Survey of Trichinella spp. infection in pigs from commercial piggeries in Zimbabwe

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Submitted for publication: 10 November 1998
Accepted for publication: 24 June 1999

Summary

Trichinella spp. infection has never been reported among domestic pigs in Zimbabwe. Given that Trichinella spp. occurs in a sylvatic cycle in Zimbabwe and particularly in the light of the recent notification of the presence of the infection in farmed crocodiles, a survey was undertaken to evaluate the present epidemiological situation on commercial pig farms. Carcasses of 7,446 fattener pigs (average 11.7% ±0.2% of those slaughtered from each farm) were investigated by artificial digestion of pooled diaphragm muscle samples. These carcasses originated from 70 commercial piggeries and were selected by stratification on a farm basis from 63,602 pigs slaughtered during the survey period. No Trichinella spp. larvae were found in any of the 7,446 diaphragm muscle samples. The results demonstrated no evidence of Trichinella spp. infection within the pig population of the commercial piggeries in Zimbabwe.

Keywords

Commercial piggeries — Digestion methods — Domestic pigs — Surveys — Trichinella — Zimbabwe.

Introduction

Trichinella infection is one of the most widespread zoonoses and has been reported world-wide with only a very few countries claiming freedom from the infection. Trichinella is found in at least 150 mammalian species and also in birds (19). In Africa, this nematode parasite has been isolated from many wild species (18). Natural cycles of infection occur amongst reservoir hosts including carnivores, scavengers and other predators which have an important role in transmission. Domestic pigs, humans and horses are occasional hosts. In Africa, Trichinella infection has not been reported in domestic pigs south of the Sahara, although pigs may acquire sylvatic infection (10).

In Zimbabwe, Trichinella has been detected in civet (Viverra civetta), spotted hyaena (Crocuta crocuta) (20), black-backed jackal (Canis mesomelas) (6) and in lion (Panthera leo) and cheetah (Acinonyx jubatus) (R. Jooste, personal communication, 1998). Recently, the infection was reported for the first time in farmed crocodiles (Crocodylus niloticus) (4). Routine surveillance of pig carcasses at abattoirs has not detected the presence of Trichinella larvae for over thirty years, suggesting either that the parasite has not been present or has been present at a very low prevalence (J.B. Condy, personal communication, 1997). Trichinella is a notifiable organism in Zimbabwe because of international trade requirements and public health concerns.

In order to evaluate the present epidemiological situation and to avoid the potential health hazard of trichinellosis both in Zimbabwe and in countries importing pork from Zimbabwe, a survey was initiated to detect the presence of Trichinella larvae in carcasses of pigs reared in commercial piggeries and slaughtered at abattoirs of a large food processing company in Zimbabwe.

Materials and methods

Sample collection

A specimen of at least 20 g muscle tissue from both diaphragm pillars was taken for examination from each of 7,446 carcasses, following the directives of the Commission of the European Economic Community (2, 3). These individual specimens were placed in special trays capable of holding 300 samples, separated on the basis of the farm of origin.
If the infection is present in the population at an upper limit level (d) of < 0.06%, the size of the sample (n) required for testing at the 99% confidence level (β) for the presence of at least one positive sample, was determined using the following formula (1):

\[ n = (1 - \beta^{\text{sub}}) \cdot \left( N - \frac{d}{2} - 1 \right) \]

where:
- n is the number of animals sampled
- \( \beta \) is the desired confidence level
- N is the population size
- d is the upper limit of assumed positives.

Consequently, 7,434 (11.7%) carcasses of a total of 63,602 pigs slaughtered during the survey period had to be tested for Trichinella infection.

### Sample digestion

Artificial digestion of collective muscle samples (pools of 20 samples at a time) was used for detection of Trichinella larvae. From each individual specimen of diaphragm muscle tissue, a 5 g sample was obtained. Twenty 5 g samples from pigs sourced from one farm were combined in each 100 g pool. The pooled sample was ground in a commercial meat grinder to facilitate digestion. Each 100 g of ground tissue was then added to 1 litre of artificial gastric fluid containing 1% w/v pepsin (strength 1:12,500 [British Pharmacopoeia]) and 1% w/v hydrochloric acid (0.12 N final). The mixture was stirred on a magnetic stirrer and incubated at 38°C in a water bath for 20 h to provide complete digestion and to ensure that any Trichinella larvae present in the sample would be detected.

