Report of the Scientific Committee of the Spanish Agency for Food Safety and Nutrition (AESAN) in regard to the risk of trichinosis through suckling pig meat consumption

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Abstract

Trichinosis is a zoonosis due to nematodes of the genus *Trichinella*, especially *T. spiralis* and infections to human beings occur by the consumption of raw or undercooked infected meat and certain meat products of different origins, mainly pork, boar and horse. Commission Regulation (EC) No 2075/2005 laying down specific rules on official controls for *Trichinella* in meat establishes that the carcases of domestic swine shall be systematically sampled in slaughterhouses as part of the *post mortem* examination. AESAN Executive Director has requested the Scientific Committee for a report on the risk of trichinosis transmission to humans by consumption of meat from suckling pigs slaughtered in their first weeks of life, with the aim of requesting a different handling of the requirements for *Trichinella* detection in them, in the case of potential legislative changes.

In current pig production, piglets are weaned at 21 to 28 days of age. Besides, in Spain, suckling pigs are traditionally slaughtered at 3 to 5 weeks of age with the only purpose of cooking the carcases afterwards. At this age, the digestive system of suckling pigs is immature and is not ready for eating foodstuffs other than mother's milk or substitutes of similar composition. Moreover the usual productive intensive system, with detailed controls of feeding, hygiene and environment, does not favor the access to potentially *Trichinella* contaminated materials, like leftovers or carrion. On the other hand, newborn larvae of *Trichinella* do not acquire their infectious capacity till the day 15 to 20 post-infection. Therefore, even in those scenarios in which the risk of infection for the suckling pigs is at highest (recently weaned piglets and in an extensive environment with access to *Trichinella* contaminated material), there is only a very low probability of occurrence of newborn larvae before the suckling pigs have reached the 35 days of life (weaning at the age of 21 days plus at least 15 days for the acquisition of the infectious capacity); therefore the Scientific Committee considers the risk of transmission to humans by the consumption of suckling pig meat slaughtered at an age equal o lower than 35 days (5 weeks) as low.

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In the case of intensive breeding without supervision or audit of the housing conditions but with no access to the outdoors, the detailed control on breeding seems to prevent the suckling pigs to intake *Trichinella* spp. infected meat before the slaughter. In this case, the possibilities of piglets entering in contact with *Trichinella* contaminated material are negligible and the risk is insignificant when the pigs are slaughtered right after the weaning and until the first 35 days of life (5 weeks).

This period may be extended until the 24 to 26 days after the weaning in piglets raised under intensive conditions, without supervision or audit of the housing conditions taking into account that to the weaning period a week must be added in order to allow the piglet's digestive system to adapt to the consumption of products other than breast milk.

Key words

Trichinella, trichinosis, suckling pig, Regulation (EC) No 2075/2005, inspection at slaughterhouse.

Introduction

1. Basis of the request

Regulation (EC) No 2075/2005 of 5 December 2005, laying down specific rules on official controls for *Trichinella* in meat (EU, 2005), in article 2.1 states that "carcases of domestic swine shall be systematically sampled in slaughterhouses as part of the *post mortem* examination".

Normally, in current porcine production, the weaning of the piglets takes place during the first 21-28 days of their lives. Specifically in Spain, there is also a tradition to slaughter suckling pigs at the age of 3 to 5 weeks, with the exclusive aim of subjecting the carcases to later culinary treatment. The young age of the piglets, their diet before being slaughter and the later destination of the carcase bring into consideration if the *Trichinella* detection analysis in animals younger than a certain age or of a certain weight is a disproportionate measure in comparison to the risk.

There are guarantee marks that control the conditions in which the suckling pigs are bred and slaughtered. Consequently, the Regulation of the Use for the Guarantee Mark *Cochinillo de Segovia* (Vaquero et al., 2007) (Anonymous, 2009) establishes the following conditions, among others: Piglets must only be fed with breast milk from birth until the age they are slaughtered, which should be a maximum of 3 weeks. Their weight before slaughter should be between 4.5 and 6.5 kg, and the weight of the carcase should be between 3.8 and 5.8 kg. Furthermore, the Regulation controls the lactating mother's feed.

