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Cross-sectional study on gastro-intestinal parasites of equids in South-western Ethiopia

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ABSTRACT

A cross sectional study was conducted in Jimma town from October 2010 to March 2011 with the objective of determining the status of intestinal nematode parasites of equids, and the association of different variables with infection rate. To address this, a total of 400 equids; donkeys (n = 29), horses (n = 317) and mules (n = 54) were used in this study and based on the coprological examination to identify parasite eggs, three species of nematodes were identified with an overall prevalence of 72.25%. A prevalence of 63.25%, 16.50%, 4.25%, and 10.75% were identified for Strongyles, *Parascaris equorum*, *Oxyuris equi*, and mixed infection respectively. Highest to lowest prevalence of Strongyles (63.72, 51.85 and 79.31%), *P. equorum* (17.98, 12.96 and 6.89%) and *O. equi* (5.04, 1.85 and 0.00%) were observed in horse, mule and donkey, respectively. The statistical analysis between the species of equine and strongyle infection rate, body condition scores with strongyle and *P. equorum* infection rate ($p < 0.05$). However, species of the animal was not significantly associated with *P. equorum* ($p < 0.05$). The infection rate of *O. equi* was not significantly associated with body condition score, age and species of equines ($p > 0.05$ for all variables) and no significant difference ($p > 0.05$) between the prevalence of intestinal nematodes and sex of the animal was showed. Therefore, the present study revealed that intestinal nematodes are an important health problem in the area affecting the wellbeing and productivity of equids.

1. Introduction

Despite the increase in mechanization in the world, donkeys, horses, and mules are still well deserving of the name "beasts of burden". They have a prominent position in agricultural system of many developing countries (Pearson et al., 1999). The world equine population is about 122.4 million consisting of 43.4, 40 and 15 million horses, donkeys, and mules respectively. Out of the global distribution, 98% of donkeys, 97% of mules and 60% of horses are distributed in developing countries. The equine population in Africa is 17.6 million, consisting of 11.6 million donkeys, 3.7 million horses and 2.3 million mules (Fielding, 1991). Ethiopia possesses nearly half of African equine population with 58%, 46% and 37% of horses, mules, and donkeys respectively. Equids are important animals to the resource poor community in the rural and urban areas of Ethiopia providing traction power and transport service at low cost (Elisabeth and Svendsen, 1997). In Ethiopian farming system, equids play a vital role in both economic as well as social functions. They are kept and are often used for land tillage, cultivation, pack purposes, riding, social security, and providing of manure for both energy and soil fertility (Elisabeth and Svendsen, 1997). Regardless of their benefits, equids are disadvantaged animals in terms of getting attention. Parasitic diseases, dominated by gastrointestinal nematodes,

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are serious health hazards contributing to poor body condition, reduced power output, poor reproductive performance, retarded growth, and short lifespan. Large number of internal parasites has been reported to occur in six African countries including Ethiopia, Kenya, Zimbabwe, Burkina Faso, Chad and Morocco (Pandey et al., 1994). The most common intestinal nematodes identified in equids are large strongyles (*Strongyles vulgaris*, *Strongyles equinus*, *Strongylese dentatus* and *Triodontophorous* species), *Parascaris equorum*, *Oxyuris equi* and to the lesser extent other small strongyles (Cyathostomins). Intestinal nematodes of equids have similar life cycle. Clinical illness occurs not only from the presence of the adult parasite in the intestine, but also from larval migration in the intestinal wall and other organs, notably the circulatory system (Wintzer, 1996). Virtually, all grazing horses infected with the parasites show clinical symptoms but many low to moderate infection are sub-clinical, although they may cause reduced weight gain and performance (Zajac and Conboy, 2006). Young non-immune animals are more susceptible to clinical disease, which may include diarrhea, colic and hypoproteinemia (Zajac and Conboy, 2006). As a result, infection with intestinal nematodes can result in reduction of productivity due to complications such as colic, diarrhea, pruritis and intestinal obstruction (Foreyt, 2004). Diagnosis of most intestinal nematodes of equines is possible through demonstration of eggs of the parasites from faecal samples (Foreyt, 2004). In all regions of Ethiopia, three broad spectrum anthelmintic drugs are currently in use, namely, benzimidazoles, tetrahydropyrimidines and macrocyclic lactones. However, regardless of the availability of the drugs, those animals are neglected and get less attention comparing to other livestock populations. The lack of adequate veterinary service and management for equids is one of the main factors for higher incidences of parasitic or non-parasitic infections. There are only limited studies so far on parasitic diseases of equids in Ethiopia. Therefore, this study was conducted with the aim of estimating the prevalence of the parasites and how the prevalence is associated with different confounding factors in the region.

