

## Case Report

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Received 2 July 2014  
Accepted 28 August 2014

# A case of trichurosis in gilts and fattening pigs

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**Introduction:** *Trichuris suis*, also called whipworm, is a parasite of the caecum and colon distributed widely and considered as a fairly common parasite in swine. It may be responsible for porcine trichurosis characterized by diarrhoea, anorexia, growth retardation, dehydration, emaciation and anaemia.

**Case presentation:** This report presents a case of trichurosis diagnosed in a farrow-to-finish Belgian pig herd. The infection was associated with severe and persistent diarrhoea, growth retardation, emaciation and/or anaemia in 10 recently purchased gilts and in fattening pigs. In gilts, levamisole [8 mg (kg body weight)<sup>-1</sup>] administered once *per os* gave a good clinical response, as diarrhoea resolved in nine gilts out of 10. In parallel, for these nine gilts, the number of eggs of *T. suis* (g faeces passed)<sup>-1</sup> decreased from 12 400 to less than 100 eggs. In fattening pigs, flubendazole (1 mg kg<sup>-1</sup>) administrated over 5 days in drinking water allowed a reduction in the number of *T. suis* eggs g<sup>-1</sup> and was effective against diarrhoea.

**Conclusion:** Although most of the time pig whipworm infections are light and asymptomatic, in some cases when large numbers of worms are present, they can cause watery to bloody diarrhoea that can lead to anaemia. This less frequent disease should not be forgotten in the differential diagnosis of persistent diarrhoea in growing pigs.

**Keywords:** diarrhoea, flubendazole; levamisole; pigs; *Trichuris suis*.

## Introduction

Most of the time, pig whipworm infections are light and asymptomatic, although they occur with high frequency (Pittman *et al.*, 2010). Nevertheless, in some cases when large numbers of worms are present, they can cause a haemorrhagic colitis and/or a diphtheric inflammation of the caecal mucosa, resulting in acute or chronic inflammation of the caecal mucosa with watery diarrhoea, often containing blood, which can lead to anaemia (Taylor *et al.*, 2007). The severity of the disease is usually related to the infective dose or the occurrence of concurrent bacterial enteritis (Pittman *et al.*, 2010). Additionally, whipworm infection can lead to suppression of mucosal immunity against resident bacteria (Mansfield & Urban, 1996). An efficacy of more than 90 % against *Trichuris suis* adults has been reported for fenbendazole, flubendazole and febantel given in feed, whilst for levamisole administrated subcutaneously, an efficiency against adults of between 75 and

90 % has been reported (Marriner & Armour, 1986). In most cases the treatment will be equally administered orally (*per os*, in water or in feed) or injected (subcutaneously or intramuscularly). If the disease is severe, sick pigs will have to be injected.

This report documents severe parasitism and disease in naïve gilts introduced into a highly contaminated environment. Although this is not a particularly new or unique case, the present article could be useful for practitioners involved in swine health management. Indeed, the recent literature informs us more about the presence of the parasite in modern swine production than about this uncommon disease.

## Case report

### Consultation purpose

Severe and persistent diarrhoea and weight loss were observed in 10 recently purchased gilts, whilst no evident clinical signs were recorded in resident sows.

Abbreviation: EPG, eggs of *T. suis* (g gilt faeces)<sup>-1</sup>

## Clinical history

A 40-sow, farrow-to-finish unit breeding crossbred Duroc × French Landrace sows with a Piétrain boar was affected by severe and persistent diarrhoea in 10 recently purchased gilts. The 10 gilts were introduced to the pig farm on 10 March 2009. They were 6 months old and weighed 110 kg on average. Diarrhoea appeared in April. The veterinarian advised the farmer to perform several treatments. Ivermectin (Ecomectin) was administered to the 10 gilts in early May as a subcutaneous injection ( $0.3 \text{ mg kg body weight}^{-1}$ ). As there was no clinical response to ivermectin treatment, enrofloxacin  $2.5 \text{ mg kg}^{-1}$  was administered once daily for 3 days. Florfenicol (Nuflor)  $15 \text{ mg kg}^{-1}$  was injected intramuscularly twice at 48 h interval. Finally, tiamulin (Tiamutin 10 %) was intramuscularly injected ( $8 \text{ mg kg}^{-1}$ ) from 4 June once daily for 3 days. As no clinical improvement was observed, we were contacted on 9 June.

