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Helminth infections in a group of Icelandic horses with little exposure to anthelmintics

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SUMMARY

The objective of this study was to determine the presence and nature of helminth infections in horses in Iceland with very little exposure to anthelmintics.

Faecal samples were collected from 57 horses, five months to 20 years old, in October 1991. The animals belonged to a group of unbroken horses which had only been treated once with anthelmintica when they were one year old. Faecal egg counts and third stage larval (L_3) cultures for differentiation of nematodes were performed.

Strongyle EPG (eggs per g faeces) increased significantly with age. Mean strongyle egg counts ranged from 120 EPG in foals to 615 EPG in horses older than 7 years. *Parascaris equorum* eggs were found in the samples from 90% of the foals (mean EPG=285) and in one 3 year old horse. *Oxyuris equi* eggs were found in several foals and eggs of the cestode *Anoplocephala perfoliata* in two horses.

The following L_3 strongyle species/genera were recovered: *Cyathostomum, sensu lato* in all the horses, *Gyalocephalus capitatus* in 16%, *Poteriostomum* spp. in 44%, *Oesophagodontus robustus* in 16%, *Triodontophorus* spp. in 25%, *Strongylus edentatus* in 40%, *S. equinus* in 9%, *S. vulgaris* in 13% and an unidentified larva in one horse. The strongyle L_3 diversity was greatest in two and three years old horses. Of other nematodes, L_3 of *Trichostrongylus axei* were recovered from 7% of samples and L_3 *Strongyloides westeri* from one foal. *Cyathostomum, sensu lato* accounted for 95% of the total L_3 recovered but other L_3 accounted for ≤2% each.

Key words: helminth eggs, horses, no anthelmintics, prevalence, species diversity, third stage larvae.

YFIRLIT

Ormasýkingar í hrossastóði þar sem ormalyf hafa lítið verið notuð

Meginmarkmið verkefnisins var að athuga ormasýkingar í stóði þar sem ormalyf hafa lítið verið notuð um árabil.

Saursýni voru tekin í október 1991 úr 57 ótömdum hrossum á ýmsum aldri (5 mánaða til 20 vetra) úr stórum hrossahópi í Austur-Landeyjum. Þessum hrossum hafði ekki verið gefið ormalyf nema í eitt skipti veturgömlum. Ormaegg voru talin og tegundagreind og ræktaðar úr þeim 3. stigs lirfur til frekari tegundagreininga.

Fjöldi dreyraormaeggja (Strongylidae) í grammi saurs (ígs) jókst marktækt með auknum aldri hrossanna. Meðalormaeggjafjöldi ígs var á bilinu 120 (folöld) til 615 (hross eldri en sjö vetra). Egg hrossaspóluorma (*Parascaris equorum*) fundust í 90% sýna úr folöldum (meðaltal=285 egg ígs) og í einu þriggja vetra hrossi. Egg hrossanjálgs (*Oxyuris equi*) fundust í nokkrum folöldum og bandormsegg (*Anoplocephala perfoliata*) í tveim hrossum.

Eftirtaldar 3. stigs dreyraormalirfur ræktuðust úr ormaeggjum: *Cyathostomum, sensu lato* í 100%

sýnanna, *Gyalocephalus capitatus* í 16%, *Poteriostomum* spp. í 44%, *Oesophagodontus robustus* í 16%, *Triodontophorus* spp. í 25%, *Strongylus edentatus* í 40%, *S. equinus* í 9% og *S. vulgaris* í 13%. Einnig fannst dreyraormslirfa sem ekki hefur verið lýst í greiningarlyklum. Tegundafjölbreytni var mest í tveggja og þriggja vetra hrossum. Þriðja stigs lirfur hárormsins *Trichostrongylus axei* fundust í 7% sýnanna og lirfur folaldaormsins *Strongyloides westeri* í einu folaldi. Hlutdeild *Cyathostomum, sensu lato* tegunda var 95% af heildarfjölda lirfa, en hlutfall annarra tegunda var mest 2%.

INTRODUCTION

Earlier investigations on parasites in horses in Iceland include a survey identifying all of the species of helminth parasites occurring in the gastrointestinal tract of horses and various studies on the effect of anthelmintic treatment of horses (Eydal, 1979, 1980, 1981, 1983; Gestsson, 1993; Gestsson and Eydal, 1994; Matthías Eydal, unpublished data). Parasites found in horses in Iceland have been summarized by Eydal (1992, 1994).

Anthelmintic treatment of horses in Iceland is not as intensive as in most other countries, although increasing in the last ten years or so. Riding and breeding horses in Iceland are commonly treated with anthelmintics once to three times a year but horses on some farms are not treated.