Under these conditions, it seems highly unlikely that these animals could ingest meat infected with *Trichinella* spp. It is even less likely that it could complete its biological cycle and reach the stage of infecting larvae before the animals are slaughtered. Therefore, Spain has requested on numerous occasions in different European Commission's working groups, a revision on the obligation to perform *Trichinella* spp. analyses in piglets that are a few weeks old.

In 2010, the European Commission requested the European Food Safety Authority (EFSA)'s scientific opinion and technical assistance regarding public health risks to be controlled during meat inspection through mandate number M-2010-0232. The request asks EFSA to establish both general and specific biological and chemical risks to public health that should be taken into account in European Union meat inspections. It also includes a request for differentiation in accordance with the production systems and the age of the animals.

In response to the aforementioned mandate, the EFSA has recently published the reports *Scientific Opinion on the public health hazards to be covered by inspection of meat (swine)* (EFSA, 2011a) and *Technical specifications on harmonised epidemiological indicators for public health hazards to be covered by meat inspection of swine* (EFSA, 2011b). These reports do not mention any possibility of excluding the obligation to carry out any *Trichinella* spp. analysis in piglets that are a few weeks old.

Although the age of the pigs was not considered a risk factor or an indicator in the two reports, the groups of piglets described above could be included in the population at low risk if they are bred in a controlled environment, with no access to the outside. Therefore, according to the opinion of the BIOHAZ panel, the *Trichinella* analysis might not be necessary (neither for piglets or adults).

Spain intends to request, in the possible new legislative changes, different treatment for young piglets slaughtered for human consumption and therefore the Executive Director of the Spanish Agency for Food Safety and Nutrition (AESAN) has requested that the Committee carry out an assessment of the following specific criteria.

2. Terms of reference

1. Only taking into account the piglet digestive system in the first days of life and the biological cycle of *Trichinella* spp., what is the maximum age at which the pigs could be slaughter with no significant trichinosis risk for humans?
2. Regarding young pigs, when they are bred in intensive farms without an audit of supervision of the housing conditions, as described in relation to *Trichinella* in Annex I of the EFSA report *Technical specifications on harmonised epidemiological indicators for public health hazards to be covered by meat inspection of swine:*
   a. If piglets aged between 21 and 28 days are sent directly to be slaughtered after weaning, could the risk of trichinosis for humans be considered negligible or even non-existent?
   b. In pigs sent directly to be slaughtered at a maximum age of 35 days, both if they were weaned between 21 and 28 days of being alive or if they continued being breastfed until the age of 35 days, could the risk of trichinosis for humans be considered negligible or even non-existent?
   c. In these situations, what is the maximum age at slaughter for pigs at which the trichinosis risk for humans may be considered as negligible?

Assessment of the transmission risk of *Trichinella* in young pigs (piglets)

1. Hazard identification

Etiology and biological cycle

Trichinosis is a zoonosis, caused by nematodes of the *Trichinella* genus, especially *T. spiralis*, a species which widely spread in countries of temperature climate (Acha and Szyfres, 2003). These parasites can be found in wild animals in every continent, except the Antarctic, and in domestic pigs in many countries with carnivores and omnivores being the main reservoirs. Infections in human come from consuming parasitized meat that is undercooked or raw or meat products of different origins (for example, pork, horse or wild boar).