2. Methods

2.1. Study site

The study was conducted in Jimma town (Fig. 1), Southwestern Ethiopia located in Oromia regional state, 352 km Southwest of Addis Ababa. The area is located at latitude of 7°13′–8°56′N and longitude 35°52′–37°37′E, and 880–3360 m above sea level. The area receives a mean annual rainfall of 1530 mm. The average annual minimum and maximum temperature is 14.4 °C and 26.7 °C respectively.

2.2. Study population

A total 400 equids were sampled in this study. These animals were a single working animal kept under traditional husbandry conditions. Horses, mules, and donkeys comprised 79.25% (317), 13.5% (54) and 7.25% (29) respectively. All age and sex groups of local equids were included in this study and equines <5 years of age were considered as young, while those >5 years old as adults (David, 2002). Body condition scores were performed using the pelvic and rump assessment as the base and the score was give as 1(poor), 2(medium) and 3(good).

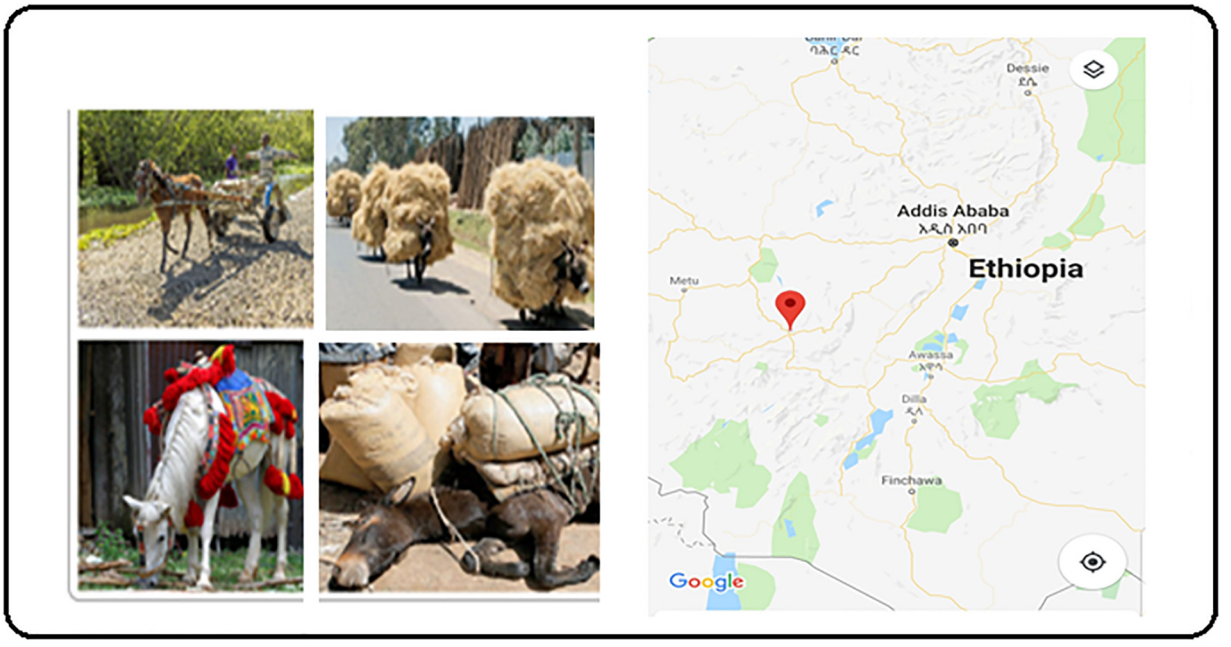

Fig. 1. Location of study area and the socio-economic contribution of study animals in the area.

2.3. Sampling method and sample size determination

Sample size was calculated using the formula: $n = 1.96^2 P_{exp} (1 - P_{exp}) / d^2$, where n = required sample size, P_{exp} = expected prevalence, d = desired precision (Thrusfield, 1995). Purposive sampling was employed to select kebeles and households keeping horse in Jimma town followed by simple random sampling to select study animals from the selected households. Kebeles and households were purposively selected based on accessibility, population of the study animals and willingness of the owners to be involved in the survey. Accordingly, the sample size (n) was 384, and therefore, a total of 400 equids were included in the study.

2.4. Coprological examination

Faecal samples were collected by a veterinarian directly from the rectum of each animal or during defecation with strict sanitation in plastic bottles labelled with identification number and samples were subjected to saturated sodium chloride flotation method (William, 2001). Briefly, approximately 3 g of faces was placed in a beaker. Then 50 ml of floatation fluid was poured into the beaker containing 3 g of faces and mixed thoroughly. The resulting faecal suspension was poured through a tea strainer into another beaker. Then the faecal suspension was poured into a test tube from the second container. The test tube was placed on the test tube rack. Then the test tube was gently filled with the suspension leaving a convex meniscus at the top of the tube and a cover slip was carefully placed on the top of the test tube. Then the tube was allowed to stand for 20 min. Finally, the cover slip was lit off carefully from the tube vertically, together with the drop of fluid adhering to it, and immediately placed on microscope slide and examined under the microscope.

