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Short communication

Parasite infections and their risk factors in foals and young horses in Finland

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ABSTRACT

One-hundred-and-thirty-nine fecal samples were examined to assess the prevalence of *Parascaris* spp. and strongyle infections in two-year-old or younger horses in Finland. The owners of the horses were asked to answer an online questionnaire about the horses' environment and the management practices of the stable. The results of fecal examination and the survey were analyzed to evaluate the effect of different risk factors as ascertained by the survey on parasite prevalence. The prevalence of *Parascaris* spp. infections at 11.5% was lower than expected based on previous research and the strongyle prevalence of 57.6% was found in young Finnish horses. *Strongyloides westeri* and *Eimeria leuckarti* infections were also found. Pasture hygiene had a stronger influence on the prevalence of strongyle infections than on *Parascaris* spp. infections, whereas the hygiene routine of the horses' housing was found to be more important in the prevention of *Parascaris* spp. infections. The planning of the control of parasitic infections should be based on the identified risk factors.

1. Introduction

For decades, anthelmintic drugs have been routinely used against equine parasite infections. This has led to a widespread drug resistance among parasites, and the need for other parasite control methods has emerged (Fritzen et al., 2010; Reinemeyer, 2012 and von Samson-Himmelstjerna, 2012). Studies have been conducted to identify factors related to host, environment and management practices that have an effect on the parasite infection status of horses (Fritzen et al., 2010; Kornaś et al., 2010 and Relf et al., 2013). Parasite infections have been shown to be more prevalent in foals and young horses (Fritzen et al., 2010; Kornaś et al., 2010 and Relf et al., 2013), which is explained by an age acquired immunity. The males have been shown to have higher Fecal Egg Counts (FECs) compared to females (Kornaś et al., 2010 and Relf et al., 2013) and thoroughbreds have higher FECs than other breeds (Kornaś et al., 2010). A study conducted in Poland found that horses kept on sand paddocks had lower stongyle FECs compared to others, and also horses kept on large farms had higher FECs (Kornaś et al., 2010). A study from the UK reported longer grazing periods increased the prevalence of strongyle infections and FECs (Relf et al., 2013). Fritzen et al. (2010) found that farms fertilizing pastures with horse manure had a higher prevalence of *Parascaris* spp. It also appears that on farms where roughs are clipped regularly, the strongyle infection rate is lower (Fritzen et al., 2010 and Relf et al., 2013).

A previous study in Finland in 2008 tested young trotters for anthelmintic resistant *Parascaris* spp. and strongyles (Näreaho et al., 2011). In that study, 112 horses aged between one and three years were housed in trotter training stables. The prevalence of *Parascaris* spp. was 21% and that of strongyles was 48%. The results of the study showed that ivermectin resistance in *Parascaris* spp. and pyrantel resistance in strongyles was widespread in young Finnish trotters. Thus, it is evident that the parasite control of horses can no longer be solely based on regular anthelminthic treatments. The aim of this study was to estimate the prevalence of *Parascaris* spp. and strongyle infections in two-year-old or younger horses in Finland and to evaluate the associations between the prevalence of parasite infections and different living environments and management practices.

2. Materials and methods

An open invitation for owners of foals and young horses to participate in the study was spread via social media and appeared in the University of Helsinki web pages in the autumn 2013. Horses of all breeds living in Finland born from 2011 to 2013 inclusive, and which had not been given an anthelminthic medication during the preceding month were accepted into the study. The owners were asked to send a fresh fecal samples through mail at the day of collection. They were also asked to answer the questions of a survey. Only the horses with both the sample and the answered questionnaire, a total of 139, were included into the study. Of those, 29 (21%) were born in 2011, 50 (36%) born in 2012 and 60 (43%) were born in 2013. Of the foals and young horses, 65 (47%) were fillies, 59 (42%) colts and 15 (11%) geldings. In total, 26

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Table 1
The number of horses participating in the study by breeds.

Breed	Number of horses
Finnhorse	33
Finnish warmblood	23
Standardbred	16
Icelandic horse	16
Shetland pony	9
Warmblood horse	8
Oldenburg horse	7
Gotland russ	5
Hanoverian horse	4
Estonian horse	2
Unknown	1
Akhal-Teke	1
American standardbred	1
American Bashkir Curly	1
American Quarter horse	1
Arabian horse	1
Boulonnais horse	1
Friesian horse	1
Irish Cob	1
Lusitano-Andalusian horse	1
Pintabian horse	1
Swedish Ardennes horse	1
Tori horse	1
Welsh Cob	1
Welsh Mountain	1
Riding pony	1

different breeds were represented (Table 1). The most common breed was the Finnhorse (23.7%) and the second-most common was the Finnish warm blood riding horse (16.5%). The proportion of both, standardbreds and Icelandic horses was 11.5%.