The digestion was filtered through a wire sieve (mesh size 180 µm) into a conical glass. The debris in the sieve was gently washed with a fine spray of water in order to remove larvae which may have been trapped on the screen. After settling for 30 min at room temperature, the supernatant was withdrawn by suction, leaving a final volume of 50 ml. The sediment was washed repeatedly with water (30°C) until the supernatant fluid was clear. The washed sediment in a final volume of 10 ml was transferred to a gridded Petri dish and examined under a dissection microscope at x 40 magnification for the presence of Trichinella larvae.

The digestion method employed has a sensitivity of approximately 1 larva per gram of tissue examined. As a quality control test, a representative sample of crocodile muscle tissue containing a known number of Trichinella larvae per gram was digested simultaneously with each batch of pork. In the case of a doubtful result following the examination of a pooled sample digest, the entire procedure had to be repeated on each of the individual samples comprising the pool.

### Results

From October 1997 to March 1998, 7,446 carcasses of fattener pigs were stratified and selected on a farm basis from a total of 63,602 pigs, slaughtered at the abattoirs during the survey period. The pigs originated from 70 commercial piggeries country-wide which produce approximately 80% of the swine in the commercial sector. An average of 11.7% (±0.2%) of those pigs slaughtered from each farm were randomly sampled and muscle tissue tested for Trichinella larvae. This ensured adequate representation of those pigs slaughtered from each farm in the aggregate population. The annual production of the 70 commercial piggeries amounted to 119,708 fattener pigs.

The hygienic conditions in the farms were generally of a high standard. The animals were penned without access to fenced outdoor lots and were fed a commercial diet. The pigs had no free access to garbage containing pork or offal. Malnutrition was not evident and observations indicated that mortality among the pigs was very low. Evidence of cannibalism was not observed at any time by inspection. The commercial piggeries had a limited commensal rodent population which was kept under control continuously. Feral cats did not have access to the farms. There was no history of Trichinella infection.

Using the pepsin digestion technique, no Trichinella larvae were detected in any of the 7,446 samples of diaphragm muscle collected from 11.7% (±0.2%) of those pigs slaughtered from each farm during the survey period. All carcasses tested were negative for Trichinella infection and consequently, no carcasses were condemned as unsuitable for human consumption due to Trichinella infection and none of the meat derived from those carcasses was subject to long freezing periods or heat treatment. All meat was released for domestic and export markets.

### Discussion

The examination of 7,446 carcasses of fattener pigs originating from 70 commercial piggeries in Zimbabwe did not reveal Trichinella infection using the digestion method. This finding confirms the results of previous incomplete examinations at abattoirs, which also failed to find Trichinella larvae in the muscle of carcasses of domestic pigs. The author can certify that, at a 99% confidence level, the infection is not present at a level greater than 0.06% (which would be less than 37 positive animals in this population); it is also possible that the infection is absent within the commercial pig population. This is consistent with the negative findings of other studies of Trichinella infection in domestic pigs (5).

To prove that Trichinella is not present among these animals requires the testing of all individual carcasses in the population. However, this approach would not be
cost-effective. Nevertheless, the results of the current survey provide sufficient information to prove that if the infection is at all present, prevalence is very low in pigs reared in commercial piggeries in Zimbabwe (less than 6 out of 10,000).

An interesting problem arises concerning identification of the Trichinella species involved in the sylvatic cycle of infection in Zimbabwe; isolates have never been identified to the species level. Trichinella isolates from Kenya, Tanzania and South Africa have recently been characterised as *T. nelsoni*, and isolates from South Africa and Namibia as *Trichinella T8*, with uncertain taxonomic status (15, 16). Analysis of enzyme polymorphism of various geographical isolates of *Trichinella* have shown that isolates from wild carnivores are distinct from those from domestic pigs (11). In Africa, sylvatic isolates of *Trichinella* have been of low infectivity to domestic pigs (8, 9, 12, 13, 19, 21). Although thousands of domestic pigs have been examined for parasites in Kenya, the results have always been negative (12). In this context, the data concerning freedom from *Trichinella* of domestic pigs in commercial piggeries in Zimbabwe should not be viewed as an indication of the level of abundance of sylvatic trichinellosis in the country, as pigs may not be involved in the sylvatic cycle.

