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Short communication

Prevalence of *Isospora suis* and *Eimeria* spp. in suckling piglets and sows in Poland

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Abstract

The aim of this investigation was to determine the prevalence of coccidian infections in suckling piglets and sows in Poland. The research was carried out in 14 out of 16 Polish provinces in the years 2003–2005. The investigation was conducted on three types of farms: large farms (>100 sows), medium farms (25–100 sows) and small farms (<25 sows). Diarrhoea of unweaned piglets was observed on all the examined farms. Overall, 780 litters of suckling piglets from 104 farms and 267 mother sows were examined. The faeces were analyzed with the modified McMaster method. *Isopsora suis* was found in 217 (27.8%) litters from 70 (66.7%) farms. *Eimeria* spp. was detected only in 20 (2.6%) litters from 12 (11.5%) farms. On the large farms *I. suis* infection was detected in 31.7% of litters whereas *Eimeria* spp. in 1.4% of them. On the medium sized farms *I. suis* was found in 18.1% of litters and *Eimeria* spp. in 0.6%. On the small farms *I. suis* was detected in only 13.2% of litters, whereas *Eimeria* spp. in as many as 28.9%. *I. suis* and *Eimeria* spp. oocysts were found in 18 (6.7%) and 16 (6%) sows respectively. From 72 sows producing *I. suis* infected piglets only 12 (16.7%) shed *I. suis* oocysts and as little as 4 (5.6%) shed *Eimeria* oocysts. In the remaining 56 sows (77.8%) no cases of coccidian infections were detected. The results of this investigation demonstrate the high prevalence of *I. suis* in suckling piglets on the large swine farms in Poland.

Keywords: Coccidia; *Isospora suis*; *Eimeria*; Piglets; Sows; Poland

1. Introduction

Among many pathogens causing diarrhoea in suckling piglets coccidian infections, and *Isospora suis* invasion in particular, play a leading role. Piglets with clinical coccidiosis (isosporosis) presented with diarrhoea, which most frequently occurs in the second week of life, excrete a watery or pasty yellowish faeces. In piglets clinical signs result from the destructive action of coccidian endogenous developmental stages on the intestinal mucosa. Mortality due to isosporosis is at a low or even moderate level. The greatest economical losses caused by isosporosis are connected with a reduction in weight gains of infected piglets (Mundt et al., 2006; Niestrath et al., 2002). *I. suis* has been detected in piglets all over the world (Driesen et al., 1993; Meyer et al., 1999; Sayd and Kawazoe, 1996). Some investigations demonstrate the significant role of this parasite as a pathogen causing diarrhoea in suckling piglets. In Australia, for example, *I. suis* oocysts were found in more than a half of the examined diarrhoeal piglets, whilst *Escherichia coli* and rotavirus were isolated only in 17 and 18% of these piglets respectively (Driesen et al., 1993). Similar results were obtained in Germany where in 2 and 3-week-old diarrhoeal piglets *I. suis* was the most prevalent pathogen (32–40%),

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whereas *E. coli*, rotavirus and coronavirus infections were found in relatively low percentages (2–9%) (Wieler et al., 2001).

In previous decades, some prevalent studies were carried out in Poland, in which coccidia in pigs were reported, though it was generally found to be in older animals (weaners, fatteners, sows) (Janeczek, 1967; Surma, 1981). Suckling piglets, usually being the most susceptible to the pathogenic impact of these protozoans age group, were not included in these studies.

The aim of our investigation was to determine the prevalence of coccidian infections in suckling piglets and sows (mothers of the examined piglets) in Poland.

2. Materials and methods

The research was carried out between 2003 and 2005, in 14 out of 16 Polish provinces. The diarrhoea of unweaned piglets was observed on all of the examined farms. Overall, 780 litters of suckling piglets from 104 farms and 267 mother sows were examined. The Iinvestigation was conducted on three types of farms: 63 large farms (>100 sows), 30 medium farms (25–100 sows) and 11 small farms (<25 sows). The examined swine groups were comprised of: 571 litters and 159 sows from large farms, 171 litters and 98 sows from medium sized farms, and 38 litters and 10 sows from small farms. Faecal samples of 5 to 28-day-old piglets were collected directly from the rectum. Samples were taken from 3 to 5 piglets per litter and pooled. 5–10% of litters from each farm were investigated. In addition a faecal samples was collected from the mother sows directly from the rectum, or from the floor directly after defecation. The faeces were analyzed with the McMaster method in Raynaud modification and the OPG value (number of oocysts per gram of faeces) was estimated according to this method (Raynaud, 1970). The saturated NaCl solution sugar enriched (1 litre of saturated NaCl + 500 g sugar) was used at room temperature (specific gravity 1.3). The enrichment of flotation solution with sugar improved the microscopic examination of the samples of fatty faeces of suckling piglets. The samples were examined at 100× magnification and in questionable cases at 400× magnification. Samples with unsporulated oocysts were mixed with 2.5% potassium dichromate solution and stored on Petri dishes at 25 °C in order to induce the sporulation. The species of coccidia were defined based on oocysts morphology and sporulation time.