Most surveys on the prevalence and intensities of intestinal parasites of horses in other countries have mostly been restricted to horses regularly treated with anthelmintics. An exception is a survey of intestinal helminths of ponies in the United States with little exposure to anthelmintics (Torbert *et al.*, 1986). In that survey the helminths from the intestines of the ponies were counted and identified post mortem. In the study presented here the objective was to determine by faecal examinations the presence and nature of helminth infections in horses with very little exposure to anthelmintics. The data may serve as comparison for other faecal studies in Iceland of horses under varying management and treatment practices.

MATERIALS AND METHODS

Animals

Faecal samples were collected on a single occasion per rectum from 57 horses in October 1991. Ten were five months old, ten were yearlings, seven were two years old, ten were three years old, ten were four to five years old and ten were 8–20 years old. The animals belonged to a group of unbroken horses in Austur-Landeyjar, South-Iceland, grazing permanently on drained fen pastures. The horses had been rotated between three separate pastures each year. These horses are kept outside the whole year. Foals, born in spring, are housed for a few months the first winter and given one anthelmintic treatment before they are put out on pasture the next spring. There was no further treatment with anthelmintics.

Egg counts

Faecal egg counts were performed by a modified McMaster technique (Helle, 1971). No attempt was made to differentiate between eggs of different strongyle species/genera (see larval cultures) but all other helminth eggs were identified to species.

In order to estimate the water content of the faecal samples their consistency was evaluated on a scale from 1–4 (1=normal pelleted, dry, 2=soft pelleted, 3=paste, 4=liquid/semiliquid).

Larval cultures

In order to discriminate between the eggs of strongyle species/genera third stage larval (L_3) cultures were prepared from all the samples, according to standard procedures (see Eydal, 1983; Matthías Eydal, unpublished data). The infective third stage larvae (L_3) were recovered from the samples using a modified Baermann analysis (Henriksen, 1965). The larvae were killed/paralysed by

carefully heating a sample drop on a microscope slide. One hundred L_3 from each sample were counted and identified according to the descriptions (identification keys) of Ministry of Agriculture, Fisheries and Food (1986), Georgi and Georgi (1990), Russel (1948) and Soulsby (1965).

The nomenclature of Lichtenfehls (1975) is followed and the use of ecological terms is in accordance with Margolis *et al.* (1982) and Krebs (1985).

RESULTS

Egg counts

Four types of helminth eggs were identified, i.e. strongyle eggs (belonging to the large group of Strongylidae nematodes plus *Trichostrongylus axei* eggs), eggs of the pinworm *Oxyuris equi*, eggs of the ascarid *Parascaris equorum* and eggs of the cestode *Anoplocephala perfoliata*.

Strongyles were found in all faecal samples (a few samples negative for strongyle eggs were shown to be positive by recovering strongyle larvae from larval cultures). Figure 1 shows the result of strongyle egg counts. The number of strongyle eggs increased significantly with increased age of the horses. Mean counts from different age groups were as follows (mean faecal consistency in parenthesis): 120 EPG (1.4) in young foals, 160 EPG (2.3) in yearlings, 314 EPG (2.0) in two years old, 425 EPG (1.8) in three years old, 245 EPG (1.5) in four to five years old and 615 EPG (1.9) in 8–20 years old horses.

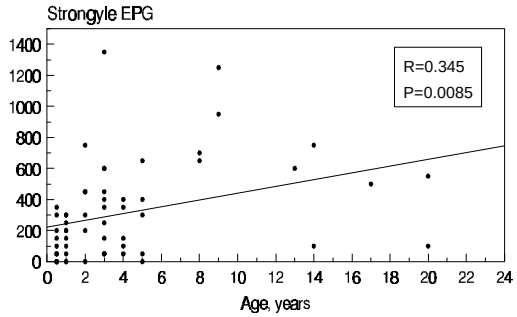

Figure 1. Relationship between the number of strongyle EPG and age of horses.
1. mynd. Samband milli fjölda dreyraormaeggja í grammi saurs og aldurs hrossa.

Parascaris equorum eggs were found in the samples from 90% of the foals with a mean of 285 EPG (range 50–1100 EPG) and from one three years old horse (50 EPG).

Oxyuris equi eggs were detected in the samples from 30% of the foals (50–400 EPG) and in one yearling (50 EPG).

Eggs of the cestode *Anoplocephala perfoliata* were found in two samples (50 EPG in each).

Larval cultures

Representatives of all horse strongyle species or genera identifiable at the L_3 level were recovered. In addition one unidentified strongyle larva (Eydal and Gunnarsson, 1993) and the L_3 of *Trichostrongylus axei* and *Strongyloides westeri* were found. The L_3 species/genera recovered and their prevalence in the horses are shown in Table 1. No L_3 were recovered from two of the samples, probably due to nonviable cultures. Although less than one hundred L_3 were recovered from six of the samples they are included in the data.

