Epidemiological study on Gastrointestinal Helminths of horses in Arsi-Bale highlands of Oromiya Region, Ethiopia

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Abstract

A study to determine the prevalence and associated risk factors of gastrointestinal helminths in horses was conducted from October 2009 to May 2010 in three districts of the Arsi-Bale highlands of Oromiya region. A total of 2683 fecal samples for the coproscopic examination and 80 pooled samples for recovery of parasitic larvae were collected and processed in Asela Regional Veterinary Laboratory. The overall prevalence of gastrointestinal helminths was 84.4 %, out of which, 59.1 % were mixed infections. Coprological examination revealed the existence of six species and five genera of helminths namely, *Strongylus* species 39.5 %, *Cyathostomes* 35.1 %, *Trichostrongylus axei* 29.0 %, *Fasciola hepatica* 23.1 %, *Triodonthophorus* species 13.9%, *Parascaris equorum* 11.7 %, *Oxyuris equi* 1.8 %, *Strongyloides westeri* 0.7 %, *Dictyocaulus arnifieldi* 0.5 %, *Anoplocephala* species 0.3 % and *Gastrodiscus* species 0.2 %. No significant variations ($P>0.05$) in prevalence of helminths were noticed in relation to districts, age and sex groups of horses, except in case of *Parascaris equorum* and *Fasciola hepatica*, in which prevalence was observed to significantly decrease and increase with age, respectively ($P<0.05$). The average egg per gram of faeces in this study was 745.2 with a range of 100 to 10,500. The coproculture study revealed that *Strongylus vulgaris*, *Strongylus edentatus* and *Cyathostomes* were the major helminths larvae identified in the area during the study period. Thus, the present study revealed that gastrointestinal helminths are among the major health constrains of equines in the area demanding an urgent control intervention.

Keywords: Epidemiology, GI helminths, Horses, Ethiopia, Arsi-Bale, Oromyia.

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Introduction

In developing countries like Ethiopia, the contribution of equines in the energy scenario is of the considerable significance as power source, for transportation, cultivation and post harvest activities in places where the road network is insufficiently developed (Feseha Gebreab, 1998). Only few regions in Northern western and south eastern of Ethiopia use equines for ploughing and threshing of crops is practiced (Feseha Gebreab *et al.,*, 1990; Hagos Ashenafi, 2005).

Ethiopia is home to the oldest feral horse population in Africa and the only wild horses left in east Africa, the Kundudo. One of the oldest recorded breeds, the Oromo bloodlines come from Ethiopia & later spread along the coast of the Red Sea. They were first imported into England in 1861, where they quickly became prized for several of their unique characteristics. Arsi and Bale provinces of Oromia region are known with their densely populated equine population, mainly with Oromo breed horses (The Equinest, 2012).

As any other animal, equines are also vulnerable to a variety of diseases of biological origin, nutritional diseases or disorders and miscellaneous causes. Among which the most common entities leading to ill-health, suffering and early demise and finally death are infectious diseases and parasitism, which resulted in considerably reduced animals work output, reproductive performance and most of all their longevity (Feseha Gebreab, 1998).

Endo parasitic diseases dominated by gastro intestinal helminthes are the serious health problem contributing to poor body condition, reduced work out, poor reproductive performance and short life span. The deleterious effects of helminthes parasites on the equine hosts are well recognized globally and documented (Clayton, 1986). Large number of internal parasites has been identified in study done in some African countries including Ethiopia, Kenya, Zimbabwe, Burkina Faso and Morocco (Feseha Gebreab *et al*., 1990). In general, more than 150 types of internal parasites are known to infect horses (Johnson, 2000).

In Ethiopia various studies disclosed that strongyles, *Parascaris equorum*, bot stomach worms, lungworms, tapeworms and liver flukes to be the most prevalent gastrointestinal parasites of equines (Yoseph Shiferaw *et al*., 2001). Among gastrointestinal helminths, strongylosis is the most common diseases of horses throughout the world and cause death when control measures are neglected. (Urquhart *et al*., 1996). The disease process caused by strongyles can be produced by migrating larvae and by adult worms. Larval of *Strongylus vulgaris* are the most

pathogenic, causing arthritis, thrombosis and thickening of artery wall (Soulsby, 1986). In Ethiopia Equines are mainly found in highlands and middle altitudes. These altitudes are known by presence of fasciolosis and other parasitic diseases in livestock (Feseha Gebreab, 1998).