## Farm and clinical description

**Farm description** Apart from sows and piglets that were kept on a fully slatted floor in the farrowing room, all other pig production stages were kept on or had access to deep sawdust litter. Following their introduction to the herd, the 10 gilts were kept in the group of gestating sows in a large room equipped both with a large deep sawdust litter resting area and a concrete slatted floor area. The nursery consisted of three pens, and fattening pigs were kept in six pens, all equipped with deep sawdust litter. Both nursery and finishing pens were in continuous flow. Annually, the dirtiest litter was removed and some fresh sawdust was added. But there was no all-in all-out procedure for cleaning and disinfection. The routine deworming programme consisted of a doramectin injection of  $1 \text{ ml } 33 \text{ kg}^{-1}$  (Dectomax  $10 \text{ mg ml}^{-1}$ ) for sows 1 week before entering the farrowing room and of levamisole  $8 \text{ mg kg}^{-1}$  (Levamisole hydrochloride 80 % Kela) in drinking water every 8 weeks for fattening pigs.

**Clinical description** During our visit (10 June), we observed diarrhoea in gilts but no clinical signs in sows. All 10 gilts also presented growth retardation, and there was even emaciation in two animals. At that time, severe, persistent diarrhoea (liquid to pasty and greyish to orange faeces) and growth retardation were also present in fattening pigs.

## Investigations

### Coprology

Faeces were collected manually from the rectum of gilts. A standard sedimentation/flotation technique and a McMaster egg-counting technique on pooled faecal samples were performed. Briefly, for the sedimentation/flotation technique, 4 g fresh faeces was mixed with 56 ml

water and then filtered ( $150 \mu\text{m}$  filter). The supernatant was centrifuged up to 1000 g. The pellet was resuspended in a saturated solution of  $\text{ZnCl}_2$  and NaCl and centrifuged up to 100 g. The tubes were filled with the  $\text{ZnCl}_2/\text{NaCl}$  solution in order to obtain an upper meniscus. A cover slip was deposited onto the meniscus. Five minutes later the cover slip was removed and examined at a magnification of  $\times 100$  for the presence of eggs. For the McMaster egg-counting technique, 4 g fresh faeces was mixed with 56 ml saturated NaCl solution, and the supernatant was stirred. The McMaster compartments were filled and examined 5 min later at a magnification of  $\times 100$ . The sensitivity of the McMaster technique is 25 eggs in 1 g faeces.

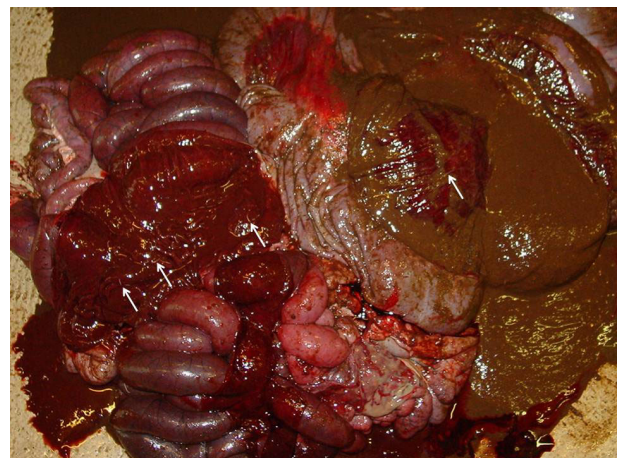
The McMaster count (10 June) showed 12 400 eggs of *T. suis* (g gilt faeces) $^{-1}$  (EPG). Sows kept in the same pen showed only a few *T. suis* eggs in faeces.

## Post-mortem examination

Despite the treatment, one gilt died 6 days later. The animal was emaciated (9 months old and weighing 80 kg) and the ocular and buccal mucosa were pale. The necropsy examination highlighted a haemorrhagic and acute enterotyphlocolitis (Fig. 1). Numerous adult whipworms were seen in mid-gut, caecum and colon.

## Stool PCR test

A stool sample was collected during necropsy and sent to bioScreen GmbH (Münster, Germany) to perform a PCR test for the detection of *Brachyspira hyodysenteriae*, *Brachyspira pilosicoli*, *Lawsonia intracellularis* and/or *Salmonella* Typhimurium. Using the present protocol, *Brachyspira hamptonii* could not be detected. The result was negative for the four tested pathogens.



**Fig. 1.** Haemorrhagic enterotyphlocolitis (arrows show *T. suis*).

## Histopathological findings

This histopathological examination revealed a very severe typhlocolitis (Fig. 2) with a subacute inflammatory infiltrate in mucosae and submucosae. The infiltrate was mostly comprised of round nucleus cells with lymphocytes, plasmocytes and macrophages but also neutrophils and rare eosinophils. There were numerous picnotic cells and mucosal superficial necrosis. Furthermore, an important intravascular leucocyte influx was observed with occasional thrombosis. In the small intestine, mild subacute enteritis was observed with exclusively round nucleus cells in the mucosa; the submucosa was undamaged.

