

## FALSE-POSITIVE *TRICHURIS SUIS* EGG COUNTS IN PIGS IN RELATION TO COPROPHAGIA

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### Summary :

Sixteen non-infected control pigs housed together with 16 pigs infected with *Trichuris suis*, excreted *T. suis* eggs in their faeces (range 20-4,960 eggs per gram faeces (EPG)). When the control pigs were moved to clean pens, their egg counts dropped to zero EPG within five days. A significant correlation was found between *T. suis* egg counts of infected and control pigs penned together ( $r = 0.89$ ,  $P < 0.001$ ). These results suggest that false-positive faecal egg counts may be the result of coprophagia.

**KEY WORDS :** *Trichuris suis*, false-positive egg counts, pigs, coprophagia.

### Résumé :

COMPTAGE FAUSSEMENT POSITIF DES ŒUFS DE *TRICHURIS SUIS* CHEZ LE PORC  
Seize porcs témoins sains, placés avec 16 porcs contaminés par *Trichuris suis*, excrètent des œufs de *T. suis* dans leurs fèces (de 20 à 4 960 œufs par gramme de fèces). Quand les porcs témoins ont été placés dans des enclos propres, le nombre d'œufs dans leurs fèces est passé à zéro en l'espace de cinq jours. Une corrélation significative a été trouvée entre le nombre d'œufs présents chez les porcs contaminés et chez les porcs témoins ( $r = 0,89$ ,  $P < 0,001$ ). Ces résultats confirment que le comptage faussement positif des œufs dans la matière fécale est peut-être le résultat de la coprophagie comme suggéré antérieurement.

**MOTS CLÉS :** *Trichuris suis*, comptage faussement positif des œufs, porcs, coprophagie.

The presence of intestinal worm infections is usually demonstrated by determination of faecal egg counts. However, discrepancies are sometimes observed between egg counts and worm burdens. Animals that do not harbour worms may excrete eggs in their faeces, causing false-positive egg counts, due to ingestion and passage of eggs, especially the thick-shelled, resistant types of eggs, which may be present in the environment in large numbers. This phenomenon is particularly common for the large roundworm of pigs, *Ascaris suum*, as demonstrated in slaughterhouse surveys (Bindseil, 1974; Bøgh *et al.*,

1994) and under experimental conditions (Eriksen *et al.*, 1992). Boes *et al.* (1997), in a survey of twelve experiments on *A. suum* infections in pigs, reported that the percentage of pigs with false-positive *A. suum* egg counts ranged from 4 to 36 %. Prevalence of false-positive egg counts and their magnitude were correlated primarily with housing/management factors. This survey further supported earlier suggestions that coprophagia, i.e. direct ingestion of faeces, can be a major source of false-positive egg counts in pigs.

*Trichuris suis* is a nematode frequently encountered in various pig production systems, with highest prevalences in systems involving outdoor rearing (Roepstorff & Nansen, 1994). As with *A. suum*, *T. suis* eggs are resistant to adverse conditions and have a relatively slow embryonation rate (Burden *et al.*, 1987; Roepstorff & Murrell, 1997), and pre-infective eggs may therefore accumulate in large numbers in faeces and soil. Johansen *et al.* (1997), in a recent study investigating the effect of malnutrition on the establishment of *T. suis* infections in pigs, observed high numbers of *T. suis* eggs in the faeces of uninfected control pigs penned together with pigs experimentally infected with *T. suis*. This observation prompted the retrospective study presented in this short report, with the objective to describe this phenomenon in detail and to point out its possible cause.

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Briefly, the experiment comprised two groups of 16 four-week old pigs which were fed either a high- or low-protein diet, in order to test hypotheses relating to malnutrition and parasitism (Johansen *et al.*, 1997). After 11 weeks on the experimental diets, eight pigs in the low-protein group and eight pigs in the high-protein group were each infected orally via a stomach tube with 4,000 infective *T. suis* eggs that had been isolated from pig faeces. The remaining eight pigs in each group were kept as uninfected controls in the same pen together with the infected animals. The pens had solid floors with a straw bedding and were located in a rodent-free environment to prevent contamination with *T. muris*. Faecal samples were collected from the rectum of each pig every second week of infection. Egg counts were determined using a modified McMaster technique (Roepstorff & Nansen, 1997), expressed as number of eggs per gram faeces (EPG). Twelve weeks post infection (day 79 p.i.) all infected pigs were slaughtered and adult *T. suis* worms were recovered according to the procedure described by Roepstorff & Murrell (1997). Because *T. suis* eggs were observed in the faeces of the uninfected control pigs, they were moved groupwise to two clean pens on the same day when the infected pigs were slaughtered, and their egg excretion was measured for ten additional days.