Regarding Epidemiological study on helminthosis of equines in the Arsi-Bale highlands of Oromyia region, no detailed similar work has been performed, prior to this study. Therefore the objectives of the present study were to determine the prevalence of gastrointestinal helminths of equines and assess the effect of putative risk factors on the distribution of these parasites.

Materials and Methods

Study area

Arsi-Bale highlands are found in the Oromiya Regional State southeast of Ethiopia where Asela and Robe, the capitals of Arsi and Bale zones are located at 175 and 430 Kilo meters away from Addis Ababa respectively. Topographically, the altitude ranges from 1500 to 4250 meters above sea level, where a central plateau (2000-2500 meters above sea level predominates with a narrow lowland area. The area experiences a bimodal rainfall occurring from July to October and April to May. An average annual temperature of 20- 25 ^{0}C and 10- 15 ^{0}C and rainfall 400 to 700 mm in the lowlands whereas 1200 to 1400 mm in the highlands are recorded, respectively (CSA, 2003).

Equine population is the highest in Oromiya region mainly of the Arsi-Bale highlands (Arsi-Bale zone plan office, 2006). Bale Mountains National Park located in Bale highland of Oromiya region is the largest area of Afro-Alpine habitat in the whole of the continent which gives the visitor opportunities for unsurpassed mountain walking, horse trekking and the chances to view many of Ethiopia's endemic mammals (Ethiopia Tourism Commission, 2012).

Study animals and design

A cross sectional study involving a two stage cluster sampling technique was employed to conduct the study. Horses considered in this study were local (Oromo bloodlines) breeds in origin belonging to different age and sex groups. Young and adult groups were estimated using an age determination chart developed by Svendsen (1997). The age of sampled horses ranged from 1.2 to 27 years with an average of 8.7 years old. All horses were kept under typical traditional farmer's

management conditions and allowed to graze without or poor supplementation (crop residues) and did not receive anthelminthic treatment before and during the study period. The body condition score was subjectively estimated based on guides published by Svendsen (1997).

Sample Size

A total of 2683 faecal samples of horses were collected to examine for the presence of helminth ova and 80 pooled samples for recovery of third stage larvae**.** The sample size was determined using standard procedures as described by Thrusfield (1995) for an infinite population, 50 % estimated prevalence, 95 % confidence interval and 5 % allowable error for the estimate.

Sampling Method

A two stage cluster sampling technique was used to calculate the minimum sample size. Three districts namely Asela, Dodola and Goba were selected purposively based on equine population. Three peasant associations (PA) from each district were selected randomly using a lottery system. One village from each PA was selected randomly and all accessible horses in the village were sampled. Faecal samples were collected directly from the rectum using arm length rubber gloves and placed in 28 ml glass, screw-corked universal bottles half filled with 10 % formaldehyde (samples for coproculture were collected without preservative). A floatation technique was used to concentrate the helminth eggs and microscopic examination of feces for helminth ova using procedures as described by Hendrix (1998). A quantitative fecal examination, for egg per gram of feces (epg) determination was conducted using a modified McMaster egg counting technique according to Hanson (2000) to count helminth parasite eggs selectively on those samples positive for parasitic ova up on qualitative procedures. Additionally, 80-pooled fecal samples were collected and used to differentiate parasitic larvae whose eggs could not be distinguished by examination of fresh feces using a procedure described by Hendrix (1998).

Data analysis

Collected data was subjected to SPSS 11.5 software of the computer program for the statistical analysis. Based on the type of data, the association between risk factors and distribution of parasites were analyzed using bivariate and multivariate statistical analysis of logistic regressions, the chi square test and analysis of

variance. The strengths of associations were determined using estimates of odds ratio. Statistical significance was set at P<0.05 according to Thrusfield (2005).

