



# pork industry handbook

Michigan State University Extension

## Toxoplasmosis in Pigs

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Toxoplasmosis was first reported in pigs in 1951 on a farm in Ohio. The etiologic agent is a protozoan parasite, *Toxoplasma gondii*. It is microscopic, measuring 1/200th of a millimeter in length. Infection by this parasite is widespread in pigs worldwide. The primary concern regarding *Toxoplasma* infection in pigs is that edible tissues become infected with *T. gondii* and the ingestion of undercooked pork can become a source of infection for humans.

### Etiology and Transmission

*Toxoplasma gondii* causes infection in most warm-blooded animals including livestock and humans. Approximately 40% of adult humans in the U.S. are infected with the parasite and *T. gondii* infections are more prevalent in Continental Europe. The three major sources of infection with *T. gondii* are: 1) ingestion of food and water contaminated with *Toxoplasma* oocysts from cat feces, 2) ingestion of infected meat containing tissue cysts, and 3) congenitally from an infected mother to her fetus (Figure 1).

Cats (both wild and domestic) are the definitive (reservoir) hosts for the parasite because they are the only hosts known that excrete in their feces the resistant stage of *Toxoplasma*, the oocysts. Cats become infected by eating tissues of infected animals (rodents, birds, rabbits). After the ingestion of infected meat, *Toxoplasma* multiplies in the intestine of cats and eventually produces oocysts. A cat may excrete several hundred million oocysts in a period of one to two weeks. The oocysts are resistant to environmental influences including disinfectants, and can survive for months. Oocysts are infectious to most warm-blooded animals, including pigs and humans. After the ingestion of the oocysts, *Toxoplasma* multiplies in many host animal tissues eventually becoming encysted in the muscles, liver, brain, and other tissues. Tissue cysts (resting stage of *T. gondii*) are microscopic and they can remain dormant in tissues for the life of the animal. Humans and other carnivores can become infected with *T. gondii* in a variety of ways including ingestion of pork from pigs and other tissues from animals.

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*Toxoplasma* infection during pregnancy can lead to infection of the fetus and the birth of an infected child.

### Infection in Pigs

About 15% to 25% of apparently healthy pigs in the U.S. are estimated to be exposed to *T. gondii*, as determined by antibody tests. *Toxoplasma* generally does not make pigs ill. The parasite can persist in the edible tissues of pigs and other food animals for years, perhaps for life. The parasite has been found in virtually all body muscles of pigs.

### Clinical Toxoplasmosis in Pigs

Most *T. gondii* infections in swine are subclinical, but toxoplasmosis can cause clinical signs in pigs of all ages. Clinical toxoplasmosis has been reported most often in nursing pigs. Infected piglets are born dead, sick, or become sick within 3 weeks after birth; some remain clinically normal. Labored respiration is the most common clinical sign of toxoplasmosis. Other clinical signs include fever, general weakness, diarrhea, nervous signs and rarely, loss of vision. Detection of antibodies to *T. gondii* by a blood test can aid diagnosis. Dead piglets should be submitted to diagnostic laboratories for necropsy and histologic evaluation. *Toxoplasma* can cause mummified fetuses and stillborn piglets. A blood test for *T. gondii* antibodies in body fluid of the fetus can detect toxoplasmosis.

### Public Health Concerns

As mentioned earlier, about 40% of adult humans in the U.S. are infected with the parasite *Toxoplasma*. In most humans, like pigs, *Toxoplasma* does not cause clinical signs of illness. The primary human population at risk are pregnant women and individuals with depressed immunity, including cancer patients, organ transplant recipients receiving immunosuppressive therapy, and people with AIDS.

Toxoplasmosis may cause mental retardation, loss of vision, and birth defects in children whose mothers acquired

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*Toxoplasma* for the first time during pregnancy. Approximately 1 to 10 children are born with toxoplasmosis per 10,000 pregnancies. Most congenitally infected children have no symptoms at birth, but all are likely to develop complications later in life. The most common symptom in congenitally infected children with toxoplasmosis is loss of vision, which may occur even 20 to 30 years after birth. Many AIDS patients (as many as 30%) are likely to die of toxoplasmosis. In most AIDS patients, clinical toxoplasmosis is due to reactivation of a latent infection rather than acquisition of *Toxoplasma* after the diagnosis of AIDS. Symptoms of toxoplasmosis in AIDS patients are mostly due to the destruction of the brain, and in most cases the diagnosis is not made until death because of the confinement of the parasite to the nervous tissue.

Because of the high *T. gondii* infection rate in the general adult population, the recipients of organ transplants are at great risk of becoming infected with *Toxoplasma*.