Substantial numbers of *T. suis* worms were obtained from the experimentally infected pigs in the low- and high-protein groups (mean worm counts 1,786 and 1,357, respectively) and were statistically indistinguishable. Faecal egg counts reached maximum levels (arithmetic mean EPG = 47,220) on day 65 p.i. in the infected low-protein pigs (Table I), but the mean faecal egg count in their uninfected penmates was as high as 2,890 EPG on the same day (Table I). Infected and control pigs receiving a high protein diet generally showed lower egg counts, with a mean peak egg count on day 65 p.i. of 15,737 and 186 EPG, respectively (Table I). The higher egg counts in pigs on a

low protein diet were primarily the result of reduced weight gains and lower feed consumption leading to production of less faeces, even though all pigs were fed *ad libitum*; the higher egg counts in the low-protein group were therefore not unexpected. However, *T. suis* egg counts dropped to zero within five days in all control pigs from the low- and high-protein groups after the infected pigs had been slaughtered. No worms were found in any of the control pigs when they were slaughtered ten days later.

These observations suggest that false-positive *T. suis* egg counts of considerable magnitude may occur in pigs under experimental circumstances. Moreover, since all pigs practise coprophagia to some extent, faecal egg counts of true-positive pigs will also be biased, especially when large numbers of eggs are excreted by the true-positive animals. A significant positive correlation was found between mean *T. suis* faecal egg counts throughout the study of infected and control pigs housed together in the same pen (Pearson correlation coefficient  $r = 0.89$ ,  $n = 10$ ,  $P < 0.001$ ). Under controlled conditions false-positive egg counts may therefore be avoided if experimentally infected pigs are housed separately. However, false-positive egg counts may seriously complicate studies such as prevalence surveys in which the infection status of individual animals or herds is unknown and can be based on faecal egg counts only. It should also be noted that sporadic *Trichuris* eggs found on pig farms could be *T. muris* eggs, which are indistinguishable from *T. suis* eggs, excreted by rodents that are common on most pig farms (A. Roepstorff, pers. comm.).

Our observations also strongly suggest that false-positive *T. suis* egg counts in pigs are the result of coprophagia. Although bedding material was used in the pens, the only source of eggs could have been the faeces of infected penmates. This is supported by the fact that the egg counts in the non-infected pigs coincided with the occurrence of faecal egg counts in the inoculated pigs after the 8-week prepatency period.

	Mean <i>T. suis</i> EPG (+ range) post inoculation								Mean <i>T. suis</i> EPG (+ range) after slaughter of infected penmates				
	day	0	15	28	41	57	65	71	79	80	81	85	89
HP-infected	0	0	0	63	9,873	15,737	8,749	5,357*	—	—	—	—	—
				(20-280)	(500-17,040)	(240-61,200)	(40-16,440)	(60-18,720)					
HP-control	0	0	0	0	220	186	163	57	17	3	0	0	0*
					(40-540)	(60-340)	(100-280)	(0-200)	(0-60)	(0-20)			
LP-infected	0	0	0	63	27,925	47,220	38,608	27,535*	—	—	—	—	—
				(20-320)	(860-53,520)	(4,800-82,320)	(1,260-78,960)	(980-81,360)					
LP-control	0	0	0	0	740	2,890	1,080	810	423	180	0	0	0*
					(200-1,880)	(1,220-4,960)	(780-1,460)	(440-1,260)	(0-2,780)	(0-1,320)			

\* Determined at slaughter

Table I. — Arithmetic mean *Trichuris suis* faecal egg counts (EPG) in infected and control pigs (group  $n = 8$ ) fed a high-protein (HP) or low-protein (LP) diet. Infected pigs were slaughtered on day 79 p.i. and the control pigs moved to clean pens.

Furthermore, the magnitude of the false-positive *T. suis* egg counts was positively correlated with the magnitude of egg counts in infected pigs. Finally, when the uninfected control pigs were removed from the original pens also containing infected pigs and placed in clean pens, their egg counts disappeared within a few days. This is in accordance with the conclusions of Eriksen *et al.* (1992) and Boes *et al.* (1997), who suggested that false-positive *A. suum* egg counts in indoor reared pigs are the result of coprophagia, which was shown to be a part of normal pig behaviour and essential for young piglets (Sansom & Gleed, 1981).

We conclude that false-positive *T. suis* egg counts in pigs may occur under experimental indoor conditions and may be an important source of experimental error in estimations of both prevalence and intensity of infection. When egg excretion is high the egg counts of true-positive pigs will be biased as a result of coprophagia. Whether false-positive egg counts occur with a similar frequency in situations with natural *T. suis* infections, deserves further investigation. The possibility of false-positive faecal egg counts should be borne in mind when studies are performed to estimate the prevalence of *T. suis* in pigs, or when it should be decided which pigs are infected and which are not if pigs are not housed individually.

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