THE EFFECT OF HOUSING SYSTEM ON THE INCIDENCE OF INTESTINAL PARASITE INFESTATION IN PIGS

WPŁYW SYSTEMU UTRZYMANIA NA WYSTĘPOWANIE PASOŻYTÓW JELITOWYCH U ŚWIŃ

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Abstract

The aim of the study was to compare the intestinal parasite fauna occurring in pigs kept in different rearing conditions (group A – extremely extensive, B – extensive and C – intensive). In the period between March and July 2010, 345 samples of faeces from piglets (125), weaners (60), fatteners (94) and sows (66) were collected and tested, using standard coproscopic methods. Six parasitic species, belonging to phylum Nematoda (*Strongyloides ransomi*, *Ascaris suum*, *Oesophagostomum dentatum*, *Trichuris suum*) and to phylum Apicomplexa (*Isospora suis* and *Eimeria debliecki*) were diagnosed. Eggs of *Toxascaris leonina*, a parasitic roundworm mostly affecting the members of the *Canidae* and *Felidae* families, not encountered in pigs until now, were found in the faeces of fatteners. The highest level of parasite invasion was recorded in pigs from group A and B; they were multi-species invasions. Parasitic species found in faeces not only bring economic losses, but they may also be dangerous for human health and life, which indicates the necessity to implement parasitological screening protocols, especially in the extensive rearing conditions.
Keywords: intestinal parasites, pigs, production systems

Streszczenie

Celem badań było porównanie parazytofauny jelitowej występującej u świń utrzymywanych w odmiennych warunkach produkcyjnych (grupa A – skrajnie

ekstensywne, B - ekstensywne, C – intensywne). W okresie od marca do lipca 2010 pobrano i przebadano za pomocą standardowych technik koproskopowych 345 prób kału od prosiąt (125), warchlaków (60), tuczników (94) i loch (66). Zdiagnozowano 6 gatunków pasożytów należących do typu Nematoda (*Strongyloides ransomi, Ascaris suum, Oesophagostomum dentatum, Trichuris suum*) oraz typu Apicomplexa (*Isospora suis i Eimeria debliecki*). W kale tuczników znaleziono jaja *Toxascaris leonina,* glisty niespotykanej dotychczas u świń, charakterystycznej dla psowatych i kotowatych. Największy poziom zarobaczenia stwierdzono u świń w chlewniach z grupy A i B; były to inwazje wielogatunkowe**.** Znalezione w kale gatunki pasożytów powodują nie tylko straty ekonomiczne, ale mogą być również niebezpieczne dla zdrowia i życia człowieka, co wskazuje na potrzebę wdrożenia przesiewowych badań parazytologicznych, szczególnie w przypadku ekstensywnego chowu zwierząt..
Słowa kluczowe: pasożyty jelitowe, świnie, systemy utrzymania

Detailed abstract in native language

Celem badań było porównanie parazytofauny jelitowej występującej u świń utrzymywanych w odmiennych warunkach produkcyjnych (grupa A – skrajnie ekstensywne, B - ekstensywne, C – intensywne). W okresie od marca do lipca 2010 pobrano i przebadano za pomocą standardowych technik koproskopowych 345 prób kału od prosiąt, warchlaków, tuczników i loch.
Hodowla w koprokulturze umożliwiła przyporządkowanie wszystkich uzyskanych larw do gatunku *Oesophagostomum dentatum.* Jaja tego pasożyta występowały najczęściej w kale świń badanych grup produkcyjnych (Tabela 1). Największą, bo wynoszącą 68,6% ekstensywność stwierdzono w chlewniach z grupy B (Tabela 2). W chlewniach z grupy A ekstensywność inwazji kokcydiów u świń znajdujących się w różnych fazach cyklu produkcyjnego była bardzo duża i wyniosła 82,7%. W chlewniach z w/w grupy inwazja węgorka (*Strongyloides ransomi)* i włosogłówki (*Trichuris suis*) wyrażała się dość wysoką ekstensywnością (17,2% dla obu gatunków). Największą ekstensywność inwazji włosogłówki (na poziomie 31,2%) zaobserwowano jednak u prosiąt z chlewni grupy B. U zwierząt tuczonych w chlewniach z grupy A najczęściej diagnozowano jaja glisty świńskiej (*Ascaris suum)*. Zdiagnozowano 6 gatunków pasożytów należących do typu Nematoda (*Strongyloides ransomi, Ascaris suum, Oesophagostomum dentatum, Trichuris suum***)** oraz typu Apicomplexa (*Isospora suis i Eimeria debliecki*). W kale tuczników znaleziono jaja *Toxascaris leonina,* glisty niespotykanej dotychczas u świń, charakterystycznej dla psowatych i kotowatych. Największy poziom zarobaczenia stwierdzono u świń w chlewniach z grupy A i B; były to inwazje wielogatunkowe (Tabela 1, 2, 3)**.** Znalezione w kale gatunki pasożytów powodują nie tylko straty ekonomiczne ale mogą być również niebezpieczne dla zdrowia i życia człowieka, co wskazuje na potrzebę wdrożenia przesiewowych badań parazytologicznych w chlewniach.