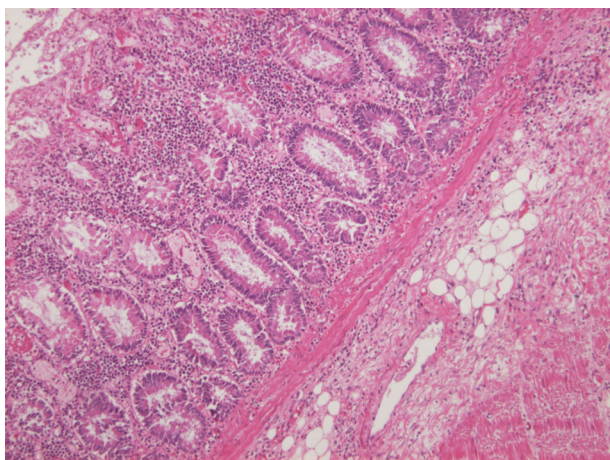
## Diagnosis

The differential diagnosis of diarrhoea and weight loss in gilts and/or fattening pigs mostly includes parasitism, haemorrhagic proliferative enteropathy (*Lawsonia intracellularis*), salmonellosis (*Salmonella* Typhimurium) and *Brachyspira* infections such as swine dysentery (*Brachyspira hyodysenteriae*) (Thomson & Friendship, 2012). The major helminth species involved in diarrhoea in temperate pig production include *T. suis* (whipworm), and *Oesophagostomum* spp. (nodular worm). According to the history of the case, the differential diagnosis should be limited here to *T. suis* and *Brachyspira hyodysenteriae* and, as it was recently isolated in Belgium, to *Brachyspira hamptonii* (Mahu *et al.*, 2014).

From laboratory examinations, trichurosis was diagnosed.

## Treatment

Gilts were treated *per os* on 10 June with levamisole (Levamisole hydrochloride 80 % Kela; 8 mg kg<sup>-1</sup>).



**Fig. 2.** Histopathological examination showing severe colitis (electron microscopy, magnification  $\times 100$ ).

## Outcome and follow-up

The day after treatment, abundant whipworms were observed in faeces. The clinical response was good in nine of the 10 gilts as the diarrhoea resolved. Later, one of the nine gilts that recovered was nevertheless culled because of marked emaciation. One gilt died 6 days after treatment. The most likely explanation is that this gilt had not properly ingested the administered doses of levamisole.

Twelve days after treatment, a coprological test was performed (22 June), showing an EPG of  $\leq 100$  in gilts and sows. A routine anthelmintic treatment was then recommended for purchased gilts: levamisole 8 mg kg<sup>-1</sup> *per os* (Levamisole hydrochloride 80 % Kela) once 3 weeks after their introduction to the farm. It was also recommended to treat sows with levamisole 8 mg kg<sup>-1</sup> *per os* (Levamisole hydrochloride 80 % Kela) once 3–7 days before they entered the farrowing room.

To treat fattening pigs, our recommendation was to inject pigs once with levamisole. However the farmer did not accept an injectable treatment for fattening pigs. We then recommended the administration of flubendazole 1 mg kg<sup>-1</sup> (Solubenol 100 mg g<sup>-1</sup>) in drinking water over 5 days. As the farmer was not equipped to solubilize the flubendazole emulsion, he tried different deworming treatments. From August 2009 to December 2010, coprological examinations were performed routinely to evaluate the efficacy of the treatments. Neither levamisole in drinking water (8 mg kg<sup>-1</sup>) nor febantel in feed (5 mg kg<sup>-1</sup>) was able to decrease the number of EPG or to stop the diarrhoea. Finally, flubendazole 1 mg kg<sup>-1</sup> (Solubenol 100 mg g<sup>-1</sup>) was given in drinking water over 5 days once every 3 and subsequently 5 weeks. At the end of the first treatment, 0 EPG was detected in the pens. The treatment had also a positive effect on diarrhoea and the pig pens were more homogeneous.

In October 2010, because of the higher price of flubendazole, the farmer decided to use levamisole 8 mg kg<sup>-1</sup> (Levamisole hydrochloride 80 % Kela) once a month. In November and December 2010, faecal *T. suis* eggs counts in one of the fattening pens were 300 and 200 EPG, respectively.