Chi-squared test with Yates correction was used to compare the prevalence of coccidia in piglets and sows of different types of farms. OPG values obtained in piglets and sows in different types of farms were compared using Kruskal–Wallis test (exceptionally, Kolmogorov–Smirnow test was used in the analysis of *I. suis* OPG in sows). The differences were considered statistically significant when $P < 0.05$. All the data were analysed by the use of the STATISTICA 7.1 (StatSoft).

3. Results

Overall, *I. suis* infection was found in 217 litters of suckling piglets (27.8%) derived from 70 farms (66.7%). The coccidia of *Eimeria* genus (*E. debliecki*, *E. polita*, *E. suis*) were detected in only 20 litters (2.6%) from 12 farms (11.5%). *E. polita* oocysts were detected in 15 litters (1.9%), *E. debliecki* in 11 litters (1.4%) and *E. suis* in 3 litters (0.4%), respectively. More than one *Eimeria* species occurred in 7 litters (0.9%). In five litters (0.6%) *I. suis* and *E. polita* occurred simultaneously. The mean OPG values in litters of piglets were: 5748.5 (7–150000) for *I. suis* and 3219.4 (7–43600) for *Eimeria* spp. oocysts. There were not significant differences between the OPG values (*I. suis* and *Eimeria* spp.) obtained in piglets from different types of farms.

As shown in Table 1, on the large farms *I. suis* infection was detected the most often (31.7% of litters), whereas on the small farms frequency of this infection was found to be twice as rare. The situation with *Eimeria* spp. was just the opposite: for the large and medium sized farms *Eimeria* spp. oocysts were very uncommon and detected only in some individual litters, while on the small farms these infections were found in as many as 28.9% litters. The prevalence of *I. suis* in piglets was significantly higher in large farms, however; the prevalence of *Eimeria* spp. was significantly higher in small farms.

The examination of faecal samples collected from sows (mothers of examined piglets), yielded the following results: *I. suis* oocysts were found in 18 sows (6.7%) and *Eimeria* spp. (*E. debliecki. E. polita*, *E. perminuta*, *E. suis*, *E. scabra*) in 16 sows (6%). *E. debliecki* oocysts were detected in 11 sows (4.1%), *E. polita* in 10 sows (3.7%), *E. perminuta* in 4 sows (1.5%), *E. suis* in 3 sows (1.1%) and *E. scabra* in 2 sows (0.7%). More than one *Eimeria* species occurred in 10 sows (3.7%). In only two sows (0.8%) *I. suis* and *Eimeria* oocysts (*E. debliecki* and *E. polita*) occurred simultaneously. The prevalence of *Eimeria* spp. in sows was significantly higher in small farms. There were not significant differences between the prevalence of *I. suis* in different types of farms. The mean OPG values in

Table 1
The prevalence and the mean OPG values (number of oocysts per gram of faeces) of *Isospora suis* and *Eimeria* spp. in suckling piglets and sows on different types of Polish farms

Types of farms (no. of sows on farm)	No. of examined farms	% of farms with coccidia in piglets		No. of examined litters	% of litters infected with coccidia (mean OPG)		No. of examined sows	% of sows infected with coccidia (mean OPG)	
		I. suis	*Eimeria* spp.		*I. suis*	*Eimeria* spp.		*I. suis*	*Eimeria* spp
Large (>100)	63	82.5^{a}	7.9^{b}	571	31.7^{a} (6620)	1.4^{b} (712)	159	8.2^{a} (84)	4.4^{b} (90)
Medium (25–100)	30	50.0^{b}	3.3^{b}	171	18.1^{b} (1220)	0.6^{b} (43600)	98	5.1^{a} (183)	5.1^{b} (246)
Small (<25)	11	27.3^{b}	54.5^{a}	38	13.2^{b} (2284)	28.9^{a} (1092)	10	0^{a}	40.0^{a} (769)

^{a,b}Values in the same column with differing superscripts are significantly different ($P < 0.05$).

sows were: 111.3 (7–500) for *I. suis* and 299.5 (7–3000) for *Eimeria* spp. oocysts. There were not significant differences between the OPG values (*I. suis* and *Eimeria* spp.) obtained in sows from different types of farms.

From 72 sows delivering *I. suis* infected piglets just in 12 sows (16.7%) *I. suis* oocysts and in as little as 4 (5.6%) *Eimeria* spp. oocysts were found. In the remaining 56 sows (77.8%) no cases of coccidian infections were detected.