Introduction

Parasitic invasions in pigs constitute a serious medical-veterinary problem. The consequence of their incidence includes the decreased daily gains of the infected animals, lower feed conversion and sexual activity and decline in the number of piglets per litter (Lawlor and Lynch, 2007; Stewart and Hale, 1988). Parasitic diseases of pigs not only cause economic losses (Popiołek et al., 2009), but may

also be dangerous for human health and life (Bornay-Llinares et al, 2006; Holec-Gasior et al., 2001; Lindergard et al., 2001).

In great majority of domestic pig-keeping farms in Poland the scale of production is small or moderate; the production has an extensive character in part of them (CSO of Poland, 2010). In high-scale production farms, various programs concerning genetic value of animals, nutrition and maintenance, are introduced. These farms implement the biosafety programs. Among other, they include quarantine and acclimatization, control of health state, sanitary measures such as vaccinations and deparasitation, cleaning and disinfection in CPP-CPP system. Additionally, they might incorporate health programs including control of internal and skin parasites. Anti-parasitic drugs are administered with feed and/or water and the procedures of animal cleansing with the use of surfactant preparations as well as periodical disinfection of their housing places are employed. In some cases dehelminthisation is carried out sporadically, mainly when the signs of disease appear, which may lead to drug-resistance in parasites (Varady et al., 1996).

The aim of the study was to establish the species composition and determine the frequency of incidence of intestinal parasite fauna in various age groups of pigs kept in different production conditions.

Material and methods

The study covered pigs reared in seventeen farms located in Central Poland. The collection of faeces was performed from March until July 2010.

The farms were divided into three groups: A, B and C. Group A included 8 extremely extensive farms, where management of animals was carried out in an open system. The animals intended for fattening, often of unknown breed and origin, were bought on the marketplace. The pigs were kept on a deep litter, they were not dehelminthised and any disinfection was not carried out in their premises. In extensive feeding only farm feeds were distributed, such as cereal meals and steamed potatoes, daily rates of feds were supplemented with green forage in summer and purchased mixed feeds in winter.

Group B included 5 farms employing closed cycle production systems; the animals in three farms were reared on a deep litter, and in other two they were kept in shallow premises with a small quantity of litter. The piglets were dehelminthised after birth. The animals from the remaining production groups (sows, weaners, fatteners) ad hoc received dehelminthising preparation in feed. It was medicinal preparation called Fenbenat (active substance – fenbendazole 4.0 g, vehiculum 100 g). Once a year, total disinfection of premises was carried out with the use of calcium oxide for bleaching the walls. The animals were fed full-ration mixtures based on the own raw materials (cereals), purchased supplementary mixture and calcium additive Formosan.

Group C included 4 farms. The pigs were reared on litter-free system, with slatted floor or in solid floor pens with a small quantity of litter (fatteners). The piglets received dehelminthising preparations twice; the first dehelminthisation was performed in 3 days old piglets (preparation against coccidiosis), the second treatment was carried out after weaning, ca. at 28th day of life. The sows were dehelminthised in each production cycle before their introduction to farrowing pen and the weaners after reaching the body weight of 30 kg. The preparations Caramec or Paramectin 1% (10 mg of ivermectin per 1 ml of the solution) were used. Total disinfection of farms was carried out in spring. Once a year, the premises were bleached with calcium hydroxide solution (1 kg of lime per 5 l of water). Before the

introduction of animals to the pens, the disinfection with 2-% iodine preparation (Pollena) was conducted. Metaflox was used in premises for fly control and Toxan for the control of rodents. The animals were fed full-ration mixtures; their composition and value satisfied the requirements of particular production groups.

