Pork Industry Handbook Trichinosis
Michigan State University
Cooperative Extension Service

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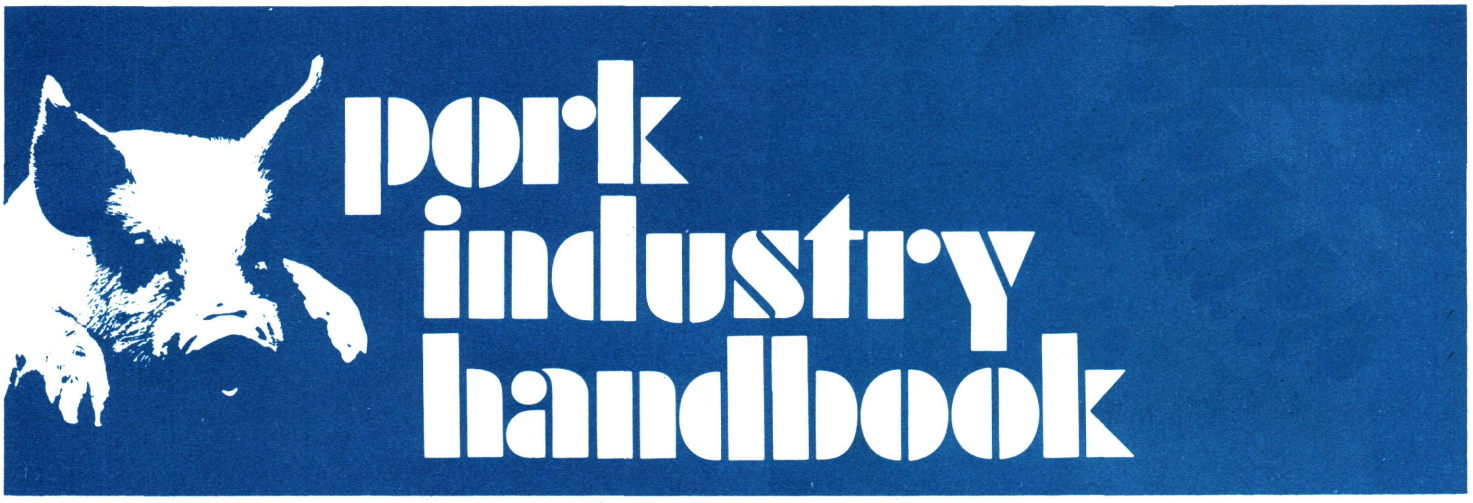

MICHIGAN STATE UNIVERSITY COOPERATIVE EXTENSION SERVICE • EAST LANSING, MICHIGAN

Trichinosis

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Trichinosis has been a stigma associated with the consumption of pork for years. A recent study indicates that a trichinae-safe pork supply would increase consumer confidence and pork consumption, resulting in additional income to pork producers.

Trichinosis is a disease of man and other animals caused by a tiny parasitic worm, *Trichinella spiralis*. Humans may be infected by eating the meat of infected domestic pigs or occasionally the meat of wild bears, wild pigs or other animals such as horses. A number of wild animals including raccoons, opossums, skunks, foxes and rodents are known to be infected and serve as a reservoir of the disease. Over the past five years (1986-1990), between 27 and 109 cases in humans per year were reported in the United States. One study indicated 73.2% of the human cases were attributed to pork products.

The number of human cases of trichinosis has declined dramatically in the United States in the last 40 years, but the infection rate in swine remains the highest of any developed country in the world. Recent surveys indicate the national prevalence in swine is about 0.125%. In contrast, the prevalence in swine in Germany is 0.00003%, 0.0008% in the Soviet Union and none in Denmark. With approximately 89 million hogs slaughtered each year in the United States, this means there are about 110,000 infected hogs per year. If 360 meals are obtained from one hog carcass, approximately 40,000,000 potential servings of infected pork are produced each year in the United States. Some investigators estimate that there are as many as 100,000 or more human exposures per year in the United States but nearly all of these infections are subclinical. In Europe, a major factor in reducing the incidence of swine trichinosis has been the adoption of specific trichinae inspection procedures at the slaughter houses.