4. Discussion

The literature reports that among coccidia *I. suis* is the most important factor causing diarrhoea in piglets. *I. suis* oocysts in piglets faeces were detected in many European countries (Farkas et al., 2004; Koudela and Vitovec, 1986; Mundt et al., 2005). Similar results were obtained in our investigations carried out in Poland, where *I. suis* oocysts were reported on 67% of the farms. In our study *Eimeria* spp. infection in piglets, like in other investigations (Niestrath et al., 2002), were uncommon. Considerably lower percentages of suckling piglets infected with *Eimeria* spp. in comparison to *I. suis*, is probably due to some differences in the development cycles of these two types of coccidia. Namely, in the environment, the time period needed for *I. suis* oocysts to become infective (the sporulation time) is very short (about 24–48 h) while *Eimeria* spp. oocysts need 5–12 days (depending on the species) to sporulate. Moreover, a microclimate in farrowing pens (high temperature – about 30 °C) can shorten the sporulation time of *I. suis* oocysts to a mere 12 h whereas, according to other authors (Lindsay et al., 1984), these conditions may hinder the sporulation of *Eimeria* spp. oocysts. This situation enables a quick spreading of the *I. suis* infection among piglets before their immunity reaches an adequate level (Koudela and Kucerova, 2000).

The system of production, rearing conditions and hygienic status on swine farms may also have an impact on some differences in the prevalence of coccidia infections in piglets. Hence, in our investigation *I. suis* invasion was more often reported on the large commercial farms, whereas *Eimeria* spp. on the smaller farms. Bad hygienic conditions and suboptimal temperatures in piglet pens, is often observed on small individual swine farms, which in turn favours the occurrence of *Eimeria* spp. infections. The occurrence of *Eimeria* spp. in pigs is considered by some authors as the indicator for the hygienic status of a farm – the lower the level of hygiene is, the more frequently *Eimeria* spp. infections occur. However, such conditions observed on

the smaller farms (appropriate for *Eimeria* spp.), as it was shown in our investigation, are unfavourable for *I. suis*, which on this type of farms were rarely found. Similar results confirming a more frequent occurrence of *I. suis* on larger farms than those of the smaller ones were obtained in Nordic countries (Larsen, 1996). In this study in herds comprising of less than 50 sows *I. suis* oocysts were only found in 7% suckling piglets, in herds with 50–100 sows – in 22%, and in herds with more than 100 sows – 34% piglets.

In our investigation *I. suis* and *Eimeria* spp. oocysts were observed in small number of sows. Our results also demonstrate a lack of correlation between the presence of oocysts in the sows, and the *I. suis* infected piglets born from them. Similarly, no such correlation was observed in the study carried out in Hungary (Farkas et al., 2004) where no cases of coccidian infections were detected in sows, and in Sweden (Nilsson et al., 1984) where about a half of the examined sows shed *Eimeria* spp. oocysts; however, *I. suis* was found only in one animal – despite the fact that *I. suis* was detected in suckling piglets coming from these sows. Lindsay et al. (1984) having examined 200 sows that derived from the farms with and without a history of neonatal isosporosis, found *I. suis* oocysts in only one sow from the farm free from isosporosis whereas he detected *Eimeria* spp. oocysts in 82–95% of these sows. It should be stressed that the lower percentages for sows shedding *Eimeria* spp. oocysts reported in our investigation might result from the fact that only lactating sows were examined. German researchers (Daugschies et al., 2004) found that in lactating sows *Eimeria* oocysts occurred several times more rarely than during the period from weaning to next farrowing.

The lack of *I. suis* oocysts in faeces of most of the examined sows – mothers of piglets infected with this coccidia – observed in our and other authors' investigations, indicates that the environment of pens contaminated with oocysts, excreted by previous litters, was the main source of infection for piglets. However, the existence of extraintestinal developmental stages of *I. suis* and related alternative routes of infection, is still questionable and left unanswered. The morphology of *I. suis* oocysts (particularly a lack of Stieda bodies in sporocysts), suggests the occurrence of such stages in the *I. suis* life cycle. Similar oocysts morphology is characteristic for the group of coccidia of *Isospora* genus (e.g. the species occurring in dogs and cats), all of which produce tissue stages. Some trials were carried out in order to demonstrate *I. suis* extraintestinal stages but they failed to yield positive results (Pinckney et al., 1993; Stuart et al., 1982).

These studies demonstrated the high prevalence of *I. suis* infection and low prevalence of *Eimeria* spp. in suckling piglets in Poland. It proves an important role of *I. suis* as a cause of diarrhoea in suckling piglets in Poland, especially on large swine farms.

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