Results

Coprological findings

The coprological examination in the present study revealed the existence of 11 different gastrointestinal helminths of horses (6 at species and 5 genus levels), with different prevalences. These include : *Strongylus* species 39.5 %, *Cyathostomes* 35.1 %, *Trichostrongylus axei* 29.0 %, *Fasciola hepatica* 23.1 %, *Triodonthophorus* species 13.9%, *Parascaris equorum* 11.7 %, *Oxyuris equi* 1.8 %, *Strongyloides westeri* 0.7 %, *Dictyocaulus arnifieldi* 0.5 %, *Anoplocephala* species 0.3 % and *Gastrodiscus* species 0.2 %. The overall prevalence of gastrointestinal helminths of horses was 84.4 %, out of which 59.1 % were mixed infections with two or more types of helminths (Table 1 and 2).

Table 1. Prevalence of GI helminths in horses in relation to different risk factors in three study districts

Risk factors	No. samples examined	Overall helminth ova		Mixed infection	
		No. positive	Prevalence (%)	No. positive	Prevalence (%)
District:					
Asela	915	742	81.1	442	48.3
Dodola	952	802	84.2	467	49.1
Goba	816	721	88.4	430	52.7
Age:					
< 4 years	391	337	86.2	214	54.7
4-8 years	1346	1121	83.3	655	48.7
> 8 years	946	807	85.3	470	49.7
Sex:					
Male	1728	1444	83.6	847	49.0
Female	955	821	86.0	497	52.0
Body condition:					
Poor	1310	1101	84.0	655	50.0
Medium	1308	1113	85.1	655	50.1
Good	65	51	78.5	29	44.6
Total	2683	2265	84.4	1339	59.1

There was no significant difference (P>0.05) in the prevalence of gastrointestinal helminths in districts, age groups, sexes and body condition of horses (Table 1).

There was statistically significant variations in the prevalence of *Strongylus* species among sex (P<0.05) of the examined horses. Accordingly, female animals were more affected with *Strongylus* species (43.2 %) than males (37.4 %). However, districts, age and body condition did not seem to have significant effect on *Strongylus* species infection (P>0.05) (Table 2). On the other hand, the prevalence of *Cyathostomes* in different districts was significantly (P<0.05) variable (Table 2). There was significant variation in the prevalence of *Trichostrongylus axei* among the three districts (P<0.05) but age, sex and body condition were not seen to have significant effects (P>0.05).

Table 2. Prevalence of GI helminths of horses in relation to different risk factors in three study districts

Risk factors	*Strongylus* species	Cyathostomes	*T. axei*	*Fasciola hepatica*	*Parascaris equorum*	*Triodonthophorus*
District:						
Asela	42.3 %	32.8 %	30.6 %	12.6 %	11.7 %	15.2 %
Dodola	33.5 %	33.6 %	24.8 %	37.9 %	10.2 %	13.2 %
Goba	43.3 %	39.6 %	32.2 %	17.5 %	13.6 %	13.1 %
Age:						
< 4	50.1	35.0 %	27.1 %	16.4 %	21.0 %	15.1 %
4-8	37.2	34.2 %	27.3 %	23.9 %	10.9 %	13.3 %
> 8	37.9	36.3 %	32.3 %	24.5 %	9.1 %	14.2 %
Sex:						
Male	37.4	35.8 %	28.3 %	23.8 %	9.5 %	14.2 %
Female	43.2	33.8 %	30.4 %	21.8 %	15.7 %	13.2 %
Body condition:						
Poor	40.0	33.9 %	26.3 %	25.1 %	13.2 %	15.0 %
Medium	39.1	36.8 %	32.0 %	21.2 %	10.2 %	13.1 %
Good	35.4	24.6 %	23.1 %	20.0 %	12.3 %	6.2 %
Total	39.5	35.1 %	29.0 %	23.1 %	11.7 %	13.9 %

The variation in the prevalence of *F. hepatica* among the three districts was highly significant (P<0.05) and horses in Dodola were 4.29 and 2.9 times more likely to be infected by *F. hepatica* than horses in Asela and Goba districts, respectively. The prevalence of *F. hepatica* was seen to increase as age advances. The age variation in the prevalence of *F. hepatica* was statistically significant (P<0.05)

where horses more than 8 years old were 1.65 times more likely to be infected with *F. hepatica* than horses less than 4 years of age. Likewise, horses between 4-8 years of age were 1.6 times more likely to be infected with *F. hepatica* than horses less than 4 years of age. There was a statistically significant difference in the prevalence of *F. hepatica* with body condition of horses ($P<0.05$). However, the effect of sex on the prevalence of *Fasciola hepatica* was not statistically significant ($P>0.05$) (Table 2).