The fecal samples were refrigerated upon arrival and examined within a week from sampling. The FECs were obtained by using a modified McMaster method (Ministry of Agriculture, Fisheries and Food, 1986) from September to December 2013 inclusive. A saturated $MgSO_4$ solution was used as a flotation solution. The minimum detection level was 25 eggs per gram (EPG) of feces. All the detected parasite eggs and oocysts were identified morphologically and counted by microscopy.

The owners were asked to answer an online questionnaire about the living environment of the foals and young horses and the management and parasite control practices of the stable. Some of the owners left some questions unanswered, which was taken into consideration in the statistical analysis of the results. Moreover, unclear answers were excluded from the data.

The FECs and survey answers were examined together by cross-tabulation to evaluate the effect of different factors on the *Parascaris* spp. and strongyle infection prevalences. A result was considered statistically significant if its P-value was lower than 0.05. The ORs were calculated to evaluate the differences in infection pressures between answer groups. The parasite prevalence and 95% confidence intervals were calculated using the Open Epi -program online (version 3.03a). The Mid-P exact method was used in calculating the confidence intervals. P-values, odds ratios (ORs) and 95% confidence intervals of ORs were calculated by cross-tabulation using IBM SPSS Statistics 22 software. P-values were obtained first by using Pearson chi-squared test, and if the preconditions of the test were not fulfilled, then Fisher's exact method was used instead.

3. Results

Strongyle infections were the most frequent parasite infections found in the samples examined in this study (57.6%, Table 2). Other infections detected from the samples were *Parascaris* spp. (11.5%), *Eimeria leuckarti* (5.8%) and *Strongyloides westeri* (2.2%). Fourteen (10,1%) of the foals and young horses were infected by more than one parasite species. A total of 92 (66.2%) foals and young horses were found to be infected by at least one parasite species.

Table 2
Parasite infections found in fecal samples, prevalence and infection intensity in positive animals: maximum, minimum, and median EPGs. N = 139.

	Parascaris spp.	Strongyle	*Eimeria leuckarti*	*Strongyloides westeri*
Number of infected horses	16	80	8	3
Prevalence	11.5%	57.6%	5.8%	2.2%
95% confidence interval	7.0–17.7%	49.2–65.6%	2.7–10-6%	0.6–5.8%
Maximum EPG	4500	4325	350[a]	775
Minimum EPG	25	25	25[a]	350
Median EPG	188	363	88[a]	475

[a] Oocysts per gram (OPG).

Different factors that possibly affect the risk of parasite infections were evaluated by correlating these factors with the FEC results. The factors that had a statistically significant effect on strongyle infection prevalence were the frequency the horses of the stable move inside Finland, whether the horses were kept in loose-boxes or in open sheds, the size of an area the horses had for grazing and are the piles of feces spred or broken on the grazing fields (Table 3). For *Parascaris* spp. infections the statistically significant factors were the age of the horse and how frequent was the cleaning of the box or the shed (Table 4).

Strongyloides westeri and *Eimeria leuckarti* infections were too rare to be analyzed for their risk factors. All the foals found positive for *S. westeri* were born in 2013. Of those, two were standardbreds and one was a Finnhorse. *Eimeria leuckarti* was found in eight samples. Six of those samples were from standardbred foals born in 2013, one from a Finnhorse born in 2012 and one from a warmblood riding horse born in 2011.

4. Discussion

The prevalence of *Parascaris* spp. infections in this present study was lower at 11.5% than the 21% reported in a previous study conducted in Finland (Näreaho et al., 2011) that used a similar methodology but in a different population. In the previous study, only young trotter horses in training stables were included and the ages of the horses varied from one to three years. Our present study included riding horses, hobby-horses, ponies and trotter horses but the intended use of the horses when they matured was not asked in or ascertained by the questionnaire. The facilities and the management practices in trotter training stables might differ from those in other kinds of stables. The prevalence of *Parascaris* spp. in the present study was expected to be even higher than in the previous study because this study included suckling foals, which have been previously shown to have more *Parascaris* spp. infections than older age classes (Kornaś et al., 2010 and Relf et al., 2013). It is possible that some samples were taken too soon after the last anthelmintic medication, since the minimum time interval was one month and the prepatent period for *Parascaris* spp. is over two months. The prevalence of strongyle infections were perhaps less influenced by such timing as their prevalence was higher compared to *Parascaris* spp. infections. This might be due to a shorter prepatent period of cyathostome infections (Love and Duncan, 1992). Here we did not do larval cultures to differentiate between cyathostomin and *Strongylus* spp. infections, but previous studies have shown the majority of strongyle infections to be caused by cyathostomins (Kaplan, 2002 and von Samson-Himmelstjerna, 2012). The foals and young horses are also commonly medicated against *Parascaris* spp. with fenbendazole, which is not the drug-of-choice for treating strongyle infections due to a widespread resistance in cyathostomins (Kaplan et al., 2004).