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Full Length Research Paper

Helminthosis of sheep and goats in and around Haramaya, Southeastern Ethiopia

Tesfaheywet Zeryehun*

College of Veterinary Medicine, Haramaya University, P. O. Box 301, Dire Dawa Ethiopia. E-mail: tesfahiwotzerihun@yahoo.com.

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A cross-sectional study was carried out in sheep and goats kept under extensive management system in and around Haramaya, Southeastern Ethiopia, during the period from July 2010 to June 2011 with the aim of determining the prevalence, and the status of gastrointestinal (GIT) helminthosis and the risk factors associated with it. For this purpose 768 fecal samples were collected from 384 sheep and 384 goats. Parasitological methods including floatation, sedimentation and coproculture were employed in the study. The fecal samples examined revealed an overall prevalence of 472 (61.4%) in the small ruminants where as 259 (67.75%) in sheep and 213 (55.47%) in goats harbor one or more genera of helminths with nematodes (59.89%) being the most prevalent helminths. Upon coproscopic examination, strongyle type of helminths was the most prevalent parasite (36.20%) in the area in both hosts. The study revealed significantly higher ($p<0.05$) prevalence of helminths in sheep than in goats and in young animals than in adults, and wet season than drier ones. In this present study, there was no association between egg per gram of feces and the prevalence of helminths. Overall, 7 and 6 genera of helminths were identified in sheep and goats, respectively. Coproculture of the samples positive for strongyle type helminths revealed *Haemonchus* sp., *Trichostrongylus* sp., *Oesophagostomum* sp., *Strongyloides* sp., *and Bunostomum* sp. in a decreasing order in both sheep and goats. The present study revealed polyparasitism in both host species, hence proper management of young stocks and treatment of animals by considering risk factors such as age and season, could help in the control of the disease. The result of this study indicates that, even though subclinical in nature, gastrointestinal helminths are one of the major problems that could hamper health and productivity of sheep and goats in the study area. Thus, further studies on species-based prevalence and larval ecology are recommended in order to design appropriate control measures.

Key words: Prevalence, helminths sheep, goats, Ethiopia.

INTRODUCTION

Ethiopia possesses an estimate of 26.1 million sheep and 21.7 million goats (CSA, 2009) which are well adapted to local climatic and nutritional conditions and contribute greatly to the national economy (Alemayehu and Fletcher, 1995). However, poor animal production and management (Ademosun, 1992) coupled with infectious and parasitic disease had lead to reduce productivity of small ruminants (Haileleul, 2002). By and large, parasitic infections pose a serious health threat and limit the productivity of livestock due to the associated morbidity and mortality (Tibbo et al., 2006; Nwosu et al., 2007). More specifically, plethora of parasitic diseases plays a detrimental role in hampering small ruminant production leading to serious economic loss (Teklay, 1991).

Small ruminants managed under extensive and

intensive production systems are extremely susceptible to the effect of wide ranges of endoparasites (Abebe and Esayasu, 2001). Helminthosis of sheep and goat is among the endoparasite infections that are responsible for economic losses through reduced productivity and increased mortality (Perry et al., 2002). The loss through reduced productivity is related to reduction of food intake, stunted growth, reduced work capacity, cost of treatment and control of helminthosis (Pedreira et al., 2006; Odoie et al., 2007; Chaudhary et al., 2007). The effect of infestation by gastrointestinal helminths varies according to the parasite concerned, the degree of infestation and other risk factors such as species, age, season and intensity of worm burden (ILCA, 1990).

Although considerable work has been done on endoparasites of sheep and goats in many parts of Ethiopia (Jobre and Ali, 2000; Abebe and Esayasu, 2001; Regassa et al., 2006; Kumsa et al. 2010; Dagnachew et al. 2011) and losses from clinical and sub-clinical level including losses due to inferior weight gains, lower milk yields, condemnation of organs and carcasses at slaughter and mortality in massively parasitized due to parasitic diseases were documented (Tilahun, 1995; Regassa et al., 2006); however, no report so far has been published on the prevalence of small ruminant helminthosis in the present study areas, where sheep and goats are important assets to the local farmers. Hence, it is imperative to investigate the level of the parasitism, the type of helminths and the associated risk factors that make small ruminants susceptible to the wide range of GIT helminths in an area, in order to devise effective control measure and monitor their outcome properly. Therefore, it is the objective of this study to determine the prevalence and severity of GIT helminths, establish the relationship between risk factors of helminthiasis and their prevalence and identify the most prevalent helminths in small ruminants in and around Haramaya, Southeastern Ethiopia.

MATERIALS AND METHODS

Study area

The study was conducted in and around Haramaya in the Eastern Haraghe zone of Oromiya region, Southeastern Ethiopia. The area is located, 14 km from west of Harare and 508 km east of Addis Ababa. The estimated animal population in the area is about 63,723 cattle, 13,612 sheep, 20,350 goats, 15,978 donkeys, 530 camels and 42,035 chickens. The production system of the district is mixed type. Topographically, it is situated at altitude of 1600 to 2100 m above sea level with the mean annual temperature and relative humidity of 18°C and 65%, respectively. There are four seasons; a short rain season (from March to mid May), a short dry season (from end of May to end of June), a long wet season (early July to mid October) and a long dry season (end of October to end of February). The Haramaya area receives an average annual rain fall of approximately 900 mm, with a bimodal distribution pattern, picking in mid April and mid August. The vegetation that constitutes the available pasture lands in this area is predominantly native grasses and legumes inter dispersed with open acacia shrub land (HADB, 2010).