This parasite was first discovered and described by Owen in 1835, and until 1972, *T. spiralis* was the only species of the genus (Riva et al., 2007). Nowadays, eight species and three genotypes are recognised (Gottstein et al., 2009): *Trichinella spiralis, T. nativa,* and its related genotype *Trichinella* T6, *T. britovi* and its related genotype *Trichinella* T8, *T. pseudospiralis, T. murrelli* and its related genotype *Trichinella* T9, *T. nelsoni, T. papuae,* and *T. zimbabwensis*, and the genotype *Trichinella* T12 has also been recently added to this list (Krivokapich et al., 2008) (Gottstein et al., 2009). All species can develop in mammals. *T. pseudospiralis* can also affect birds and *T. papuae* y *T. zimbabwensis* can affect some reptile species. Although there are no clear morphological differences between species and genotypes, they can be distinguished using biochemical and molecular techniques (Pozio, 2007) (Riva et al., 2007). Furthermore, depending on the species, the resistance to freezing differs, as well as their ability to form a collagen capsule in the muscle stage, a trait present only in affecting mammals. In Spain, the species described are *T. spiralis* and *T. britovi* (Pozio, 2007).

Trichinella spp. undergoes an auto-heteroxenous cycle, with two phases in the same host, one in the intestine and the other one in the striated muscle. It begins with a shedding phase in the intestine between the moment the host ingests the infecting larva (L1) and the production of the new generation (newly born larva, NBL) by a viviparous adult female. After ingesting infected meat, the infecting larvae (L1) are freed from the capsule and the muscle tissue that surrounds it by means of the pepsin and the hydrochloric acid's actions in the host stomach. They migrate to the host's small intestine, they penetrate the mucosa a mechanism that is still unclear, and in 4 to 5 days post-infection (p.i.) (Dupouy-Camet and Bruschi, 2007) after shedding the cuticle four times (going through L2-L3-L4-L5), they mature and become adults in a period of 2 days. Males and females return to the intestinal lumen and copulate. Females, penetrate the mucosa again between days 5 to 7 p.i., and begin to give birth to NBL for at least 7 to 15 days. This period lasts until the immune response from the intestinal mucosa causes expulsion of adults (Pozio, 2007) (Riva et al., 2007). It is estimated to be a period of 3 to 4 weeks (Dupouy-Camet and Bruschi, 2007).

The NBL, 110 x 7 µm in size, migrate from the intestinal mucosa, spreading throughout the whole organism through the blood and lymph. The NBL become infecting larvae (L1) after penetrating the myocytes of the striated muscle, where they can survive for years. They prefer striated muscle fibres with a weak carbohydrate metabolism, as they selectively feed themselves from the glycogen reserves of the muscle. The metabolism of the infecting larva is anaerobic (Pozio, 2007) (Riva et al., 2007). The penetration of the larvae and their permanent presence in the striated muscle tissue requires modifications that not only affect the larvae but also the muscle cells. They also entail the transformation of the muscle cell into a nurse cell that forms a complex with the larvae, its encapsulation through the production of a collagen capsule that surrounds the larvae, and the creation of a micro-network of capillaries surrounding the infected cell.

In general terms, the different authors establish that the infecting capacity occurs between 15 and 20 days post-infection (Acha and Szyfres, 2003) (Nöckler et al., 2005) (Pozio, 2007) (Riva et al., 2007) (Gottstein et al., 2009).

The nurse cell/larva complex survival varies according to factors related to both the parasite and the host. It can vary from one to two years, although it has been reported that some have survived more than 30 years (Dupuoy-Camet and Bruschi, 2007).

2. Hazard characterisation

Trichinosis epidemiology

In the epidemiology of trichinosis, two cycles or environments are identified: wild and domestic.

In nature, trichinosis infects wild animals. The parasite circulates among carnivore predators, omnivores and scavengers and has been found in over 100 mammal species. It is important to remember that the parasite is resistant to rotting, which makes infection in omnivores easier when feeding from carcases of predator carnivores. This cycle can also affect humans when they consume potentially infected animals, such as wild boar and other game animals.