2.5. Data management and statistical analysis

All date collected from the study were recorded in a Microsoft excel spreadsheet and the statistical analysis was performed using STATA version 13 (StataCorp, 2013). Prevalence was calculated by dividing the number of positive animals to total animals examined multiplied by 100. Multivariate logistic regression analysis was used to indicate the association of different risk factors with the occurrence of parasite and p value < 0.05 was required for significance.

3. Results

From a total of 400 faecal samples examined, 289 were positive for one or more eggs of intestinal nematodes of equids, and revealed an overall point prevalence 72.25% [Table 1]. Three types of gastrointestinal parasites were identified following coprological examination of faecal samples. The prevalence of gastrointestinal strongyles, *Parascaris equorum* and *Oxyuris equi* was found to be 63.25%, 16.5% and 4.25% respectively [Table 2]. Prevalence of gastrointestinal strongyles in horses, mules and donkeys was 63.72%, 51.85% and 79.31% respectively and there was a significant difference ($p < 0.05$) between the species of equids and infection rate. Age and sex were not significantly associated with the occurrence of gastrointestinal strongyles infection ($p > 0.05$). Rate of infection with *strongyles* in poor, medium and average body conditioned equids was 86.90%, 61.15 and 37.50% respectively. There was a highly significant variation ($p = 0.001$) between body condition score and infection rate of intestinal nematodes [Table 2]. As shown in Table 2, the prevalence of *P. equorum* in horses, mules and donkeys was 17.98%, 12.96% and 6.89% respectively and there was no significant difference between species. The difference in the prevalence of *P. equorum* between different age groups and sexes was not significant ($p > 0.05$). However, prevalence of *P. equorum* in different body condition scores was found statistically significant ($p < 0.05$). The prevalence of *O. equi* based on species, age, sex, and body condition score is indicated at Table 2 and there was no significant variation ($p > 0.05$) in infection rate for all variables.

