Monitoring of *Ascaris suum* in slaughter pigs during 2000 – 2009 in Slovakia

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Summary

Ascaris suum is a parasitic nematode of pigs with worldwide distribution causing economic losses due to health interactions, reduced feed to gain efficiency and losses due to liver condemnation at abattoirs. To survey the herd prevalence of ascariasis in Slovakia, the presence of milk spots in liver of slaughtered pigs is monitored at abattoirs. According to shortened life-span of fattening pigs, this is the most suitable screening method for efficiency evaluation of control measures. Within the monitoring in 2000 – 2009, in total 279 herds (19 017 animals) were examined. During this period, marked decrease in occurrence of pathological lesions, resp. milk spots, in liver was recorded (from 39.51 % to 6.85 %) in investigated herds.

Keywords: *A. suum*; pigs; milk spot; monitoring

Introduction

Ascaris suum, Goeze, 1782, is parasitic nematode (Family Ascarididae) of pigs that causes the most important helminthosis in farmed pigs worldwide. The prevalence of *A. suum* infection varies according to geographical region and management practices, but almost all herds are afflicted (Roepstorff, 2003; Dubinský *et al.*, 2000a). Host becomes infected via faecal-oral route. After ingestion infective eggs hatch in small intestine and develop *Ascaris* larvae that migrate via portal blood to the liver and then to the lungs, where they penetrate to the pharynx. Swallowing of larvae results in return of larvae to the small intestine, where they finish moulting, mature and reach sexual maturity in about 24 d. p. i. (Pilitt *et al.*, 1981). In *A. suum* infection, milk spots (white spots) are white pathological lesions formed by mechanical injury and inflammatory response induced by migrating larvae in the liver. Formation of these healing foci in the liver stroma is characteristic of porcine infection and their presence has been used for monitoring of herd prevalence in many European

countries (Dubinský *et al.*, 2000b; Levkut *et al.*, 1999; Strachan *et al.*, 2006; Stalker and Hayes, 2007; Lundeheim and Holmgren, 2010; Boes *et al.*, 2010; Sanchez-Vazquez *et al.*, 2012).

Monitoring of slaughter pigs is performed in order to control health issues on farms; is intent in particular on detection of alterations – macroscopic lesions in the lung that are distinctive for Porcine Respiratory Syndrome (Žižlavský *et al.*, 2006) and pathological lesions in the liver – milk spots, which are symptoms of *A. suum* infection (Sanchez-Vazquez *et al.*, 2010). For efficiency evaluation of on-farm anthelmintic programmes that is based on examination of white spots in livers, the appropriate number of animals is to be inspected that takes into account the size of herd.

This study investigates the prevalence of white spot livers in abattoirs in Slovakia in the period of 2000 – 2009. The intention of the paper is to provide the report on *A. suum* prevalence in herds and to outline possible control strategies.

Material and methods

During 2000 – 2009, in total 19 017 slaughtered pigs from 279 farms were in detail post-mortem inspected for pathologies by trained veterinarians at the abattoir. Monitoring encompassed whole territory of Slovakia and included pedigree breeding, livestock production and farrowing farms raising 80 – 4000 sows. Pigs from selected farms were monitored at request of farm owner, breeder or veterinarian to ascertain the health condition of slaughter pigs. For recording and evaluation of results obtained within monitoring, the integral recording form was used designed by Marek Žižlavský, DVM, PhD., Sevaron, s.r.o. All obtained data about pathological lesions were collected and evaluated.

The routine detailed post mortem examination was proceed

in standard way, using adspersion and palpation and can slightly differ by technological facility of the abattoir. Within the monitoring was except for inspection of skin, lungs, hearth, intestines, lymph nodes and abscesses performed also examination of the liver, in particular of milk spots. All found abnormalities were recorded, including their localisation, extension, and quality. The intensity of milk spots occurrence in liver parenchyma was evaluated according key as showed in Table 1. Obtained prevalence data were statistically compared using Chi-square test for trend analysis ($p < 0.0001$), in program Graph Pad Prism®.

Table 1. Intensity of milk spots on/in the liver parenchyma

Intensity category	Number of milk spots on/in liver parenchyma
0	0
1	1 – 4
2	5 – 15
3	>15

Results

Within the monitoring at the abattoir, during the years 2000 – 2009 in total 19017 individual pigs were examined originating from farms from whole Slovakia. The most frequent alterations detected by post mortem examination were: lesions localised in cranio-ventral parts of the lungs (sharply defined, solid, red-blue coloured – *Mycoplasma pneumoniae*; brown to greyish brown lesions – *Pasteurella multocida*, interstitial pneumonia – mixed with SIV, PRRS, PCV-2 porcine viruses, pulmonal and costal pleuritis as the result of other etiologic agents – *Actinobacillus pleuropneumoniae*, *Mycoplasma hyorinis*, *Haemophilus parasuis*. Investigated was also the presence of milk spots – *hepatitis interstitialis parasitaria multiplex* as a reliable indicator of infestation in organism. The inspection results of slaughtered pigs focused on occurrence of milk spots in/on the liver caused by *A. suum* larvae are

summarised in Table 2 and Figure 1. During the years 2000 – 2009 a significant decrease ($p < 0.0001$; Chi-square df 917.6,9; $\alpha < 0.05$) in prevalence of milks spots was recorded from 39.51 % in 2000 down to 6.85 % in 2009 as a result of consistent execution of de-worming programmes and sanitation management. The intensity of infection was expressed as the number of milk spots in the liver. Most infected pigs belonged to category 1 with 1 – 4 milk spots (aver. 9.4 %); less frequent was category 2 with 5 – 15 milk spots (3.78 %). In the category 3, represented by intensity of over 15 milk spots, also decrease in numbers of positive animals was recorded over the study period with only 9 (0.96 %) pigs in 2008.