The domestic or synanthropic cycle comes from aforementioned, and occurs when synanthropic animals, such as rats, dogs, cats and pigs get infected by consuming wild animals. Once in the domestic environment, infection in pigs is maintained by feeding them with leftovers that contain raw pork meat or by consuming rat, dog or cat carcases. The incidence of trichinosis is 20 times higher in pigs fed with raw kitchens or slaughterhouse leftovers than in those fed with commercial feeds (Acha and Szyfres, 2003). The consumption of this type of waste and uncontrolled extensive breeding are important factors that increases the risk.

Disease in humans

Humans are the only species to suffer from this clinical disease (Gottstein et al., 2009). Infection comes from eating raw or undercooked meat and meat products that carry infecting larvae, and therefore the presence itself of the parasite in domestic or wild animals cannot be considered a risk factor. In accordance with the epidemiological data, the main source of trichinosis in humans is pork meat and their derivatives. Horse *(Equus caballus)* and wild boar *(Sus scrofa)* meat could also cause this disease. Some isolated cases of infection due to the consumption of walrus *(Odobenus rosmarus)* and bear *(Ursus americanus, U. arctos, U. maritimus)* in North America, fox meat *(Vulpes vulpes)* in Italy and weasels in Switzerland (Pozio, 2007) have been reported. Cynophagia cannot be dismissed as possible risk in societies with these eating habits.

According to European Union (EU) data, all Members States, except Denmark and Greece, reported cases of human trichinosis in 2009. The total number of cases recorded was 1,073, 748 of which were confirmed (EFSA/ECDC, 2011). In most cases *Trichinella* could not be confirmed: *T. spiralis* was confirmed in 34 cases, but no case of *T. nativa* or *T. pseudospiralis* was detected (EFSA/ECDC, 2011). The prevalence of confirmed cases has remained stable over recent years in the EU, with rates between 0.14 and 0.16 per 100,000 people since 2006.

In Spain in 2009 and 2010, 17 and 21 cases were recorded respectively and no species was confirmed (CNE, 2010).

Although the prevalence of human trichinosis in Europe was 0.15 confirmed cases per 100,000 people in 2009 (ECDC, 2011), the distribution between countries is not homogenous. Bulgaria, Romania, Lithuania and Latvia reported more than 90% of all the cases recorded at the European Centre for Disease Prevention and Control (ECDC).

3. Risk exposure assessment

Prevalence in animals

Due to the legal obligation in Regulation (EC) No 2075/2005 to sample the carcases of the domestic swine for *Trichinella* (EU, 2005), most EU data (EFSA/ECDC, 2011) regarding the prevalence of trichinosis in pigs for consumption derive from meat inspections. Its prevalence in the EU is low, with values of 0.0002% of domestic swine slaughtered in 2009. Between 2004 and 2009, ten EU Member States reported to have detected *Trichinella* in pigs (EFSA, 2011b) and in most cases, the larvae were isolated to animals kept in free-range or uncontrolled systems. It must be noted that the data provided show significant differences among countries, being remarkable the high prevalences in Bulgaria (0.13%), Romania (0.008%) and Lithuania (0.001%).

In Spain, in 2009, the prevalence in domestic pigs was 0.00016%, from a total of 39,990,011 slaughtered animals (64 positive) (EFSA/ECDC, 2011).

As stated earlier, the EU data for trichinosis prevalence in pigs are general, for the total of pigs slaughtered in abattoirs, and do not distinguish between ages at slaughter or breeding systems. Data from Castilla y León regional government (Díez-Baños et al., 2011) show that from 2004 to 2008, the presence of the parasite was not detected in any of the 1,210,461 piglets slaughtered in 48 abattoirs controlled by the regional government's Official Veterinary Services. These authors, using data from the Ministry of Agriculture, Food and Environment and the Castilla y León Health and Food Safety Agency stated that in 2009, three million of intensively bred pigs were slaughtered in this region, and *Trichinella* spp. was not reported in any of them. All positive cases were in free-range farmed Iberian pigs.

It is much more prevalent in wild boar bred on farms, with values of 0.02%, and this was even higher in boar hunted in the wild. European data for the same year (2009), showed a prevalence of 0.2%, whilst the Spanish figure was 0.16%. This species also shows significant differences between countries. The highest frequency was in Poland (619 positive cases from a total of 50,583 analysed (1.22%)) and Romania (0.68%).