4. Discussion

This study showed a significantly higher prevalence of gastrointestinal strongyle species (63.25%), *P. equorum* (16.5%), and *O. equi* (4.25%) which is relatively lower comparing to other studies conducted at different geographical locations, who reported a prevalence of 100%, 39.77% and 22.88% respectively (Belay, 2011). However, this finding agrees with a study previously reported with *P. equorum*, 14.45% and *O. equi*, 4.82% (Sinasi and Mustafa, 2009) and a study reported with a *strongyles* prevalence of 64% (Sotiraki et al., 1997).

Table 1
Overall prevalence of intestinal nematodes on species basis.

Species of equids	N(Total)	Positive	Prevalence	CI [95%]	p-Value
Horse	317	234	73.81	74.10–76.30	0.53
Mule	54	32	59.25	59.50–62.10	
Donkey	29	23	79.31	80.13–84.20	
Total	400	289	72.25	72.77–74.30	

Table 2
Prevalence of intestinal nematodes based on different risk factors.

Type of nematode	Risk factors		N (total)	Prevalence (%)	CI [95%]	p-Value
Gastrointestinal strongyle	Species	Horse	317	63.72	60.3–65.4	0.037
		Mule	54	51.85	48.7–52.4	
		Donkey	29	79.31	76.3–81.2	
	BCS	Poor	84	86.9	84.2–89.1	0.03
		Medium	260	61.15	57.7–63.1	
		Good	56	37.5	34.3–38.9	
	Age	Young	12	66.66	68.5–70.4	0.63
		Adult	388	61.25	62.1–63.5	
	Sex	Male	241	61.41	61.8–63.9	0.41
		Female	159	66.03	66.9–68.1	
P. equorum	Species	Horse	317	17.98	18.1–20.0	0.29
		Mule	54	12.96	13.0–14.7	
		Donkey	29	6.89	7.1–8.9	
	BCS	Poor	84	28.57	26.2–29.0	0.02
		Medium	260	14.61	13.1–15.2	
		Good	56	7.14	5.3–7.9	
	Age	Young	12	16.66	17.0–19.1	0.35
		Adult	388	16.49	16.9–21.0	
	Sex	Male	241	19.08	19.4–21.3	0.61
		Female	159	12.57	12.8–14.1	
O. equi	Species	Horse	317	5.04	5.5–7.1	0.24
		Mule	54	1.85	2.1–3.3	
		Donkey	29	0	0	
	BCS	Poor	84	8.33	8.7–11.2	0.14
		Medium	260	3.07	3.2–5.0	
		Good	56	3.57	3.6–7.2	
	Age	Young	12	0	0	0.69
		Adult	388	4.25	4.4–6.3	
	Sex	Male	241	4.56	4.6–6.8	0.73
		Female	159	3.77	3.9–4.1	

Prevalence of gastrointestinal strongyle was significantly higher ($p = 0.04$) than *P. equorum* and *O. equi*. Low infection rates of *P. equorum* and *O. equi* in this study might be attributed to the difference in agro-ecological zones of the study area (Chaudhry et al., 1991) and some other factors such as management, climate, and parasite control program. In addition, the low prevalence of *O. equi* is may be as a result of the identification method we employed which is saturated sodium chloride flotation method, low sensitive to detect the parasite egg. The use of broad spectrum anthelmintic causes drastic reduction in worm populations of large strongyles (Konigova et al., 2003). Unlike coprological examinations, higher infection rates were reported in animals examined by post mortem examination (Boxell et al., 2004) and studies based on necropsy findings is better in diagnosing many undetected infections that are missed at coprological examination (Boxell et al., 2004; Chapman et al., 2002). This study showing a significant difference ($p < 0.05$) between the species of equids and infection to gastrointestinal strongyles and this finding agrees with previous studies showed the prevalence of *strongyles* in horse, 58.50% (Saeed et al., 2010) and 68% (Cirak and Gulegen, 2005). It has been reported that the overall prevalence of small strongyles is high in horses; it is believed that 100% of horses are infected with these parasites (Reinemeyer et al., 1984). Khallaayoune,1991 (Khallaayoune, 1991) showed that donkeys in Morocco were heavily infected with helminth parasites including *Trichostrongylus axei* and Habronema spp. in the stomach, *P. equorum* in the small intestine and *S. vulgaris*, *S. edentatus*, *O. equi* and small strongyles in the large intestines.

