

Parasites and Foodborne Illness

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OBJECTIVES

Upon completion of this course, the learner will be able to:

1. Explain what parasites are, and the illness caused by them
2. Discuss *Giardia duodenalis*, its mode of transmission, signs and symptoms and its Prevention
3. Discuss *Cryptosporidium parvum*, its mode of transmission, signs and symptoms and its prevention
4. Discuss *Cyclospora cayentanensis*, its mode of transmission, signs and symptoms and its prevention
5. Discuss *Toxoplasma gondii*, its mode of transmission, signs and symptoms and its prevention
6. Discuss *Trichinella spirallis*, its mode of transmission, signs and symptoms and its prevention
7. Discuss *Taenia solium* and *Taenia saginata*, their mode of transmission, signs and symptoms and their prevention

INTRODUCTION

Parasites may be present in food or in water and can cause disease. Ranging in size from tiny, single-celled organisms to worms visible to the naked eye, parasites are more and more frequently being identified as causes of foodborne illness in the United States. 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 disease. 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.

What are some common parasites?

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

GIARDIA DUODENALIS (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.

How do people get giardiasis?

People get giardiasis the following ways:

- By consuming food or water contaminated with *G. duodenalis* **cysts** (the infective stage of the organism).
- By putting anything into your mouth that has touched the stool of a person or animal with giardiasis.

Symptoms of giardiasis

Diarrhea, abdominal cramps, and nausea are the most common symptoms. 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 4 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:

- persons working in child daycare centers and children attending daycare centers;
- international travelers (traveler's diarrhea);

- hikers, campers, or any other persons who may drink from untreated water supplies; and
- persons with weakened immune systems including those with HIV/AIDS infection, organ transplant recipients, or those individuals undergoing chemotherapy.

How to prevent giardiasis

- Wash hands with hot, soapy water before handling foods and eating, and after using the toilet, diapering young children, 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 or hot coffee and tea are safe alternatives.
- Do not swallow water while swimming.
- Do not swim in community pools if you or your child has giardiasis.
- 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.

CRYPTOSPORIDIUM PARVUM

Cryptosporidium parvum, cause of the disease cryptosporidiosis (KRIP-toe-spo-RID-e-O-sis), is a one-celled, microscopic parasite, and a significant cause of waterborne illness worldwide. It is found in the intestines of many herd animals including cows, sheep, goats, deer, and elk.

How do people get cryptosporidiosis?

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 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, but in some outbreaks in daycare centers, diarrhea has lasted 1 to 4 weeks. In people with AIDS and other 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:

- persons working in child daycare centers and children attending daycare centers;
- persons with weakened immune systems including those with HIV/AIDS infection, organ transplant recipients, 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 hot, soapy water before handling foods and eating, and after using the toilet, diapering young children, 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 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 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.

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), 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.

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

How to prevent cyclosporiasis

- Wash hands with hot, soapy water before handling foods and eating, and after using the toilet, diapering young children, 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 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 has cyclosporiasis.
- Wash, peel, or cook raw fruits and vegetables before eating.
- Do not use untreated manure to fertilize fruits and vegetables.

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 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 tissue stages can remain in the infected individual for life.

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.

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 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 meats thoroughly to 160 °F.
- 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 hot, soapy water after handling cats, cleaning and 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 **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 trichinosis?

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

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

Symptoms of trichinosis

The first symptoms are nausea, diarrhea, vomiting, fever, 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.

Who is at risk for contracting trichinosis?

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 trichinosis

Cook pork and wild game to 160 °F to kill any *Trichinella* larvae that may be present.

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 infected beef or pork (raw or undercooked).

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.

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

When will symptoms appear? What is the duration?

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 beef and pork to 160 °F to kill encysted tapeworm larvae that may be present.

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, 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.

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 cysticercosis

- Drink water only from treated municipal water supplies.
- 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. 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.

The contents of this course are taken from the U.S. Department of Agriculture, Food Safety and Inspection Service. Reference:

http://www.fsis.usda.gov/Fact_Sheets/Parasites_and_Foodborne_Illness/index.asp