Since 1975, various outbreaks of trichinosis have occurred from the consumption of soliped meat (2,296 people were infected in eight outbreaks in France, and 1,038 in seven outbreaks in Italy). All cases from one outbreak came from eating meat from one animal and horses that had parasites were not from the EU with a high prevalence (Pozio, 2007). European data (EFSA/ECDC, 2011) show that in the period between 2007 and 2009, only one of the 500,000 solipeds inspected was identified as carrying *Trichinella* spp.

Infectious doses in humans

There are no specific data on the minimum infectious dose that causes clinical trichinosis response in people infected individually. Some authors (Murrell and Bruschi, 1994, quoted by Dupuoy-Camet and Bruschi, 2007) state that ingesting 70 live larvae would be enough to detect clinical infection. From the data that Zimmerman (1983) provided, the minimum infectious dose in humans can be estimated as between 100 and 300 larvae. Ingesting between 1,000 and 3,000 larvae can cause severe trichinosis in humans.

Trichinella infection in piglets

The data reference system provided by the Official Veterinary Services does not discriminate between adult and recently weaned (between 3 and 6 week-old) piglets, in the case of trichinosis inspection in slaughterhouse. According to the annual livestock slaughter survey by the Ministry of Agriculture, Food and Environment, nearly 13 million piglets have been slaughtered in Spain in the last seven years, and there is no data that confirm the presence of parasites. Of course there is no epidemiological evidence of trichinosis in humans linked to the consumption of meat from these animals.

Different authors have done research on the behaviour of *Trichinella spiralis* in different animals after experimental infection. Among others, Nockler et al. (2005), confirmed positive serological responses using inoculations of between 200 and 20,000 larvae in pigs at the age of 10 weeks. For the highest inoculations this was measured after 25 days p.i. and 40-60 days for the lowest. This indicates a high correlation between the inoculation dose and the serological response. The same correlation between the dose and the presence in the muscle was noted, although in this case the presence in the muscle was detected 60 days p.i.

There is little bibliographical data on scientific results on the infective ability of *Trichinella* spp. in piglets whose digestive system after lactation is not fully developed yet. Recently, Díez-Baños et al. (2011) presented their results at the 12th Iberian Parasitology Conference. In this study, after inoculation of doses of 3,000 and 6,000 *Trichinella* larvae per animal in piglets between 22 and 26 days old, the presence of infectious larvae was detected at day 19 post-infection. In this case the direct experimental inoculation does not result in any conclusions about the digestive behaviour of the piglet and the degree of infection in the case of experimental ingestion of infective larvae in infected meat. However, it does show the minimum development period of larvae in young animals.

Physiology and handling of piglets

Piglets are born with relatively immature immune, thermoregulatory and digestive systems (Gómez Insausti et al., 2008) (Pérez, 2009). In the first four weeks, piglets' digestive system has a very low enzyme activity, both quantitative and qualitative, with low levels of amylase, lipase, maltase and protease. The limited enzyme capacity means that they are unable to digest substances other than lactose (main source of carbohydrates), casein (the main source of protein) and milk fat. Furthermore, hydrochloric acid secretion is also limited in the first days and up to the first weeks post-weaning. The stomach acid levels are not noticeable until the third or fourth week post-weaning (pH 4) (Gómez Insausti et al., 2008).

In the natural weaning process, the piglet, which at first only consumed the breast milk, progressively starts to consume solid foods. This process can be prolonged up to 10 or 12 weeks of life (Chapinal et al., 2006). Furthermore, in early weaning, the recently weaned piglets cannot intake solid food, the consumption of dry food is practically negligible and they show intestinal atrophy (Chapinal et al., 2006) (Gómez Insuasti et al., 2008). The only possible food to be intake at this age must be one of similar quality and nutritional content to the mother's milk, usually in the form of a special feed. It is not until 6-8 weeks post-weaning that the enzyme capacity and the digestive system's absorption reach their full maturity (Gómez Insuasti et al., 2008).