The effect of age and sex variations in the prevalence of *P. equorum* were statistically significant ($P<0.001$ and $P<0.05$) respectively. Horses less than 4 years of age were 2.65 and 2.16 times more likely to be infected with *P. equorum* than those of 4-8 years and more than 8 years of age, respectively. Female horses were found being more susceptible to *P. equorum* infection than their counter males (Table 2). The variation in the prevalence of *Triodonthophorus* species due to district, age, sex and body condition were not statistically significant ($P>0.05$) (Table 2).

Faecal egg counts

The average egg per gram (epg) of feces in this study was 745.2 with a range of 100 to 10,500. These variations due to difference in district, age, sex and body conditions were not statistically significant ($P>0.05$) (Table 3).

Table 3. Helminth egg per gram of feces (epg) counts in horses in relation to different risk factors in the three study districts

Risk factors	No. of samples	Mean epg output	Standard deviation
District:			
Asela	915	591.98	147.26
Dodola	952	636.91	385.88
Goba	816	1020.52	195.84
Age:			
< 4 years	391	750.03	295.63
4-8 years	1346	753.77	387.51
> 8 years	946	731.03	230.64
Sex:			
Male	1728	747.08	365.88
Female	955	741.84	241.00
Body condition:			
Poor	1310	734.51	361.90
Medium	1308	756.82	291.10
Good	65	722.97	253.62
Total	2683	745.21	326.90

Differential larval counts

The coproculture performed on 80-pooled fecal samples revealed three *Strongyle* genera, which were: *Strongylus vulgaris* 38.46 %, *Strongylus edentatus* 30.77 %, *Cyathostomes* species 23.08 % and *Triodonthophorus* species 7.70 % (Table 4).

Table 4. Result of differential larval counts recovered by coproculture from 80-pooled fecal samples from horses in the study areas.

Species/Genus of larvae	No. of larvae	Proportion
Strongylus vulgaris	3077	38.46 %
Strongylus edentatus	2461	30.77 %
Cyathostomes species	1846	23.08 %
Triodonthophorus species	616	7.70 %
Total	8000	100.00

Discussion

The results of the present study clearly demonstrated that helminth infections are highly prevalent in horses of Arsi-Bale highlands of Oromiya Region. This is in line with previous report from Ethiopia by Feseha Gebreab (1998) and other countries such as USA (Reinmeyer *et al*., 1984) and South Africa, (Krecek *et al*., 1989) which indicated prevalence ranging between 80 % and 100 %.

The current study also demonstrated 11 different types of helminth parasites (6 at species and 5 at genus levels), of which *Strongylus* species and *Cyathostomes* were found to be the dominant ones. This is in agreement with the findings in other parts of Ethiopia by Fiseha Gebreab *et al.,* (1990) who recorded *Cyathostomes* in 85-92 %, *Strongylus* species in 74 - 80 %, *Triodonthophorus* species in 74 - 78 %, *P. equorum* 38.4 - 44.7 % as the major helminth parasites in equines in central Ethiopia.

The present study indicated that polyparasitism to be the major problem in the area. The presence of more than one helminths in horses in these study areas may be related with lack of control measures against helminth parasites. Specifically the lack of regular deworming tends that might have attributed to the incidence of polyparasitism. The climatic condition of Arsi-Bale highlands of Oromiya region where rainfall is frequent and temperature is mild also favors the development and survival of infective larvae for most part of the years. Owing to the huge equine population in the study area considerable contamination to the communal pasture grazing system could be the other factor which favors polyparasitism. Arsi- Bale

highlands of Oromiya region have temperate type of climate being cool for most parts of year with a heavy annual rainfall. Furthermore the equine biomass in Arsi-Bale highlands of Oromiya region is the highest for the country where animals of deferent age and sex group usually graze on communal pasture facilitated easy transmission of these parasitism.