The low level of *Trichinella* infection in sylvatic suidae, the practice of eating only well-cooked meat and religious laws and customs that restrain the consumption of pork probably account for the rarity of human trichinellosis in Africa south of the Sahara (17). A recent publication which stated that young caimans (*Caiman sclerops*) were refractory to infection with nine different *Trichinella* isolates (7) is inconsistent with the findings in farmed crocodiles in Zimbabwe. However, the authors do concede that the parasite found in Nile crocodiles (*Crocodylus niloticus*) may represent a new taxon of *Trichinella*, with different biological characteristics to those used in trials with caimans. Alternatively, the method of infection or age and species of crocodilian on which the experiments were based may have influenced the results.

The negative results obtained so far by the examination of a relatively large number of pigs sourced from commercial piggeries in Zimbabwe are reassuring, but should not lead to overconfidence. For a country to be declared free from infection, certain requirements of the Office International des Epizooties must be fulfilled (14). The most important of these requirements is that there is no evidence in animals, within the country or zone, of any pathological effects due to the presence of the pathological agent, and that all results prove that the pathogenic strains of the particular agent have been eliminated.

In Zimbabwe, cull pigs at the abattoirs studied are delivered from commercial farms where control of rodents and general management conditions are good. In future, control efforts should be focused on eliminating all risk factors on the farm, in addition to the monitoring of *Trichinella* infection of a portion of the pigs produced and of rodents. This will assist in gaining *Trichinella*-free status for individual herds in the commercial pig production sector.

However, non-commercial piggeries in Zimbabwe frequently operate in a much less intensive manner and under less hygienic conditions. Pigs on these farms may have an increased risk of exposure to *Trichinella* larvae but are less likely to be processed at licensed premises because of associated costs. Although meat cannot enter the domestic retail or export market unless inspected by the Veterinary Public Health Branch, uninspected products may be consumed following the private slaughter of animals, which is the practice outside urban areas. In this context, a *Trichinella* surveillance programme is necessary, especially in non-commercial pig farms, to provide further evidence that the country is free from this infection and to ensure that all public health concerns are met. Surveillance should be implemented on pig carcasses destined for export, in addition to the random sampling of cull breeding pigs.

**Acknowledgements**

This survey was financially supported by the Department of Veterinary Services of Zimbabwe and Colcom Foods, Zimbabwe. The author is grateful to the Director of Veterinary Services, Zimbabwe, for permission to publish this paper.
Enquête sur la trichinellose dans des élevages industriels de porcs au Zimbabwe

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Résumé
La trichinellose n’a jamais été signalée chez les porcs domestiques au Zimbabwe. Compte tenu des cycles d’infection naturelle par Trichinella spp. survenant régulièrement parmi les populations sauvages de ce pays ainsi que des cas récents observés chez des crocodiles d’élevage, une enquête a été menée pour évaluer la situation épizootiologique actuelle dans les élevages industriels de porcs. Des prélèvements musculaires de diaphragme issus de 7 446 carcasses de porcs à l’engrais (en moyenne 11,7 % [±0,2 %] des animaux abattus dans chaque élevage) ont été soumis au diagnostic par la méthode de digestion artificielle. Les carcasses, qui provenaient de 70 élevages industriels de porcins, ont été sélectionnées, par stratification des élevages, parmi les 63 602 porcs abattus pendant l’enquête. Aucune larve de Trichinella spp. n’a été décelée dans les 7 446 prélèvements de diaphragme. D’après ces résultats, la population porcine des élevages industriels du Zimbabwe est indemne de Trichinella spp.

Mots-clés

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Estudio de la presencia de Trichinella spp. en explotaciones porcinas industriales de Zimbabue

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Resumen
En Zimbabue nunca se han notificado casos de infección por Trichinella en cerdos domésticos. Dada la existencia del parásito en el país, donde presenta un ciclo silvestre, y sobre todo la reciente declaración de la infección en granjas de cocodrilos, se emprendió un estudio para evaluar la actual situación epidemiológica en las explotaciones porcinas de carácter industrial. A tal efecto se analizaron, por digestión artificial de una mezcla de muestras musculares de diafragma, las canales de 7.446 cerdos de engorde (en promedio, un 11,7% [± 0,2%] de los cerdos sacrificados en cada granja). Para seleccionar las canales, originarias de 70 granjas porcinas industriales, se procedió granja por granja y por estratificación a partir del total de 63.602 cerdos sacrificados durante el período de duración del estudio. En ninguna de las 7.446 muestras de diafragma se observó la presencia de larvas de Trichinella. Los resultados no ofrecieron prueba alguna de infección por ese parásito en la población porcina de las explotaciones industriales de Zimbabue.

Palabras clave
References