The major importance of trichinosis in swine is the danger of human exposure resulting in possible clinical disease. According to a study by the Department of Energy, the purely economic benefits to the pork industry of a reduction in trichinosis would be an estimated $449 million dollar increase in revenue per year, resulting from an increase in pork exports by one-third and an increase in domestic pork consumption of 2%, due to increased confidence of consumers in trichinae-safe pork.

Life Cycle

Swine and wild animals are the reservoirs of trichinosis. Swine are usually infected by consuming viable *T. spiralis* larvae in pork scraps found in uncooked garbage or in meat from infected carcasses of swine, rats and other carnivorous wildlife (Figs. 1, 2 and 3). Recent research has demonstrated that there are other species (sylvatic) *trichinella* in wildlife that have low infectivity for swine, although they can cause disease in humans. Unfortunately, strains of *T. spiralis* that are highly infective for swine also can be found in wild animals, and these represent a potential source for swine trichinosis.

After the ingestion of infected meat, the larvae are digested free of the muscle cyst, enter the epithelia of the small intestine, and within four to six days develop into sexually mature adults. The adults give birth to larvae that migrate through the intestinal wall and into the circulatory system. When they come in contact with skeletal muscle, the larvae invade the muscle and by 17 to 21 days after infection develop to mature, encysted and infective larvae. Encysted larvae can survive in muscle tissue for the life of the host, although most die and are calcified within a few years. In addition, they can survive in putrefying meat for long periods. It has been estimated that 25% to 30% of the total number of muscle larvae present in an infected pig carcass are in the hams and 20% are present in the shoulder cuts. Apparently, swine naturally infected with trichinosis do not show clinical effects. In experimental infections with large numbers of larvae, however, rear paralysis and systemic reactions have been reported.