The prevalence of *Strongylus* (39.5 %) and *Cyathostomes* species (35.1 %) observed in this study were lower compared to those reported by Fiseha Gebreab (1998) where it was found that *S. vulgaris* 80 % and Cyathostomes 76.1 % in horses of Debre Zeit town. Similarly, Krecek *et al.,* (1989) reported a prevalence of 94 % for *S. vulgaris* in horses of South Africa. In the present study, the reported prevalence was lower due to the fact that sampling was conducted partly in the dry season of the year.

The moderate prevalence of *Trichostrongylus axei* (29.0 %) observed in this study was in agreement with reports by Krecek *et al.,* (1989) and Feseha Gebreab *et al.,* (1990) 1998; which ranged from 6-40 %. The prevalence of *Triodonthophorus* species in this study (13.9 %) was also lower than previous findings of Krecek *et al.,* (1989) and Feseha Gebreab (1998) who reported 23 % and 35 %, respectively. However, it was much higher than the finding of Reinmeyer *et al.,* (1984) which was 3.6 %. The possible explanation for the observed variation in prevalence could be attributed to differences in agro-ecology, sampling season as well as equine management system.

The overall prevalence of *F. hepatica* was 23.1 % which seems higher than the previous findings of Feseha Gebreab (1998) who reported a prevalence of 9.0 % in Menagesha and central Ethiopia and comparable with the results of Gezahegn Eshete (2000) who reported 27.1 % prevalence in cart mules in Bahir Dar Northwestern Ethiopia. This is attributed to the presence of wide marshy and swampy vast communal grazing areas which is common in many parts of Ethiopia. Moreover, there was an increasing trend in the prevalence of fasciolosis with age of equines, which can be explained from the fact that older animals might have a high risk for exposure to *Fasciola* than the young.

The prevalence of *P. equorum* in the present study (11.7 %) was relatively lower than that of Gezahegn Eshete (2000) who reported 43.8 % in Bahir Dar Northwestern Ethiopia. The prevalence of *P. equorum* was significantly higher in young horses (21.0 %) than older horses (9.1 %). This was not unexpected because *P. equorum* is more of a problem of young horses as immunity develops following

exposure during older age (Hundson, 1990; Urquhart *et al*., 1996). Acquired resistance to *P. equorum* usually develops before the second year of life and therefore, cases are highly reported from younger animals (Urquhart *et al*., 1996). Young animals were seem to more susceptible than adults. Feseha Gebreab (1998) reported *Strongyliodes westeri* and *P. equorum* frequently blamed to affect young species of equines. The prevalence of *P. equorum* was also higher in mares (15.7 %) than their counterpart stallions (9.5 %). This can be justified by the fact that mares have a close relation to their foals, which favors frequent recycling of the parasite between the dam and foal. Heavy infections of *P. equorum* cause impaction and perforation leading to fatal peritonitis (Urquhart *et al*., 1996).

The prevalence of *Oxyuris equi* 1.8 %, *Strongyloides westeri* 0.7 %, *Dictyocaulus arnifieldi* 0.5%, *Anoplocephala* species 0.3 % and *Gastrodiscus* species 0.2 % is quite lower than previous reports by Yoseph Shiferaw *et al.,* (2001). *Anoplocephala magna* and other related but less common and smaller tapeworm such as *Paranoplocephala perfoliata* are the only adult cestodes found in horses (Soulsby, 1986). This low prevalence of cestodes in horses in this study could be due to the seasonality of orbited mites (vectors) as described by Soulsby (1986).

A relatively higher mean egg per gram of feces 745.2 epg output was observed in horses of the three districts. This result was in agreement with findings of Krecek *et al.,* (1986) and Newmarket (1986) who reported the spring rise of Strongyle egg output in grazing horses. This is also attributed to the favorable condition of wet and humid environment to the biology of these parasites.

The differential larval count indicated that *S. vulgaris*, *S. edentatus* and *Cyathostome* species were the major parasites of horses in the studied districts. This result is line with the findings of Feseha Gebreab (1998).

The results of the present study disclosed that polyparasitism is one of the commonest ill-causing factors and indeed the main cause of early demise of horses in the study districts. However, the problem due to gastrointestinal helminths of equines in the study area was given less attention because of its sub clinical nature. Hence strategic treatment of equines should be undertaken on the basis of sound and complete understanding on the epidemiology of gastrointestinal helminths of equines in the study districts.

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