reduce the spread of infection.
- Drink water only from treated municipal water supplies.
- When hiking, camping, or traveling to countries where the water supply may be unsafe to drink, either avoid drinking the water or boil it for 1 minute to kill the parasite. Drinking bottled beverages can be a safe alternative.
- Do not swallow water while swimming.
- Do not swim in community pools if you or your child has giardiasis.
- Always cook your food to a safe internal temperature. [Safe temperatures](#) can be found at: www.fsis.usda.gov/Fact_Sheets/index.asp
- Drink only pasteurized milk, juices, or cider.
- Wash, peel, or cook raw fruits and vegetables before eating.
- Do not use untreated manure to fertilize fruits and vegetables. Watering untreated manure can spread the organism.

Cryptosporidium parvum

Cryptosporidium parvum, cause of the disease cryptosporidiosis (KRIP-toe-spo-RID-e-O-sis) also called "Crypto," is a one-celled, microscopic shelled parasite and a significant cause of waterborne and foodborne illness worldwide. It is found in the intestines of many herd animals including cows, sheep, goats, deer, and elk. The illness could be intestinal, tracheal, or pulmonary.

How do people get intestinal cryptosporidiosis?

This parasite can be found in soil, food, water, or surfaces that have been contaminated with feces from infected humans or animals.

People get cryptosporidiosis the following ways:

- By consuming food or water contaminated with *C. parvum* oocysts (infective stage of the parasite). The oocysts are the environmentally resistant stage of the organism and are shed in the feces of a host (human or animal).
- By putting anything into your mouth that has touched the stool of a person or animal with cryptosporidiosis.

Symptoms of intestinal cryptosporidiosis

Symptoms include watery diarrhea, stomach cramps, upset stomach, and slight fever. Some cases may be without symptoms.

When will symptoms appear? What is the duration?

Symptoms appear 2 to 10 days after ingestion of *C. parvum* oocysts. The illness usually goes away without medical intervention in 3 to 4 days. For healthy people, symptoms may last up to 2 weeks. For individuals with weakened immune systems, cryptosporidiosis can be serious, long-lasting, and sometimes fatal.

Who is at risk for contracting cryptosporidiosis?

Those at risk include:

- Day care providers and children attending daycare centers;
- Young children, pregnant women, older adults, and persons with weakened immune systems, including those with HIV/AIDS infection, cancer, diabetes, kidney disease, and transplant patients, or those individuals undergoing chemotherapy.
- International travelers (traveler's diarrhea); and
- Hikers, campers, or any other persons who may drink from untreated water supplies.

How to Prevent Cryptosporidiosis

- Wash hands with warm water and soap before handling foods and eating, and after going to the bathroom, changing diapers, and handling animals.
- Drink water only from treated municipal water supplies.
- When hiking, camping, or traveling to countries where the water supply may be unsafe to drink, either avoid drinking the water or boil it for 1 minute to kill the parasite. Drinking bottled beverages can be a safe alternative.
- Do not swallow water while swimming.
- Do not swim in community swimming pools if you or your child has cryptosporidiosis.
- Drink only pasteurized milk, juices, or cider.
- Wash, peel, or cook raw fruits and vegetables before eating.
- Do not use untreated manure to fertilize fruits and vegetables. Watering untreated manure can spread the organism.

Cyclospora cayetanensis

Cyclospora cayetanensis (SIGH-clo-SPOR-uh KYE-uh-tuh-NEN-sis), cause of cyclosporiasis, is a one-celled, microscopic parasite. Currently little is known about this organism, although cases of cyclosporiasis are being reported from various countries with increasing frequency.

How do people get cyclosporiasis?

People get cyclosporiasis the following ways:

- By consuming food or water contaminated with *C. cayetanensis* oocysts (the infective stage of the organism).
- By putting anything into your mouth that has touched the stool of a person or animal with cyclosporiasis.

Symptoms of Cyclosporiasis

Symptoms include watery diarrhea (sometimes explosive), loss of appetite, bloating, stomach cramps, nausea, vomiting, muscle aches, low-grade fever, and fatigue. Some cases are without symptoms. Symptoms are more severe in persons with weakened immune systems.