Furthermore, during lactation and on the post-weaning days, which are critical, piglets tend to slow down their growth rate and to have diarrhoea. Therefore they need continuous care and attention, with special conditions in housing and food (Chapinal et al., 2006) (Gómez Insausti et al., 2008) (Berenguer and Toledo, 2009a, 2009b).

Swine breeding systems and their relation to trichinosis spreading

Many studies have shown that pig farms with poor hygiene and sanitary levels have a higher prevalence. The increased risk of transmission in pigs is linked to biosafety system faults, which increases the likelihood of coming into contact with reservoirs. Among these faults, feeding them with rubbish, waste materials and dead animal remains can be included.

For this reason the International Commission on Trichinellosis (ICT) has recommended for years to implement training programs for breeders, improvements in the swine feeding and breeding systems, rodent control programs, the use of environmental and architectural barriers, and tests of newly arrived animals to achieve the largest possible decrease of this zoonosis.

Following this criteria, in the EU, the Regulation (EC) No 2075/2005, laying down specific rules on official controls for *Trichinella* in pigs, states in article 3.2 that "carcases and meat of domestic swine kept solely for fattening and slaughter shall be exempt from *Trichinella* examination where the animals come from:

a) a holding or category of holdings that has been officially recognised by the competent authority as free from *Trichinella* in accordance with the procedure set out in Chapter II of Annex IV".

Intensive swine breeding systems are highly specialised. They aim at protecting the reproduction and the first stages of development in piglets to guarantee profitable production. Generally, these kind of breeding systems have:

- Control systems for the feed supplied to the pigs.
- Detailed identification systems for animals from their birth to slaughter guaranteeing traceability.
- Controlled access systems to the premises where animals are kept.
- Pest control systems.
- Effluent and sediment management systems.
- Environmental control systems for the farm.

Bearing in mind lactation, weaning and post-weaning phases, it is important to point out that feeding lactating sows have some critical factors, given that excess feeding is directly linked to mastitis. Gradually increasing feed is essential to adapt the lactation curve of sows in the feeding curve, and therefore strict written protocols are needed (Berenguer and Toledo, 2009a).

As indicated above, during lactation, piglets are not capable of thermoregulation, and therefore they require very specific feeding, housing and hygiene conditions to avoid an energy deficit and stunted growth (Gómez Insausti et al., 2008) (Berenguer and Toledo, 2009b).

In this type of farms, the current early weaning process takes place between 21 and 28 days of life, for profit reasons. At this time, piglets are separated from their mother so that they start to feed themselves with other feedstuffs. In certain circumstances, and when the pig is destined for immediate slaughter, the lactation can be extended up to 35 days of life. Weaning at an earlier age is not considered as they are banned by the animal welfare regulations. The Council Directive 2008/120/EC of 18 December 2008, laying down minimum standards for the protection of pigs (EU, 2009), establishes in Annex I, Chapter II:

"No piglets shall be weaned from the sow at less than 28 days of age unless the welfare or health of the dam or the piglet would otherwise be adversely affected.

However, piglets may be weaned up to seven days earlier if they are moved into specialised housings which are emptied and thoroughly cleaned and disinfected before the introduction of a new group and which are separated from housings where sows are kept, in order to minimise the transmission of diseases to the piglets."

When weaned at 28 days, piglets and mothers are kept in highly controlled housing conditions with no access to the outdoors. These conditions are also kept after weaning, when weaned between 21 and 28 days since, as stated on the forementioned Regulation (EU, 2009), they should be transferred to special facilities.

Effects of food preservation systems and culinary treatments on *Trichinella spiralis*

The ICT (Gamble et al., 2000) has established a series of uniform recommendations the control of *Trichinella* in farm, slaughter and meat processing.