The proportional abundance and range of individual L_3 species/genera recovered from the samples is shown in Table 2. *Cyathostomum, sensu lato* accounted for 95% of the total number of L_3 recovered but other L_3's ≤2% each.

DISCUSSION

The helminth eggs found and L_3 recovered in this study include all known species/genera previously found in horses in Iceland identifiable by faecal examination reflecting a diverse helminth community.

Strongyles

The EPG counts of strongyle eggs in this study were in general rather low compared to earlier studies of horses in Iceland (Eydal, 1981, 1983, Matthías Eydal, unpublished data), lower

Table 1. L_3 species/genera recovered and their prevalence (%) in different age groups.
1. tafla. Tíðni (%) 3. stigs lirfa í saur eftir aldri hrossa.

Parasite *Sníkjudýr*	Foals *Fol-öld*	Yearlings *Vetur-gömul*	Age—*Aldur* 2 yrs *2 vetra*	3 yrs *3 vetra*	4–5 yrs *4–5 vetra*	8–20 yrs *8–20 vetra*	All horses *Öll hross*
Small strongyles—*Litlir dreyraormar*							
Cyathostomum, sensu lato	100	100	100	100	100	100	100
Gyalocephalus capitatus	0	10	30	40	30	0	16
Poteriostomum spp.	30	70	60	90	10	0	44
Large strongyles—*Stórir dreyraormar*							
Oesophagodontus robustus	10	10	15	20	10	30	16
Strongylus edentatus	0	20	85	60	60	30	40
Strongylus equinus	0	0	0	10	10	30	9
Strongylus vulgaris	0	0	30	30	0	20	13
Triodontophorus spp.	10	30	45	40	10	20	25
Unidentified strongyle—*Ógreint*				+			+
Other nematodes—*Aðrir þráðormar*							
Trichostrongylus axei	0	0	15	0	40	0	7
Strongyloides westeri	10	0	0	0	0	0	2

than would be expected in a group of horses not treated with anthelmintics. This may be due to a variety of factors such as time of the year, previous grazing intensity and pasture larval contamination, worm fecundity and age of the animals examined. Rotation between pastures may have prevented the build up of high pasture contamination and thus reduced the intensity of worm infection.

Increased water content of faecal samples (higher faecal consistency value) also results in lower EPG counts. Taking this into account, the faecal consistency values reported in this study support increasing EPG counts with age.

It is by no means simple to correlate faecal examinations with numbers or composition of helminths in the horse. Performing egg counts and differentiating L_3 from the eggs only gives a rough indication of the numbers of egg laying female worms present (Ogbourne and Duncan, 1977) but says nothing about immature worms or developing larvae in the horse.

Strongyle nematodes, comprising many species, usually account for the majority of the helminth burden of horses of all ages. Foals, like adult horses, aquire infection by ingesting infective strongyle larvae (L_3) by grazing in summer and adult populations are gradually established in their intestines, eventually contributing to the egg output in faeces. Up to 11 months are needed for some of the strongyle species to reach maturity and produce eggs. Since the large strongyles are annual species, mainly completing their development during the winter months and spring (Ogbourne and Duncan, 1977) their contribution to the faecal egg output is expected to be lowest in autumn. Although some of the small strongyles mature in summer/early autumn others undergo prolonged development before reaching maturity the next spring (Ogbourne, 1975, 1976, 1978). As a consequence strongyle egg output usually follows a seasonal pattern reaching its peak in summer followed by a decrease in autumn and winter (Eydal, 1983). Faecal samples taken at other

Table 2. Proportional abundance of L_3 recovered from larval cultures. Mean numbers from different age groups (range in parenthesis).
2. tafla. Hlutföll 3. stigs lirfa í saur eftir ræktun. Meðaltöl eftir aldri hrossa (bil í svigum).