When will symptoms appear? What is the duration?

Symptoms typically appear about 1 week after ingestion of *C. cayetanensis* oocysts. If untreated, the symptoms may last a week to more than a month. Symptoms may return.

Who is at risk for contracting cyclosporiasis?

Persons of all ages are at risk for infection.

Young children, pregnant women, older adults, and persons with weakened immune systems including those with HIV/AIDS infection, cancer, diabetes, kidney disease, and transplant patients, or those individuals undergoing chemotherapy may be at greater risk for infection.

How to Prevent Cyclosporiasis

- Wash hands with warm water and soap before handling foods and eating, and after going to the bathroom, changing diapers, and handling animals.
- Make sure infected individuals wash their hands frequently to reduce the spread of infection.
- Drink water only from treated municipal water supplies.
- When hiking, camping, or traveling to countries where the water supply may be unsafe to drink, either avoid drinking the water or boil the water for 1 minute to kill the parasite. Drinking bottled beverages can be a safe alternative.
- Do not swim in community swimming pools if you or your child has cyclosporiasis.
- Wash, peel, or cook raw fruits and vegetables before eating.

Toxoplasma gondii

Toxoplasma gondii, cause of the disease toxoplasmosis (TOX-o-plaz-MO-sis), is a single-celled, microscopic parasite found throughout the world. It is the third leading cause of death from foodborne disease. It is interesting to note that these organisms can only carry out their reproductive cycle within members of the cat family. In this parasite-host relationship, the cat is the **definitive host**. The infective stage (oocyst) develops in the gut of the cat. The oocysts are then shed into the environment with cat feces.

How do people get toxoplasmosis?

People get toxoplasmosis the following ways:

- By consuming foods (such as raw or undercooked meats, especially pork, lamb, or wild game) or drinking untreated water (from rivers or ponds) that may contain the parasite.
- Fecal-oral: Touching your hands to your mouth after gardening, handling cats, cleaning a cat's litter box, or anything that has come into contact with cat feces.
- Mother-to-fetus (if mother is pregnant when first infected with *T. gondii*).
- Through organ transplants or blood transfusions, although these modes are rare.

Symptoms of Toxoplasmosis and Severe Toxoplasmosis

Toxoplasmosis is relatively harmless to most people, although some may develop “flu-like” symptoms such as swollen lymph glands and/or muscle aches and pains. In otherwise healthy individuals, the disease is usually mild and goes away without medical treatment. However, dormant non-infective parasites can remain in the infected individual for life. An unborn child may contract the parasite congenitally resulting in severe outcomes including miscarriage or stillbirth.

However, persons with weakened immune systems such as those with HIV/AIDS infection, organ transplant recipients, individuals undergoing chemotherapy, and infants may develop **severe toxoplasmosis**. Severe toxoplasmosis may result in damage to the eyes or brain. Infants becoming infected before birth can be born retarded or with other mental or physical problems.

When will symptoms appear? What is the duration?

The time that symptoms appear varies, but generally symptoms will appear 1 week to 1 month after consuming the parasite.

Infants infected while still in the womb may show no symptoms at birth, but develop symptoms later in life.

The duration of the illness depends on the health and immune status of the host. Persons with weakened immune systems may experience illnesses of long duration, possibly resulting in death.

Who is at risk for contracting severe toxoplasmosis?

Those at risk include:

- Persons with weakened immune systems including those with HIV/AIDS infection, organ transplant recipients, or those individuals undergoing chemotherapy.
- Infants born to mothers who become infected with *T. gondii* shortly before becoming pregnant or during pregnancy. Those mothers exposed to *T. gondii* longer than 6 months before becoming pregnant rarely transmit toxoplasmosis to their infants.