The samples of faeces were collected in the morning hours to sterile containers. In total, 345 samples collected from group A, B and C were examined. In group A, the faeces from 58 pigs (19 sows, 5 piglets, 10 weaners and 24 fatteners) were examined; in group B – from 151 animals (22 sows, 80 piglets, 9 weaners and 40 fatteners) and in group C – from 136 pigs (25 sows, 40 piglets, 41 weaners and 30 fatteners). The number of the samples collected for the tests was representative for each rearing system, the managed production groups and the number of animals in the group.

In the analyses of the faeces, the modified Fulleborn's method (Ziomko and Cencik, 1999) was applied. Because of incidence of multi-species parasitic invasions in pigs (Nansen and Roepstorff, 1999; Pattison et al., 1980) and difficulties to differentiate some of the species using coproscopic method (*Oesophagostomum dentatum, Hydrostrongylus rubidu, Oesophagostomum quadrisinulatum*), larvae culture of was set up, and an attempt to identify invasive stages was undertaken (L3).

The eggs and oocysts found in the coproscopic tests as well as larvae of parasites (obtained after isolation in coproculture) were photographed with Panasonic digital signal processing camera GP-KR 222, using NIS Elements Program and subjected to identification. NIKON ECLIPSE TE 200 and OLIMPUS CX21 microscopes were used in the study.

Results

Six species of parasites, belonging mainly to phylum Nematoda, were identified. Table 1 shows the incidence of invasion in production groups of pigs. Table 2 represents the degree of incidence of parasitic invasions in the pigs reared in the group B piggeries, depending on the type of management.

Cultivation in coproculture allowed subordination of all obtained larvae to *Oesophagostomum dentatum* species. The eggs of mentioned parasite occurred most frequently in the faeces of pigs of the examined production groups. The highest incidence (68.6%) was determined in group B. In group A, the incidence of coccidian invasion in pigs in different stages of production cycle was very high (82.7%). In the same group, the invasion of *Strongyloides ransomi* and *Trichuris suis* was expressed by a quite high occurrence (17.2% for both species), however, the highest severity of *Trichuris suis* invasion (31.2%) was observed in piglets from group B. In the animals fattened in the group A piggeries, the eggs of *Ascaris suum* were most frequently found.

Table 1. Incidence of the infested animals regarding different groups
Tabela 1. Ekstensywność inwazji pasożytów u świń należących do różnych grup

Production groups Grupy produkcyjne	Number of tested animals Liczba badanych zwierząt			*0esophagostomum dentatum*			*Coccidia*			*Ascaris suum*			*Trichuris suis*			*Strongyloides ransomi*		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Sows Lochy	19	22	25	18 (94.7)	16 (72.7)	9 (36)	19 (100)	13 (59)	1 (4.0)	1 (5.2)	-	1 (4.0)	-	-	-	-	-	1 (4.0)
Piglets Prosięta	5	80	40	-	40 (50)	10 (25)	5 (100)	15 (18.7	-	-	-	-	-	25 (31.2)	-	-	-	-
Weaners Warchlaki	10	9	41	10 (100)	9 (100)	-	10 (100)	9 (100)	-	-	-	6 (14.6)	10 (100	-	6 (17.1)	-	-	-
Fatteners Tuczniki	24	40	30	-	40 (100)	-	14 (58.3)	-	-	14 (58.3)	-	-	-	10 (25)	-	10 (41.7)	-	-

Groups of rearing systems: A – extremely extensive, B – extensive, C – intensive. Values in brackets refer to % of infected animals.

Grupy chlewni: A – skrajnie ekstensywne, B – ekstensywne, C – intensywne. Wartości w nawiasach odnoszą się do % zarażonych zwierząt.

