

A qualitative assessment of the probability of human exposure to *Trichinella* spp. in Switzerland

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Abstract

Trichinellosis is a zoonotic disease caused by *Trichinella* spp. Pork is a potential source of infection for humans. A qualitative assessment was conducted to assess the probability of human exposure to *Trichinella* spp. in Switzerland via the consumption of pork. For the assessment, both the wildlife cycle and the domestic cycle were taken into account. The probability of occurrence of *Trichinella* infections in domestic pigs was assessed negligible under controlled housing systems due to biosecurity measures. Free-range pigs were assessed to have a very low probability of being infected. Pork from free-range pigs that were not tested for *Trichinella* spp. was estimated to carry a very low probability for human exposure to *Trichinella* spp.

Introduction

Trichinellosis is a zoonotic disease caused by the nematode *Trichinella* spp. Infections occur in a wide range of animal species as well as in humans, but clinical disease is largely restricted to humans. Transmission of infection from host to host occurs via the oral intake of meat containing infectious larvae (OIE, 2006). Human trichinellosis has been attributed to a variety of meat sources, including pork (Pozio, 2000).

Since 1 January 2007, all pigs, horses, wild boar, bears, and nutrias are tested for *Trichinella* spp. at slaughter or at game handling establishments in Switzerland in order to comply with the EU regulation 2075/2005, although small slaughter plants may be exempted from testing of pigs (Anonymous, 2005). Before this date, testing for *Trichinella* spp. was only compulsory for game that was sold for commercial purposes.

Human cases of trichinellosis were not reported in Switzerland since more than two decades. Cases that were reported earlier in the 20th century were not attributed to pork, but were attributed either to meat from dogs, nutrias and lynxes, or the source of infection could not be identified (Hörning, 1976; Jakob et al., 1994).

The Swiss Federal Veterinary Office therefore considers the Swiss domestic pig population to be free from *Trichinella* infections. Under this assumption, the recent implementation of the testing program for pigs will lead to an increased use of resources, without leading to a significant improvement of public health.

A release assessment was conducted to assess the probability that *Trichinella* infections occur in the Swiss domestic pig population and to assess the probability that humans in Switzerland will be exposed to *Trichinella* spp. via the release of pork containing *Trichinella* larvae. The results from this assessment can be used to evaluate the efficacy of a large scale testing of domestic pigs for *Trichinella* spp. in Switzerland.

Hazard characterisation

Pathogen

Four *Trichinella* species are indigenous on the European continent, out of 11 species that have been recognized (OIE, 2006). In this assessment only three of these (*T. spiralis*, *T. britovi* and *T. pseudospiralis*) are considered, because the natural host animals of the fourth European species *T. nativa* – arctic and subarctic carnivores – do not occur naturally in Switzerland.

Transmission of all species occurs via the oral intake of infective larvae, which are localized in muscle tissue. After maturing and reproduction in the intestinal tract, newborn larvae migrate to striated muscles where they penetrate individual muscle cells and develop into the infective stage (OIE, 2006). Transmission via worms and larvae that were excreted via faeces (Poizio, 2000) was not considered in this assessment, because it is most likely that they are damaged or killed due to environmental impact before they reach the intestines of a new host where they could replicate (B. Gottstein, pers. comm.).

Release assessment

A risk pathway was developed to identify all possible routes that may lead to the exposure of humans in Switzerland to *Trichinella* spp. via the consumption of pork (figure 1).