## Discussion

The 10 purchased gilts were heavily infected by *T. suis* and presented a severe disease 1 month after their introduction to the farm. As described by Pittman *et al.* (2010), clinical trichurosis requires a very high number of eggs to be applied to a concentrated area in a short period, or constant contamination of the environment with subsequent en masse development of the eggs. Pasture may be a risk factor for trichurosis, but here the deep sawdust litter present in this farm may also have played an important role in the contamination of gilts. Perhaps the immunodepression induced by stress (new environment, electronic sow feeder) and/or possible concurrent infections in newly



introduced gilts could also explain the severity of the disease observed here (Mansfield & Urban, 1996). Otherwise, the fact that sows kept in the same pen presented low numbers of EPG over a prolonged period (Pedersen & Saeed, 2001). Immunity reduces adult worm formation and induces a reduction in the number of EPG (Pittman *et al.*, 2010).

The heavy whipworm infection could explain the severity of the lesions observed. Indeed, Taylor *et al.* (2007) reported that occasionally, when large numbers of worm are present, they can cause a severe typhlocolitis. In the present case, enteritis of the small intestine was also observed. During the life cycle of *Trichuris* spp., the L1 larvae penetrate the mucosa via the crypts of Lieberkühn in the distal ileum, caecum and colon (Pittman *et al.*, 2010). Later, although most adults are located in the caecum and proximal colon, they can be recovered anywhere from the distal ileum to the rectum. This situation could explain the localization of the lesions in the mid-gut.

Ivermectin used as the first treatment (May 2009) showed no clinical efficacy against *T. suis* in gilts as diarrhoea was still present 1 month after treatment. A similar failure was also recorded in a previous study where a subcutaneous injection of ivermectin 0.3 mg kg<sup>-1</sup> had an efficacy of only 53.9 % for *T. suis* (Marchiondo & Szanto, 1987). Levamisole (8 mg kg<sup>-1</sup>) was evaluated in 1975 by Ferguson and White. When administered in feed or drinking water, the anthelmintic efficacy was 100 and 91 % for whipworms, respectively. In another study (Marti *et al.*, 1978), an efficacy as low as 26.1 % was recorded. In the present study, levamisole administered individually *per os* to gilts allowed the treatment of trichurosis in nine of the 10 animals.

In fattening pigs, levamisole (administered over 4–6 h in drinking water) and febantel (administered over 1 day in feed) did not result in a decrease in the number of EPG or the treatment of diarrhoea. A good clinical response and a reduced number of EPG were obtained with flubendazole (administered in drinking water over 4 h for 5 days consecutively). Thereafter, both flubendazole and levamisole in drinking water seemed effective to maintain a low number of EPG. The altered feeding and/or drinking behaviour of sick fattening pigs could potentially reduce their feed and/or water consumption and thus impair levamisole and febantel ingestion. To avoid such a situation, the initial curative treatment should have been administered by injection (with levamisole) and then followed by a routine oral worming. Flubendazole given consecutively for 5 days gave good results.

The treatment frequency recommended considering the prepatent period (41–47 days) of *T. suis* is 2 months (Taylor *et al.*, 2007). To treat a clinical case of trichurosis and in order to break the life cycle and reduce environmental contamination with eggs, pigs should be treated before the end of the minimum prepatent period, i.e. maximally every 5 weeks. Nevertheless, such a high frequency could lead to drug resistance (Hansen *et al.*, 2013).

The control of trichurosis based entirely on the use of drugs is unsustainable. Generally, trichurosis is less frequent when swine are bred in confinement rather than in an outdoor raising system. In this farrow-to-finish farm, the litter was changed infrequently and only superficially. This management provided optimal conditions (prevention of dehydration, protection from high/low temperatures) for egg embryonation and survival for up to several years (Pittman *et al.*, 2010). In soil, the eggs remain infective for up to 11 years (Burden & Ginnivan, 1978). This may also be true in deep litter. Deep sawdust litter should be renewed completely and at least annually. Moreover, the pens should be cleaned thoroughly and disinfected with wet or dry heat (>55 °C) (Pittman *et al.*, 2010).

The implications of these results are as follows:

1. Trichurosis should be included in the differential diagnosis of diarrhoea and weight loss in gilts and fattening pigs, particularly if they are raised outdoors or on deep sawdust litter.
2. In this case, levamisole (8 mg kg<sup>-1</sup>) individually administered *per os* to sick gilts and flubendazole (1 mg kg<sup>-1</sup>) administered over 5 days in drinking water in fattening pigs resulted in a reduction in the number of *T. suis* EPG and the treatment of diarrhoea.
3. Deep sawdust litter should be regularly and completely renewed in case of *T. suis* infection. *T. suis* eggs can survive for long periods and this may contribute to permanent and/or heavy (re)infection of animals, despite the administration of anthelmintics.

## Acknowledgements

The authors would like to thank Dr Bart De Bock, Dr Emilio Serrano and Dr Cathy Ardiès for case discussions and Mrs Françoise Maréchal for her help in the Parasitology Laboratory. The authors declare that they have no competing interests.

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