Three methods have proven to deactivate *Trichinella spiralis* effectively in meat for consumption: thermal treatment, freezing and irradiation. Other preservation methods such as curing, drying, smoking and microwaving are not considered to be totally safe (Gottstein et al., 2009).

Trichinella spiralis is sensitive to the combination of temperatures and time, according to what many scientific studies have confirmed. Gamble et al. (2000) made a table combining time and temperatures that are effective for experimental deactivation of *Trichinella spiralis*, which included data of deactivation at 49.0 °C/21 hours to 62.2 °C/instantaneous destruction. From a commercial point of view, Gottstein et al. (2009) point out that cooking destroys *Trichinella* when the temperature in the centre of the product reaches 71 °C for at least a minute.

At the same time freezing deactivates *Trichinella*. For *Trichinella spiralis*, and depending on the thickness of the product to be treated, different time and temperature combinations are used. In commercial freezing, the data provided by Gamble et al. (2000) shows ratios between 0 ºF (-17.8 ºC)/106 hours and -35 ºF (-37.2 ºC)/30 minutes, when these temperatures are reached in the centre of the product. Similarly, Gottstein et al. (2009) establish temperatures of -15 ºC for at least three weeks for commercial pieces of pork of thickness below 15 cm, and for at least four weeks for pieces up to 50 cm thick.

In Annex II, Regulation (EC) No 2075/2005 establishes requirements for the commercial freezing of domestic swine carcase. These recommendations are exclusively for domestic pork meat because some *Trichinella* species that affect game animals and horses, such as *T. britovi* y *T. nativa*, are resistant to freezing in the combinations of time and temperature recommended by the Regulation. Some authors state that *T. spiralis* can survive for more than four weeks in horse meat at -18 ºC (Hill et al., 2007).

Irradiation at a dose of 0.3 kGy has proven to be effective in deactivating *Trichinella spiralis* in countries where this method of preservation is authorised (Gottstein et al., 2009).

Other meat preservation systems such as curing and smoking have not proven to be completely safe in deactivating *Trichinella* larvae. Although some specific studies show positive results in certain combinations of time, temperature and curing salts, the wide variety of methods and products does not allow reaching conclusions that can be applied to all cases. It also has been suggested that a_w (water activity) values less than 0.92 deactivates *T. spiralis* (Gajadhar et al., 2009).

Conclusions of the Scientific Committee

From this data and with the uncertainties indicated at the end of this report, the following conclusions to the terms of reference requested have been established:

1. Only taking into account the piglet digestive system in the first days of life and the biological cycle of *Trichinella* spp., what is the maximum age at which the pigs could be slaughtered with no significant trichinosis risk for humans?

For any type of farm, the scientific data show that until they are weaned, between 21 and 28 days of life, and during the following weeks, the physiology of the piglet digestive system is adapted to digest milk proteins and is not prepared for digesting meat. On the other hand, the detailed control on feeding in order not to jeopardize the pigs life and development, means that the **risk** of these pigs ingesting meat or other products infected with *Trichinella* spp., or of *Trichinella* completing its biological cycle to become infective larvae before the animals are slaughtered, can be considered as **low**.

Only when piglets are in open environments (pens or extensive farms) with possible presence of rubbish, carcases or other contaminated materials, it could be possible for the animals to intake material contaminated with *Trichinella*. However, even if this may be possible, it is unlikely to happen in the first week after weaning.

For the qualitative risk assessment we should also take into account the fact that *Trichinella* spp. has not been detected in a representative sample of piglets slaughtered over several years, as indicated above.

According to the literature, the newly born larvae (NBL) of *Trichinella* spp. do not acquire the ability to infect until the day 15 to 20 post-infection. The authors do not consider it possible in any case before the day 15 p.i. and the data provided by experiments with piglets establish this date on the day 17-19 days after direct supply of infective larvae (Díez-Baños et al., 2011).