In the present study, there was no significant variation ($p > 0.05$) between the two age groups, young and adult regarding parasite infection. This may be due to less number of young animals included in the study. The difference between body condition score and infection rate was highly significant ($p < 0.001$). This significant association was supported by the fact that poor body condition animals have high chance of developing infections than good body condition animals (Shiferaw et al., 2001) and this is associated with the fact that poor body condition animals can develop a compromised immune response which might lead them to a risk of developing nematode infections. Furthermore, there was no significant difference between species of equids and the prevalence rate of parasites. Similarly, Shiferaw et al. (2011) reported a prevalence of 12.9%, 13.6% and 15.7% for *P. equorum* in horses, mules, and donkeys respectively. However, prevalence of the present study is lower, as compared to the study of Belay (2011) who reported 36.02%, 28.3% and 43.8% respectively. Such a lower prevalence in the present study might be due to the difference in the age of examined animals because equines commonly develop marked resistance to *P. equorum* after six months of age (Chapman et al., 2002). The prevalence of *O. equi* was 5.04%, 1.85% and 0% in horses, mules, and donkeys respectively. This result is comparable with previous reports (Sinasi and Mustafa, 2009) who reported 4.1% and (Sotiraki et al., 1997) reported as 1.2%. The overall prevalence of *O. equi* in our study was 4.25%. The reported prevalence of this parasite in some other countries is: 26% in Czechoslovakia, 5.3% in Belgium (Gawor, 1995), 7% in Australia (Bucknell et al., 1995) and 18% in the USA (Reinemeyer et al., 1984). *P. equorum*, with an overall prevalence of 16.5% was the first most prevalent parasite in the present study. The prevalence of this parasite was 16.8% in Czechoslovakia, 37% in Belgium (Gawor, 1995), 11% in the USA (Reinemeyer et al., 1984), 5% in Australia (Bucknell et al., 1995) and 90% in Brazil (Pereira and Vianna, 2006).

In conclusion, the present study showed the identifications of some intestinal nematode parasites mostly gastrointestinal strongyles, are prevalent in animals examined in this study. However, due to the lack of quantitative study, it is difficult to conclude that these are parasites of major equids health threats though this finding can help in implementing new control strategies of infection in the area. Therefore, from this base line information, we recommend further investigations aimed at addressing the detail quantitative and epidemiological screening.

Abbreviations

P_{exp}	expected prevalence
SPSS	statistical package for the social sciences

Limitations of the study

This study didn't cover a wide range of geographical and agro-ecological region of the country to address the epidemiology of nematode parasites. The study also focused on the qualitative findings only. Moreover, it only addresses the status of the disease without including the welfare problems frequently encountered in the area.

Ethical approval and consent to participate

Ethical approval for this study was approved by the animal ethics and welfare committee of the University of Gondar and before this research has been conducted, we received an informed consent from the animal owners.

Consent to publish

Not applicable.

Availability of data and materials

The corresponding author has full access and responsibility to all data of this work on behalf of all authors of this manuscript.

Competing interests

The authors declared that there is no competing interest.

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Authors' contributions

MT proposed the idea and performed the experimental designs, analyzed data and drafted and wrote this paper, BA conducted experiments, reviewed, read and commented the draft paper. Both MT and BA read and approve the final version of the manuscript.

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