Parasite *Sníkjudýr*	Age—*Aldur* Foals *Fol-öld*	Yearlings *Vetur-gömul*	2 yrs *2 vetra*	3 yrs *3 vetra*	4–5 yrs *4–5 vetra*	8–20 yrs *8–20 vetra*	All horses *Öll hross*
Small strongyles—*Litlir dreyraormar*							
Cyathostomum, sensu lato	0.983 (0.90–1)	0.973 (0.91–1)	0.907 (0.77–0.98)	0.909 (0.60–1)	0.965 (0.90–1)	0.962 (0.80–1)	0.952
Gyalocephalus capitatus	0	0.001 (0–0.01)	0.003 (0–0.01)	0.005 (0–0.02)	0.004 (0–0.02)	0	0.002
Poteriostomum spp.	0.014 (0–0.09)	0.014 (0–0.08)	0.049 (0–0.20)	0.025 (0–0.06)	0.001 (0–0.01)	0	0.016
Large strongyles—*Stórir dreyraormar*							
Oesophagodontus robustus	0.002 (0–0.02)	0.001 (0–0.01)	0.004 (0–0.01)	0.003 (0–0.02)	0.001 (0–0.01)	0.004 (0–0.02)	0.003
Strongylus edentatus	0	0.004 (0–0.03)	0.029 (0–0.07)	0.038 (0–0.32)	0.018 (0–0.05)	0.024 (0–0.20)	0.018
Strongylus equinus	0	0	0	0.001 (0–0.01)	0.005 (0–0.04)	0.004 (0–0.02)	0.002
Strongylus vulgaris	0	0	0.003 (0–0.01)	0.007 (0–0.04)	0	0.002 (0–0.01)	0.002
Triodontophorus spp.	0.001 (0–0.01)	0.008 (0–0.05)	0.004 (0–0.01)	0.011 (0–0.08)	0.003 (0–0.02)	0.002 (0–0.01)	0.005
Other nematodes—*Aðrir þráðormar*							
Trichostrongylus axei	0	0	0.001 (0–0.01)	0	0.004 (0–0.01)	0	0.001
Strongyloides westeri	0.001 (0–0.01)	0	0	0	0	0	<0.001

times of the year than in this study are therefore not directly comparable, both in egg numbers and proportional abundance of species.

The species belonging to *Cyathostomum, sensu lato* usually account for the majority of strongyle larvae recovered from faecal cultures. In earlier studies in Iceland the proportion of *Cyathostomum, sensu lato* L_3 recovered from different groups of horses has on the average ranged from 0.82–1.0. The occurrence, prevalence and abundance found for the other L_3 strongyle species differ considerably depending on previous ant-helmintic treatment, season, or age of the horses examined (Eydal, 1981, 1983; Gestsson, 1993; Matthías Eydal, unpublished data).

Torbert *et al.* (1986) have concluded that in general it appears that the prevalence of species of adult small strongyles has not been altered significantly in recent years by ant-helmintic exposure, whereas the prevalence of the large strongyle species, *Oxyuris equi* and *Parascaris equorum* appears to be lower than in horses lacking regular anthelmintic treatment.

The findings of this study do not indicate that the composition of helminths in this group of Icelandic horses differs markedly from earlier investigations. The order of L_3 prevalence is in general comparable with prevalence recorded for the adult strongyles in the intestines (Eydal, 1983; Torbert *et al.*, 1986). For example, *Strongylys equinus* was the rarest among the large strongyles while *Strongylys edentatus* was the most common one.

Torbert *et al.* (1986) have calculated diversity indices for small strongyles recovered from intestines of ponies with little exposure to anthelmintics. Calculating Simpson's index of diversity (Krebs, 1985) for all strongyle L_3 in this study (using values given in Table 2) gives an index of 0.09 for total recoveries from all the horses. Indices for individual age groups are highest for two and three year old horses, 0.17 in each group, indicating a more diverse strongyle community than in the other age groups. Since many small strongyle species not differentiable at the L_3 level are included in the single group of *Cyathostomum, sensu lato*, this lowers the index, while other species give relatively little weight to abundance related calculations of this kind.

Other helminths

The nematode *Trichostrongylus axei*, which is also a parasite of ruminants, seems to be an occasional species in the horses examined as has been found in earlier studies (Eydal, 1981, 1983; Gestsson, 1993; Matthías Eydal, unpublished data). On the other hand the nematodes *Parascaris equorum*, *Oxyuris equi* and *Strongyloides westeri* are characteristic parasites of foals. *P. equorum* is very common in foals in Iceland (Eydal, 1983; Matthías Eydal, unpublished data) and a recent survey indicates that foals are often infected with high numbers of this ascarid (Sigurður Sigurðarson and Matthías Eydal, unpublished data). Eggs of the pinworm *O. equi* are usually not found in faecal samples and little can therefore be concluded about their true prevalence in the foals examined. Earlier studies have revealed that this species is very common in foals in Iceland (Eydal, 1983; Matthías Eydal, unpublished data). Judging by earlier investigations in Iceland the threadworm *S. westeri* seems to be very prevalent in young foals up to 4–5 months of age (Matthías Eydal, unpublished data) but it has not been detected in older animals. Eggs of the cestode *Anoplo-cephala perfoliata*, which is very common in horses in Iceland, are rarely detected in faeces (Eydal, 1983, 1993).

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