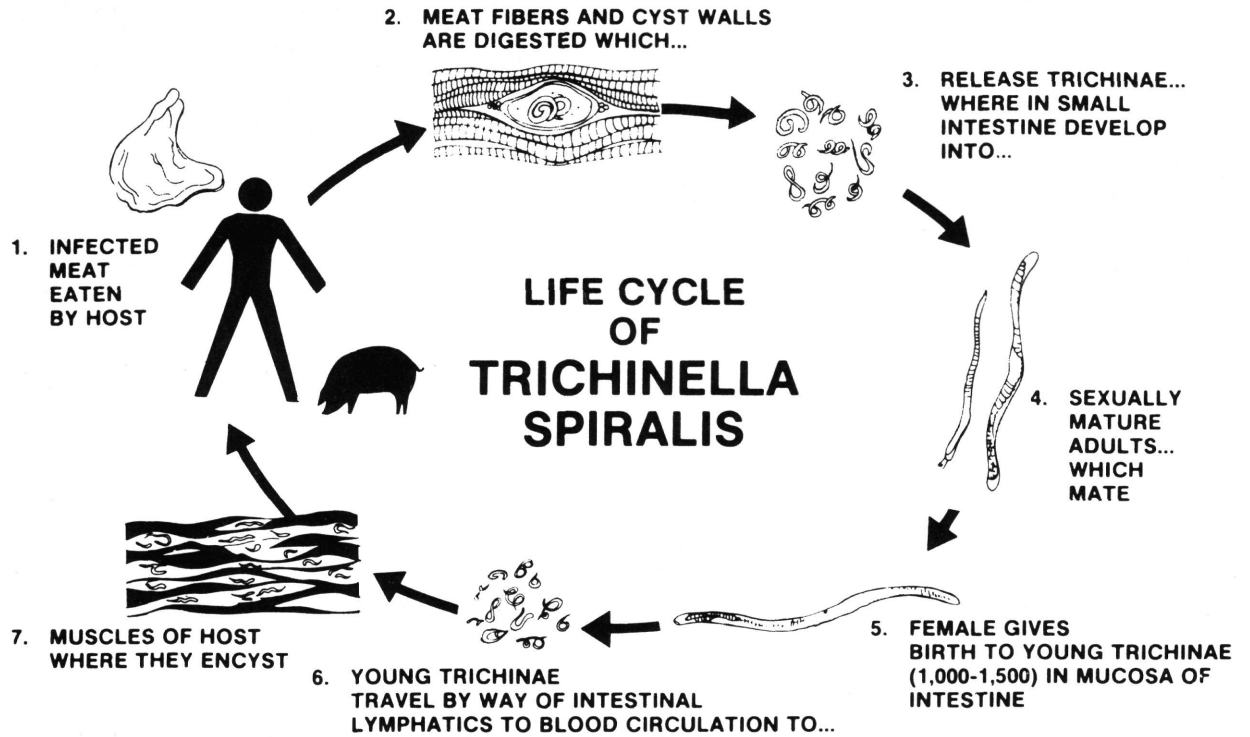

Figure 1.–Source:–Zimmerman, W. and Zinter, D. *H.S.M.H.A. Health Reports* 86 (Oct. 1971): 937-945. (Adapted from and used with permission)

Treatments

No routine preslaughter treatment has been developed for infected swine that will rid the animals of trichina cysts. In human infections, mebendazole, thiabendazole, anti-inflammatory agents and other supportive treatments are used. Similar drugs have been used experimentally in swine and have been found effective, primarily against the adult worms in the intestine and less effective against muscle larvae.

Prevention and Control

Experimental vaccines for trichinosis are being studied in pigs but are not yet available. At this time, management practices are the only tools available to producers to prevent trichinosis in their herds. Producers should practice the following trichinae-preventive measures:

- Observe all garbage feeding regulations. If garbage is fed, feed only well-cooked garbage, including household scraps (212°F for 30 min.).
- Practice stringent rodent control. Rats are important sources of infection in some swine herds.
- Avoid exposing live hogs to dead hog and wild animal carcasses. Do not throw wild game carcasses or parts to hogs or domestic pets.
- Ensure that hog carcasses are properly buried, incinerated or sent to a rendering plant.
- As often as possible, construct effective barriers between hogs and wild animals. This is important for the prevention of transmission both from and to wild animals, a potential infection reservoir.

Pork and meat from all wild mammals should be thoroughly cooked before human consumption. Official federal and state meat inspection programs require that all processed pork products that may be eaten without additional cooking be heated to at least 137°F to assure destruction of any trichina larvae that may be present. A recent USDA study indicated an increased chance of survival of trichinae in microwave cooking. Uneven cooking with cold spots in the microwave oven may cause some areas of fresh pork not to reach 137°F and thus any live trichinae might persist. This has created a concern about trichinosis by the public. However, recent research indicates that pork can be prepared safely in the microwave if an oven cooking bag is used in the cooking procedure. To allow a margin of safety the USDA recommends fresh pork be cooked to 170°F, even though some scientists believe 160°F is adequate.

Fresh pork less than 6 in. thick can be rendered safe if frozen to 5°F (-17°C) for 20 days, -10°F (-23°C) for 10 days, or -20°F (-29°C) for 6 days. Dry curing, which is the interaction of salt and drying for relatively long periods, will devitalize trichinae cysts, if proper time and temperature relationships are established. Specific federal regulations govern the commercial production of cured pork products.

Hamburger ground in a grinder not properly cleaned following grinding raw pork, or hamburger that has pork added, may transmit the disease to humans if it is insufficiently cooked.