Keeping the usual weaning period at 21-28 days, and considering the high-risk scenarios (recently weaned pigs and those in an extensive environment that may have been in contact with material contaminated with *Trichinella*), the possibility of occurrence of infective larvae would be between the day 38 and 47 of life (more than 5 weeks). Therefore, the maximum age at slaughter that would imply a **low** risk of transmitting trichinosis in non-controlled piglets weaned at the age of 21 days is **five weeks (35 days).**

2. Regarding young pigs, when they are bred in intensive farms without an audit of supervision of the housing conditions, as described in relation to *Trichinella* in Annex I of the EFSA report *Technical specifications on harmonised epidemiological indicators for public health hazards to be covered by meat inspection of swine:*
   a. If piglets aged between 21 and 28 days are sent directly to slaughter after weaning, could the risk of trichinosis for humans be considered negligible or even non-existent?
   b. In pigs sent directly to slaughter at a maximum age of 35 days, both if they were weaned between 21 and 28 days of being alive of if they continued being breastfed until the age of 35 days, could the risk of trichinosis for humans be considered negligible or even non-existent?
   c. In these situations, what is the maximum age at slaughter for pigs at which the trichinosis risk for humans may be considered as negligible?

If they are bred on intensive farms without the housing conditions being supervised or audited but without access to the outside, the thorough control of the feed and of the lactation and weaning rooms that should be carried out in order not to jeopardize the pigs life and development, seems to prevent the piglets from ingesting meat infected with *Trichinella* spp. before being slaughtered. Lactation is a delicate time for the breeding sow. Therefore, for the farmer's own interest, it is necessary to follow a strict protocol for the supply of water and feed, which implies that the mothers and the piglets feed is perfectly monitored, especially between birth and weaning.

In this case, the chances of piglets being in contact with material infected with *Trichinella* are practically non-existent, and the **risk can be considered as insignificant** in pigs sent directly to slaughter after weaning and up to the age of 35 days.

Regarding the maximum age at slaughter for animals bred in intensive farms without supervision or audit of the housing conditions, **the age can be estimated as being between 24 and 26 days after weaning**, taking into account that a week must be added for the adaptation of the piglet digestive system to the consumption of non-dairy products.

Uncertainties

The main uncertainty in this report is based on the qualitative risk assessment, which only allows making approximate conclusions on the actual risk of the presence and transmission of *Trichinella* through suckling pig meat consumption.

Among others, the following aspects related to this uncertainty can be considered:

a) Except for completely controlled breeding conditions, it is not possible to fully guarantee that animals have not come into contact with materials contaminated with *Trichinella*. The possibility is minimum in intensive farming (uncontrolled), but it cannot be dismissed.

b) The data from scientific studies on recently weaned piglets were obtained from experiments in which infective larvae kept in laboratory animals were administered orally. It is not possible to provide scientific data related to the digestive behaviour of animals fed with infected meat. If this were estudied, the safety period of 5 weeks could probably be increased since the digestive system of recently weaned animals is not adapted to the ingestion of meat.

c) The data provided on the prevalence of *Trichinella* in pork meat shows that *Trichinella* infection in recently weaned animals is non-existent. However this data is just a sample of the results obtained from inspection at official slaughterhouses over 5 years. They should be completed with wider epidemiological studies that provide more information, not only on animals slaughtered, but also about their age, type of farming and origin.

d) This report takes into account the likelihood of the presence of *Trichinella* spp. in piglets in slaughter conditions. This type of meat is usually roasted at 170 ºC for over an hour, which also contributes to diminish the risk. However, this factor has not been assessed as it does not involve control systems at slaughter.

e) Terms such as low risk and insignificant risk are ascribed depending on the qualitative risk assessment and on different circumstances and scientifically proven facts and those related to assumptions considered. There is no doubt that only a quantitative risk assessment can provide provable probabilistic data. This procedure was suggested by the EFSA in order to comply with the specifications of Regulation (EC) No 2075/2005, laying down specific rules on official controls for *Trichinella* in meat.

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