Table 2. Incidence of the infested pigs from group B, depending on the type of management
Tabela 2. Ekstensywność inwazji pasożytniczych u świń z grupy B w zależności od typu chowu

Production groups Grupy produkcyjne	Farms from group B – Chlewnie z grupy B	
	Management on deep litter Głęboka ściółka	Management on shallow litter Płytka ściółka
Sows Lochy	15/15 (100%)	1/7 (14,2%)
Piglets Prosięta	40/40 (100%)	0/40 (0%)
Weaners Warchlaki	-	9/9 (100%)
Fatteners Tuczniki	40/40 (100%)	-

Group B – group of extensive rearing systems

Grupa B – grupa chlewni ekstensywnych

Discussion

The highest level of parasite infestation was observed in the pigs from A and B piggeries; they were multi-species invasions. The results of other research confirm the results of our study. Połozowski et al. (2005) showed that different levels of hygiene of piggeries (faeces and effluents deleted daily vs. every 3 days or more rarely) influenced the prevalence of internal parasite infections (21.4% vs. 91.4% of animals infected with parasites) and their intensity (33.3% vs. 73.6% of infected animals with multi-species infections). In the study of Nosal and Eckert (2005) higher level of infection was observed in the smaller herds (50-70 sows) than in the large ones (950 sows).

Five parasitical species were found in fatteners from group A: *Strongyloides ransomi, Ascaris suum*, oocysts of coccidia – two species *(Isospora suis and Eimeria debliecki*) and eggs of *Toxascaris leonina*. Undoubtedly, *Toxascaris leonina* is a species characteristic of *Canidae* and *Felidae*, not encountered in pigs until now (Gundłach and Radzikowski, 2004). In sows from group B, invasion of *Oesophagostomum dentatum* and *Ascaris suum* and the presence of coccidian oocysts were recorded, whereas in the stool samples of fatteners, *Oesophagostomum dentatum* and *Trichuris suum* were found. Połozowski et al., (2005) and Weng et al., (2005) also observed multi-species invasions in pigs from piggeries with a similar scale of production and similar form of animal management. In our study, high parasite infestation of pigs in the group A was caused by a lack of premises disinfection and dehelminthisation of animals. These procedures were conducted sporadically in group B, but they did not bring the expected effects. The results of the present study confirmed equal incidence of parasite invasions in pigs reared in farms of both mentioned groups. In group B, the animals were mainly reared on a deep litter, which constitutes a reservoir for many parasitic species (Bornay-Linares et al., 2006). Research conducted in domestic piggeries (Knecht et al., 2009; Popiołek et al., 2009; Romaniuk, 2007), in Spain (Bornay-Llinares et al., 2006) and in Estonia (Toivo and Erika, 2008) confirm frequent occurance of the intestinal parasites invasion in pigs kept on bedding.

In the pigs from group C, the invasion of parasites was rarely observed. It is an evidence of the effectiveness of the employed dehelminthising and disinfecting

preparations. Similar results were obtained by Wertejuk and Urbaniak (1978), who showed that the use of ant-parasite programs lowers the level of infestation in pigs by applying a parasitological examination of sewage from an industrial pig farm. In single cases, the presence of the eggs of *Ascaris suum* and *Trichuris suis* was recorded in the stool samples of weaners from group C. Invasions of these parasites are characteristic of extensive farms, with a low level of hygiene (Nansen and Roepstorff, 1999). Lack of quarantine and dehelminthisation of newly purchased animals was the possible cause to the observed invasions. Pigs were reared in the piggeries with slatted floor. The animals had a limited contact with faeces and a potential risk of parasitic invasion was lower than in case of litter management. Animal faeces, including the ones obtained from the pigs in a form of manure, dung and liquid manure are employed as natural fertilizer. The eggs of certain parasitic species may survive outside the host for many days (Mawdsley et al., (1996). The eggs of *Ascaris suum*, found in the faeces of the examined pigs, remain invasive in the soil for more than 50 days (Caballero-Hernandez et al., 2004). Man may become a casual host of this parasite.

Conclusions

The results of the present study indicate a close relationship between the incidence of gastrointestinal parasites in pigs and production conditions.
The degree of incidence of parasitic invasions was considerably higher in the pigs extensively reared on litter, compared animals kept in litter-free rearing system. Additionally, in this group multi-species invasions occurred more frequently.
In the faeces of fatteners from the extremely extensive farms, the eggs of nematode *Toxascaris leonina* were recorded, a parasite characteristic for the *felidae* and *canidae* families.
The results of the present study indicate the need to continue the studies in order to obtain more complex evaluation of parasitological situation of the pigs reared in piggeries of various production scale and conditions. The determination of the complete parasitic species composition in pigs requires studies on much more numerous research material from different regions of Poland.

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