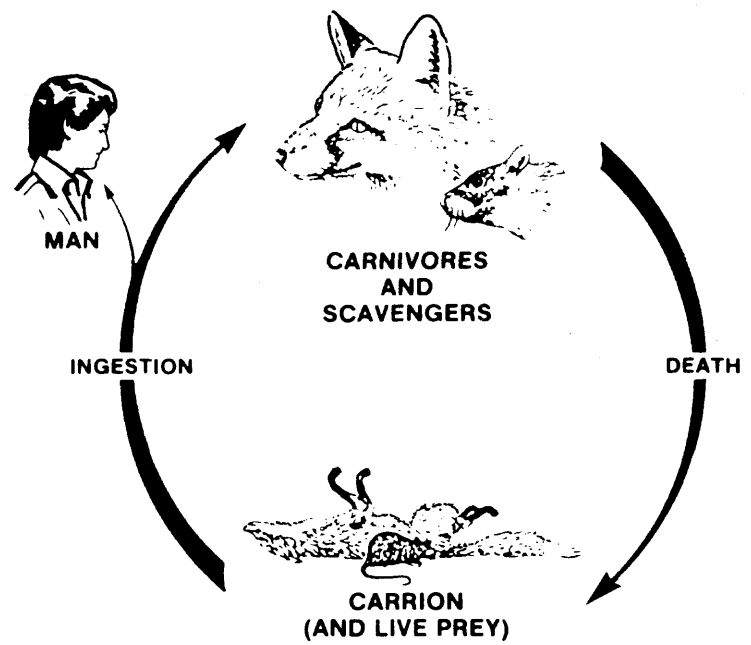

Figure 2.–Sylvatic cycle, representing the transmission of trichinosis in nature, independent of man. "Carnivores and scavengers" include fox, bear, rat, walrus, hyena, wildcats and many others. In the case of human infection, the source would be called game meat, rather than carrion, and the infection would represent an offshoot of the cycle. Original diagram from W. C. Campbell, "Epidemiology I. Modes of transmission." In *Trichinella and Trichinosis*, edited by W. C. Campbell. (New York:–Plenum Press, 1983): 425-444. (Adapted from and used with permission)

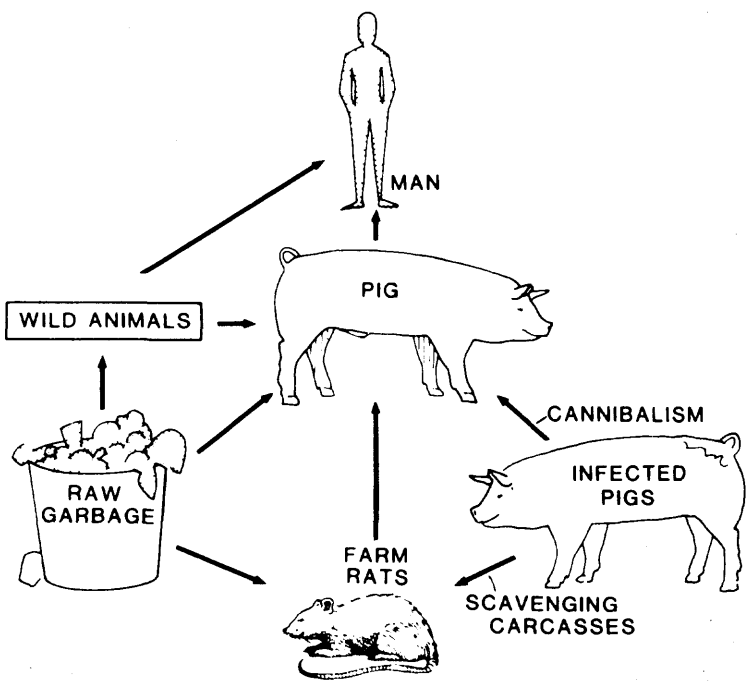

Figure 3.–Domestic cycle, the predominant source of human trichinosis. (Illustration courtesy of Dr. K. D. Murrell)

Trichinae-Safe Pork

Meat inspection programs have proven highly effective in reducing the prevalence of trichinosis in pork in those countries where inspection is required. Effective testing procedures are available for swine trichinosis including direct methods, such as the pooled sample digestion procedure, and indirect tests based on serology. An ELISA test has been shown to be highly effective for both antemortem and postmortem detection of infected swine.

As a part of the National Pork Producers Council's Trichinae-Safe Pork program, samples would be collected from all swine at slaughter and tested for trichinosis. Infected herds could then be traced back to the farm of origin if a national swine identification program is enacted. The Trichinae-Safe Committee of the NPPC has recommended adoption of such a swine identification program.

Since low-dose irradiation (30,000 rads) is sufficient to inactivate encysted trichinae, feasibility of use of this procedure on pork carcasses after slaughter also is being studied.

Eradication and certification of trichinae-safe pork will open up new markets for the industry at home and abroad. A strong educational campaign of producers and consumers is necessary to remove the currently held stigma of trichinosis from pork.

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