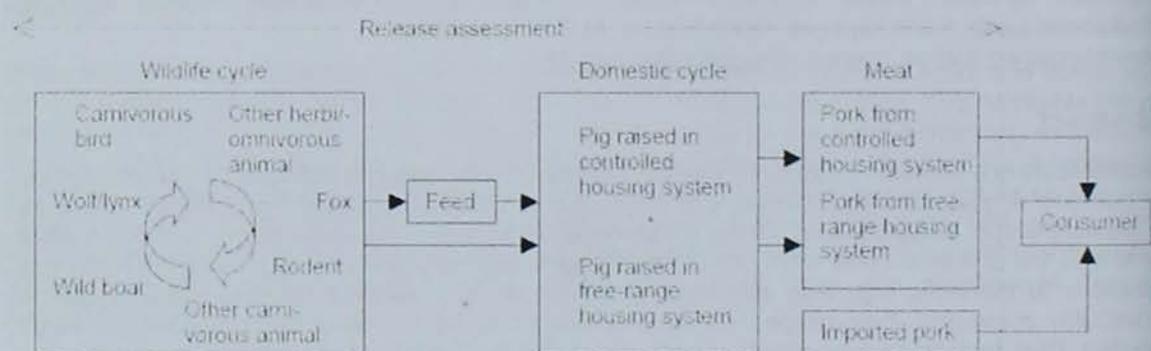


Figure 1. Risk pathway for the release of *Trichinella* spp. leading to human exposure via pork in Switzerland

Wildlife cycle

Trichinella infections were diagnosed in several wild animal species in Switzerland, but it should be noted that all larvae that were investigated were identified as *T. britovi*. The prevalence is considered to be highest in lynxes. There is a small lynx population of 30-40 lynxes, and of 53 animals that were investigated in 1999-2006, 15 were *Trichinella*-positive. Also, one of two wolves that were investigated in 2006 was positive for *T. britovi* (B. Gottstein and C. Frey, pers. comm.). The likelihood of occurrence of *Trichinella* infections in lynxes and wolves was assessed very high. The fox population is very large; annually approximately 50,000 animals are hunted or otherwise killed (BAFU, 2006). The most recent data about *Trichinella* infections in foxes date from a study conducted in 1992, when larvae were isolated from 1.3% of the tested foxes, and an antibody response against *Trichinella* spp. was detected in 12.6% of the investigated foxes (Jakob et al., 1994). The probability of occurrence of *Trichinella* infections in foxes was assessed medium.

The size of the wild boar population in Switzerland was estimated between 24,000 and 66,000 animals (Leuenberger, 2004), and according to hunting statistics 4,800 to 6,300 animals were hunted annually in 2002-2004 (BAFU, 2006). The number of wild boar that is tested annually does not exceed 2,700, but this number also includes many imported wild boar (BVET, 2006a; D. Bernet, pers. comm.). Despite this testing, since many years there are no reports about *Trichinella* infected wild boar. In neighbouring countries, *Trichinella* infections are known to occur in wild boar (Gari-Toussaint, M., 2005; Nöckler, 2005; ITRC, 2007). The probability of occurrence of *Trichinella* infections in wild boar was assessed low.

Birds, mainly carnivorous birds, are only susceptible to *T. pseudospiralis* (Poizio, 2005). This *Trichinella* species was never described in Switzerland, and also reports from neighbouring countries are absent or rare (Nöckler et al., 2006; ITRC, 2007). However, no birds were ever investigated for *Trichinella* spp. in Switzerland. The probability of occurrence of *Trichinella* infections in birds was assessed negligible.

There are no recent studies in Switzerland about the occurrence of *Trichinella* infections in other wildlife species. The probability of occurrence of *Trichinella* infections in other herbivorous and omnivorous species was assessed negligible, because their exposure to *Trichinella* spp. was assessed negligible due to their feed pattern. The probability of occurrence of *Trichinella* infections in other carnivorous species was considered low and in rodents very low.

Feed

Commercial pig feed and kitchen waste that is processed in licensed companies was assessed to pose a negligible risk related to *Trichinella*, because the compulsory heat treatment steps in the production process will inactivate any infective *Trichinella* larvae if they were present. The probability that kitchen waste from private households or slaughter waste from home slaughter is fed to pigs was considered very low, but no data were available. It is unknown how well the compulsory heat treatment is applied in this situation. Closed feed storage prevents rodent access, and manual feed distribution by the farmer allows the farmer to detect rodents in the feed. There were no data available to assess the frequency with which feed containing rodents is eaten by pigs.