How to Prevent Toxoplasmosis

- If you are pregnant or planning to become pregnant, or if you have a weakened immune system, you should discuss your risk of contracting toxoplasmosis with your health care provider.
- Wear clean latex gloves when handling raw meats, or have someone who is healthy, and not pregnant, handle the meats for you.
- Cook all raw beef, pork, lamb and veal steaks, chops, and roasts to a minimum internal temperature of 145 °F as measured with a food thermometer before removing meat from the heat source. For safety and quality, allow meat to rest for at least three minutes before carving or consuming. For reasons of personal preference, consumers may choose to cook meat to higher temperatures.
- Cook all raw ground beef, pork, lamb, and veal to an internal temperature of 160 °F as measured with a food thermometer.
- Cook all poultry to a safe minimum internal temperature of 165 °F as measured with a food thermometer.
- Wash hands, cutting boards, and other utensils thoroughly with hot, soapy water after handling raw meats.
- Clean cat litter boxes daily because cat feces more than a day old can contain mature parasites.
- Wash hands thoroughly with warm water and soap after handling cats, cleaning cat litter boxes, especially before you handle or eat food.
- Wear gloves when you handle garden soil or sandboxes. Cats may use gardens or sandboxes as litter boxes. (Cover sandboxes to prevent cats from using them as litter boxes.)
- Help prevent cats from becoming infected with *T. gondii* by discouraging them from hunting and scavenging.
- Feed cats commercially made cat foods or cook their food.

Trichinella spiralis

Trichinella spiralis, cause of trichinellosis (also known as **trichinosis**) (TRICK-a-NO-sis) is an intestinal roundworm whose larvae may migrate from the digestive tract and form cysts in various muscles of the body. Infections occur worldwide, but are most prevalent in regions where pork or wild game is consumed raw or undercooked. The incidence of trichinosis has declined in the United States due to changes in hog feeding practices. Presently, most cases in this country are caused by consumption of raw or undercooked wild game.

How do people get trichinellosis?

People get trichinellosis (trichinosis) by consuming raw or undercooked meats such as pork, wild boar, bear, bobcat, cougar, fox, wolf, dog, horse, seal, or walrus infected with *Trichinella* larvae.

The illness is **not** spread directly from person to person.

Symptoms of Trichinellosis

The first symptoms are nausea, diarrhea, vomiting, fever, fatigue, and abdominal pain, followed by headaches, eye swelling, aching joints and muscles, weakness, and itchy skin. In severe infections, persons may experience difficulty with coordination and have heart and breathing problems. Death may occur in severe cases.

When will symptoms appear? What is the duration?

Abdominal symptoms may appear within 1 to 2 days after eating contaminated meat. Further symptoms (eye swelling and aching muscles and joints) may begin 2 to 8 weeks after infection. Mild cases may be assumed to be flu. Symptoms may last for months.

Who is at risk for contracting

Persons consuming raw or undercooked pork or wild game.

Persons with weakened immune systems including those with HIV/AIDS infection, organ transplant recipients, or those individuals undergoing chemotherapy may be at a greater risk for infection.

How to Prevent Trichinellosis

- Wash your hands with warm water and soap after handling raw meat.
- Cook all raw pork steaks, chops, and roasts to a minimum internal temperature of 145 °F as measured with a food thermometer before removing meat from the heat source. For safety and quality, allow meat to rest for at least three minutes before carving or consuming. For reasons of personal preference, consumers may choose to cook meat to higher temperatures.
- Clean meat grinders thoroughly each time you grind meat at home.

Taenia saginata/Taenia solium (Tapeworms)

Taenia saginata (beef tapeworm) and *Taenia solium* (pork tapeworm) are parasitic worms (helminths). **Taeniasis** is the name of the intestinal infection caused by adult-stage tapeworms (beef or pork tapeworms). **Cysticercosis** is the name of the tissue (other than intestinal) infection caused by the larval-stage of the pork tapeworm only.

It is interesting to note that humans are the **definitive hosts** of both organisms. This means that the reproductive cycle, and thus egg production by the organisms, occurs only within humans. Eggs are passed in human feces and they may be shed into the environment for as long as the worms remain in the intestines (for as long as 30 years). In addition, the eggs may remain viable in the environment for many months.