Fig. 1. Prevalence (%) of milk spot lesions in slaughtered pigs in Slovakia in individual years under study

Discussion

The post-mortem examination for health assessment of slaughter pigs has been carried out for a long time; in last year are changing not only the methods but also the motivation for their performance (Žižlavský *et al.*, 2006; Lundheim & Holmgren, 2010). The advantage of monitoring at abattoir is the use of standard method, reporting of obtained data, the long-term collection and preparation of transparent reports, and lower costs for health assessment of slaughter pig. The goal of monitoring is to transform the

Table 2. Numbers of slaughter pigs assessed in 2000-2009, prevalence and evaluation of intensity of milk spot lesions (category 1, 2, 3)

Year	No. of examined	Intensity of milk spot lesions – category, prevalence						Total positive	
		1	%	2	%	3	%	1 – 3	%
2000	1 063	257	24.18	67	6.30	96	9.03	420	39.51
2001	2 262	300	13.26	143	6.32	220	9.73	663	29.31
2002	3 964	449	11.33	164	4.14	265	6.69	878	22.15
2003	1 960	166	8.47	60	3.06	53	2.70	279	14.23
2004	2 756	219	7.95	84	3.05	135	4.90	438	15.89
2005	2 097	188	8.97	103	4.91	115	5.48	406	19.36
2006	2 007	115	5.73	46	2.29	47	2.34	208	10.36
2007	959	28	2.92	17	1.77	15	1.56	60	6.26
2008	941	43	4.57	17	1.81	9	0.96	69	7.33
2009	1 008	23	2.28	17	1.69	29	2.88	69	6.85
	19 017	1 788	9.40	718	3.78	984	5.17	3 490	18.35

observed changes in the pig population to the appropriate numerical values for analysis. Clinical examinations, results of inspection after slaughter and post-mortem examination are essential for the diagnosis and health assessment on farm (Dold & Holland, 2011) and found significant application in implementation of preventive and therapeutic procedures in given breeding conditions with direct impact on the economic efficiency of farming.

One of frequent reasons of liver condemnation is the presence of milk spots. The milk spot liver, caused by migrating larvae of *A. suum* is one of the most prevalent issues affecting pig productivity worldwide. Infection can result in a loss of up to 10 % daily gain and 13 % in feed conversion in growing/finishing pigs, increasing the cost of production (Sanchez-Vazquez *et al.*, 2010). Transmission of *A. suum* in pig population depends on several factors, as systems of housing, hygiene, management practices and anthelmintic treatment (Nansen & Roepstorff, 1999). To assess the most important risk factors all those factors are to be regarded for controlling *A. suum* infection in pigs (Roepstorff, 2003). According Roepstorff *et al.* (1998) the age group is significantly associated with *A. suum* infection and large fatteners and young female swine were recorded to have the highest infection intensity. Other important risk factors were country, weaning age (late weaning was associated with higher prevalence of infection), and drinking facilities located in the lying area. The study of Sanchez-Vazquez *et al.* (2012) that focused on time trend and seasonality in the prevalence of milk spot liver in English pigs from 2005 – 2010 shows a general reduction over the monitoring period. These results are in compliance with our findings that are indicative of decreasing tendency in Slovakia; from 39.51 % in 2000 to 6.85 % in 2009. This is very likely due to positive attitude of breeders and farm owners to parasite control strategies. Similar findings reported Dieber and Köfer (2004) that performed monitoring at Styrian slaughterhouses and reported significant decline in percentage of pulmonary lesions and milk spot liver from almost 40 % in 2000 to 19 % in 2003. Extensive screening at abattoirs in the Czech Republic accomplished Žižlavský *et al.* (2006) in 2003 - 2005. They monitored extent of lesions on lungs and livers and revealed that it changes in direct proportion to the level and quality of control, sanitation and health improvement strategies on farm.

The importance of proper de-worming and control protocols underwrite also our findings. Despite according to our results over the monitoring period (2000 – 2009) the tendency in prevalence of milk spot livers was declining in Slovakia; in 2005 we observed increase from 15.89 % in 2004 to 19.36 %. That was a result of deteriorating economic situation of pig farms in Slovakia due to sudden and significant reduction of purchase prices for pork followed by inconsistent parasite control on some farms. Stabilization of situation on the pork market in the next years has improved the economic situation of farmers, as reflected also by the decline in prevalence in following years.

Herein discussed findings suggest that proper husbandry practices that provide optimum hygiene standards consti-

tute lower risk of milk spot in slaughtered pigs. Although the absence of milk spots does not mean that the farm is *A. suum* free, it can potentially reflect lower levels of ascariasis in the final stages of production (Sanchez-Vazquez *et al.*, 2010). Parasite control has thus to be aimed at reducing infection and minimizing their detrimental effects. Management and sanitation should be aimed at breaking the cycle of the parasite and remove parasite eggs from the environment. The use of anthelmintics should be integrated with the production system and regular monitoring in herd to achieve optimum effect. The combination of good management, sanitation, and sound nutrition plus de-worming programmes will most effectively control not only *A. suum*, but also other internal parasites of swine.

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