Domestic cycle

In Switzerland, animal-friendly production systems are widely implemented. Over 50% of all pigs have access to outdoor areas (BLW, 2005), but these systems are not equal to free-range, extensive housing systems where pigs for example have access to pasture areas. It was estimated that maximally 1-3% of all pigs are raised under such free-range conditions, but exact numbers were not available.

In addition to feed, cannibalism and the ingestion of synanthropic or sylvatic animals can lead to a *Trichinella* infection in domestic pigs (Pozio, 2000). Tail musculature can contain *Trichinella* larvae, and tail biting can contribute to maintaining an existing infection within an infected herd. This route of transmission was assessed to play a negligible role in Switzerland. Ingestion of a synanthropic or sylvatic animal could occur when an infected synanthropic or sylvatic animal died within reach of a domestic pig, or when a domestic pig chased and caught such an animal. Under controlled housing conditions, access of synanthropic or sylvatic animals to domestic pigs is restricted, but under free-range conditions access of synanthropic or sylvatic animals cannot be prevented.

Until the end of December 2006, testing for *Trichinella* was conducted on a voluntary base in a few slaughter plants. Between 2001 and 2005 the proportion of slaughtered pigs that was tested increased from 14.7% to 33.8% (BVET, 2006a). No positive results were found, which indicated that the maximum prevalence in the slaughter pig population did not exceed 0.0003% in 2005 (95% confidence).

In conclusion, the probability of occurrence of *Trichinella* infections in domestic pigs under controlled housing conditions was assessed negligible. The probability of occurrence of *Trichinella* infections in domestic pigs under free-range conditions was assessed very low.

Meat

Since 1 January 2007, all pigs are subject to testing for *Trichinella* at slaughter, however, small slaughter plants may be exempted from testing (Anonymous, 2005). Pigs from free-range housing systems can be slaughtered in both large and small slaughter plants, but no data were available to estimate the volume of each of these routes. Pork from free-range pigs that were tested negative for *Trichinella* spp. was assessed to carry a negligible probability for the exposure of humans to *Trichinella* spp. Pork from free-range pigs that were not tested was assessed to carry a very low probability for the exposure of humans to *Trichinella* spp.

Officially imported pork must be tested for *Trichinella* spp. (BVET, 2006b). Therefore, this pork was assessed to carry a negligible probability for the exposure of humans to *Trichinella* spp. Limited amounts of pork can legally be imported without import permit from Europe for private consumption (BVET, 2006c). Pork imported from EU member states was assessed to carry a negligible probability for the exposure of humans to *Trichinella* spp., but pork imported from non EU-member states was assessed to carry a low probability for the exposure of humans to *Trichinella* spp. However, no data were available to estimate the volume of each of these routes.

Discussion and conclusions

This assessment showed that free-range pigs in Switzerland have a very low probability of being infected with *Trichinella* spp. However, there is a lack of high quality data about *Trichinella* infections in free-range pigs in Switzerland. As well, part of the free-range pigs are excluded from *Trichinella* testing when they are slaughtered in small slaughter plants. Currently, a study including a serological survey is conducted that specifically targets free-range pigs to improve the knowledge base for this group of pigs.

A second category that needs special attention is the imported pork for private consumption. Pork from non-EU member states was considered to carry a low probability for human exposure to *Trichinella* spp. However, these imports are not under government control.

Other meat sources (for example game or horse meat) were not considered in this assessment. However, they should be considered as well in order to assess the overall likelihood for human exposure to *Trichinella* spp. in Switzerland.

This assessment showed that the large scale testing of pigs from controlled housing systems does not contribute significantly to the improvement of public health in Switzerland, since the probability of occurrence of *Trichinella* infections in these pigs was considered negligible. A risk based surveillance system that targets high risk animal categories, such as free-range pigs, could reduce the volume of the program without increasing the probability of human exposure to *Trichinella* spp.

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