These diseases are more prevalent in underdeveloped countries where sanitation practices may be substandard and in areas where pork and beef are consumed raw or undercooked. They are relatively uncommon in the U.S., although travelers and immigrants are occasionally infected.

How do people get Taeniasis?

People get Taeniasis by consuming raw or undercooked infected beef or pork.

Symptoms of Taeniasis

Most cases of infection with adult worms are without symptoms. Some persons may experience abdominal pain, weight loss, digestive disturbances, and possible intestinal obstruction.

When will symptoms appear? What is the duration?

Irritation of the peri-anal area can occur, caused by worms or worm segments exiting the anus.

T. saginata (beef tapeworm) infections appear within 10 to 14 weeks.
T. solium (pork tapeworm) infections appear within 8 to 12 weeks.

Taeniasis may last many years without medical treatment.

Who is at risk for contracting Taeniasis?

Anyone consuming infected beef or pork (raw or undercooked). Persons with weakened immune systems including those with HIV/AIDS infection, organ transplant recipients, or those individuals undergoing chemotherapy may be at a greater risk for infection.

How to Prevent Taeniasis

Cook all raw beef and pork steaks, chops, and roasts to a minimum internal temperature of 145 °F as measured with a food thermometer before removing meat from the heat source. For safety and quality, allow meat to rest for at least three minutes before carving or consuming. For reasons of personal preference, consumers may choose to cook meat to higher temperatures

How do people get cysticercosis?

People get cysticercosis the following ways:

- By consuming food or water contaminated with the eggs of *T. solium* (pork tapeworm). Worm eggs hatch and the larvae then migrate to various parts of the body and form cysts called cysticerci. This can be a serious or fatal disease if it involves organs such as the central nervous system, heart, or eyes.
- By putting anything into your mouth that has touched the stool of a person infected with *T. solium*.
- Some persons with intestinal tapeworms may infect themselves with eggs from their own feces as a result of poor personal hygiene.

Symptoms of Cysticercosis

Symptoms may vary depending on the organ or organ system involved. For example, in muscles, lumps under the skin may result. Cysticercosis can cause blurred vision in the eyes. An individual with cysticercosis involving the central nervous system (neurocysticercosis) may exhibit neurological symptoms such as psychiatric problems or epileptic seizures. Death is common.

When will symptoms appear? What is the duration?

Symptoms usually appear from several weeks to several years after becoming infected with the eggs of the pork tapeworm (*T. solium*). Symptoms may last for many years if medical treatment is not received.

Who is at risk for contracting cysticercosis?

Persons traveling to countries where sanitation may be substandard and the water supply may be unsafe.

Young children, pregnant women, older adults, and persons with weakened immune systems including those with HIV/AIDS infection, cancer, diabetes, kidney disease, and transplant patients, or those individuals undergoing chemotherapy may be at greater risk for infection.

How to Prevent Cysticercosis

- Drink water only from treated municipal water supplies.
- Do not eat undercooked pork or other meat.
- When traveling to countries where the water supply may be unsafe, either avoid the water or boil it for 1 minute to kill parasite eggs. Avoid ice in those same areas. Drinking bottled beverages or hot coffee and tea are safe alternatives.
- Do not swallow water while swimming.
- Do not swim in community swimming pools if you or your child are infected with tapeworms.
- Wash, peel, or cook raw fruits and vegetables before eating.
- Make sure that infected individuals wash their hands frequently to reduce the spread of infection.

Food Safety Questions?

Call the USDA Meat & Poultry Hotline

If you have a question about meat, poultry, or egg products, call the USDA Meat and Poultry Hotline toll free at **1-888-MPHotline (1-888-674-6854)**. The hotline is open year-round



Monday through Friday from 10 a.m. to 4 p.m. ET (English or Spanish). Recorded food safety messages are available 24 hours a day. Check out the FSIS Web site at

www.fsis.usda.gov.

Send E-mail questions to MPHotline.fsis@usda.gov.

Ask Karen!

FSIS' automated response system can provide food safety information 24/7 and a live chat during Hotline hours.



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