### Source of *Toxoplasma* Infection for Humans

There is no direct evidence, but there may be some indirect evidence, that pigs are important sources of infection for humans in the U.S. There is no doubt that the cat is the primary source of contamination of *T. gondii* in the environment and that the ingestion of oocysts from cats is the main mode of transmission to humans in countries where meat is cooked thoroughly before ingestion and the environment is heavily contaminated with *T. gondii* oocysts. In these situations, most people begin to acquire *T. gondii* infection during childhood. However, in the U.S. and similar urbanized societies, most people become infected during their teens or adulthood. Studies suggest that the ingestion of *T. gondii* tissue cysts in undercooked or uncooked meat is an important source of infection for people in the U.S. Among the infected meat sources of human infection, pigs are high on the list because beef has rarely been found to be infected with *T. gondii*, very little lamb is eaten in the U.S., and poultry usually is cooked well before consumption. In the two 30-year-old surveys that often are cited, live *T. gondii* was recovered from 16 of 50 pork loins in California, and in 12 of 50 diaphragms of pigs in Maryland. Even if the rate of *T. gondii* infection were only one-third the level reported in these two surveys, there may still be millions of infected pig carcasses marketed annually. Pork producers need to know about the potential public health implication of *Toxoplasma* infection and determine what they can do to minimize *T. gondii* exposure in their herd.

### Methods to Kill *Toxoplasma* in Pork

Fortunately, *Toxoplasma* in meat is easily killed by proper cooking, freezing, or irradiation. *Toxoplasma gondii* is rendered nonviable by heating to an internal temperature of 67°C (152°F). Information concerning time and temperatures that predict the killing of *Toxoplasma* are available to the meat industry. *Toxoplasma gondii* tissue cysts are killed at -12°C (12°F); freezing meat in domestic freezers for 24 hours generally renders *T. gondii* nonviable. Irradiation with 100 krad (Cobalt or Cesium) is effective in killing *Toxoplasma*.

### Control of *Toxoplasma* in Pigs

Epidemiologic data suggest that most pigs become infected after birth, either from the ingestion of oocysts in feed and water contaminated with infected cat feces, or by eating tissue cysts from animals. Based on the existing information, it is reasonable to assume that pigs raised in totally enclosed environmentally regulated buildings in the absence of cats are least likely to have *T. gondii*. However, risk factors for *Toxoplasma* infection in swine herds are not yet well defined. Until more definitive information becomes available, the following practices are recommended to reduce toxoplasmosis in swine:

1. Keep cats out of the swine barns, feed, and water.
2. Remove dead pigs immediately to prevent cannibalism.
3. Rodents should be controlled by rodenticides, not by cats.
4. Never feed uncooked garbage to pigs.

### Preventing *Toxoplasma* Infections in Humans

To prevent infection of humans, hands should be washed thoroughly with soap and water after handling meat. All cutting boards, sink tops, knives, and other materials coming in contact with uncooked meat should be washed with soap and water because the stages of *T. gondii* in meat are killed by water. Meat of any animal should be cooked to 67°C (152°F) before human or animal consumption, and tasting meat while cooking or seasoning homemade sausages should be avoided. Practice utensil isolation, so that knives, forks, and plates used in food preparation are not used in food consumption. Pregnant women should avoid contact with cats, soil, and raw meat. Pet cats should be fed only dry, canned, or cooked food. Cat litter should be emptied daily, preferably not by a pregnant woman. Gloves should be worn while gardening. Vegetables should be washed thoroughly before eating because they may have been contaminated with cat feces. Expectant mothers should be aware of the dangers of toxoplasmosis.

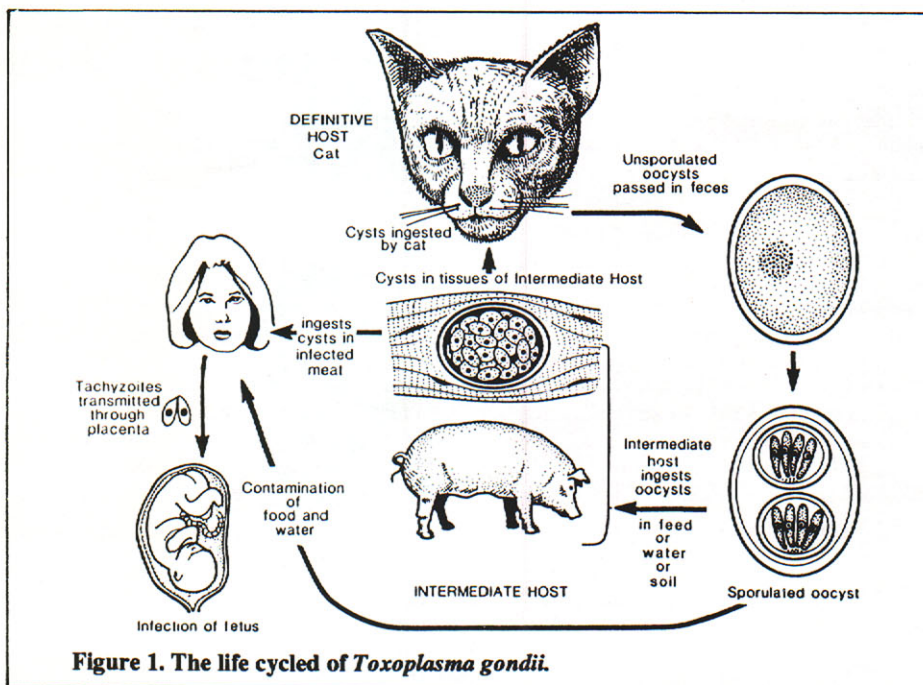


Figure 1. The life cycle of *Toxoplasma gondii*.