Study population

In the study area, small ruminants are kept under traditional extensive system where farmers maintain one to three sheep and goats. In this study 768 (384 sheep and 384 goats) were randomly selected for corpological examination. During this time, both sex and age groups of sheep and goat of local origin grazing in pasture fields were included. Those animals with the age of less than one year were considered as young while those greater than or equal to one were considered as adults according to the classification of age groups by Kumssa et al. (2010).

Sampling method and sample size determination

Simple random sampling or lottery method was conducted to collect the fecal sample from individual study animals. Since there was no record of previous prevalence in the study area, the sample size was determined by taking 50% expected prevalence using the formula described by Thrusfield (2007). Accordingly, a sample size of 768 (384 each for sheep and goat) was considered for the study.

Fecal sample collection

Fecal samples were collected directly from the rectum of each animal and placed in a sample collecting bottle (screw capped bottle) and transported to laboratory.

Coproscopic examination and EPG determination

For corposcopic examination of the fecal samples, a simple test tube flotation and sedimentation technique described by Hansen and Perry (1994) was employed and the slides prepared were examined under microscope (x10). Eggs of the different helminths were identified on the basis of morphological appearance and size of eggs (Foreit, 1999).

McMaster egg counting method was used to determine the number of eggs per gram of feces (EPG) in the positive fecal samples and the degree of severity was categorized based on previously described methods (Soulsby, 1982; Urquhart et al., 1996). Furthermore, the EPG was classified as light, moderate and massive infection for a count of 50 to 799, 800 to 1200 and over 1200, respectively.

Ovaculture and identification of third stage larvae

Fecal samples positive for strongyle type eggs upon corposcopic examination were pooled for the same species of animals, age and sex and cultured for larval identification. Fecal culture was carried out according to Kaufmann (1996). The third stage larvae (L_3) were recovered by Bermann technique. 100 L_3 parasites were counted and identification of the hatched L_3 was performed on the basis of key morphological differences described by Van Wyk et al. (2004).

Statistical analysis

Association between independent variables (sex, age and season)

Table 1. Prevalence of gastrointestinal helminths in the small ruminants by species, age, sex and season.

Risk factor	No. examined	No. positive	Prevalence (%)	χ^2 (P-value)
Species				
Sheep	384	259	67.45	11.63 (0.001)
Goat	384	213	55.47	
Total	768			
Age groups				
Young	482	311	64.52	5.13 (0.026)
Adult	286	161	56.29	
Total	768			
Sex				
Male	389	235	60.41	0.36 (0.298)
Female	379	237	62.53	
Total	768			
Season				
Dry	288	148	51.39	19.72 (0.000)
Wet	480	324	67. 50	
Total	768			

Table 2. Overall prevalence of GIT helminths in sheep and goats by types of helminthes.

Types of helminths	Sheep (n=384)		Goats (n=384)		Total (n=768)	
	Positive	Prevalence (%)	Positive	Prevalence (%)	Total positive	Overall prevalence (%)
Nematode	250	65.10	210	54.69	460	59.89
Trematodes	10	2.60	3	0.78	13	3.38
Cestodes	35	9.11	21	5.47	42	10.93

and parasitism were compared using Chi-square test for independence (SPSS version 15.0) and the level of significance was set at $p<0.05$.

RESULTS

In the present study, a total of 768 fecal samples from small ruminants (384 sheep and 384 goats) were examined with species prevalence of 259 (67.75%) and 213 (55.47%) in sheep and goats, respectively were found infected at least by one parasite species, and these give an overall prevalence of 61.4% in both species. Taking species, age, sex, age and season as a predisposing risk factor, it was observed that sheep do harbor significantly ($p<0.05$) higher number of parasite than goats. Similarly, there was a significantly ($p<0.05$) higher prevalence of GIT parasites in young ones and in wet seasons while there was no significant difference ($p>0.05$) in the occurrence of gastro-intestinal (GIT) parasites in the different sex of the animals (Table 1).

The sheep and goats were found to possess different types of gastrointestinal helminths including nematodes, trematodes and cestodes. Statistically significant difference ($p<0.05$) was observed in the prevalence of these helminths in the sheep and goats (Table 2). Of these, nematodes account the highest prevalence followed by cestodes and trematodes in both sheep and goats.

The results of coprological examination in both sheep and goats have also shown the presence of several genera of GIT helminths in each of the different types of helminths. Accordingly in sheep, 6 genera of GIT helminths were detected namely, strongyle type eggs, *Strognyloides* sp., *Trichuris* sp., *Fasciola* sp., *Paraphistomum* sp., *Monezia* sp., while in goats all the genera listed in the sheep were present except *Fasciola*

Table 3. The prevalence of particular gastrointestinal helminths infection.

Helminth eggs	Sheep (n=384)		Goats (n=384)		Total (n=768)	
	Number positive	Prevalence (%)	Number positive	Prevalence (%)	Total positive	Overall prevalence (%)
Nematode	**250**	**65.10**	**210**	**54.69**	**460**	**59.89**
Strongyle	153	39.84	125	32.55	278	36.20
Strongyloides	67	17.45	59	15.36	126	16.40
Trichuris	30	7.81	26	6.77	56	7.29
Trematodes	**10**	**2.60**	**3**	**0.78**	**13**	**3.38**
Fasciola	7	1.82	0	0.00	7	0.91
Paraphistomum	3	0.78	0	0.00	3	0.39
Cestode	**35**	**9.11**	**21**	**5.47**	**56**	**7.29**
Moneizia	35	9.11	21	5.47	56	7.29

Table 4. Mixed types of helminth eggs in sheep and goats in the study area.

Helminth eggs	Sheep (n=384)		Goats (n=384)		Total (n=768)	
	Number positive	Prevalence (%)	Number positive	Prevalence (%)	Total positive	Overall prevalence (%)
Strongyle + *Trichuris*	25	6.51	13	3.38	38	4.95
Strogyloides + Strongyle	12	3.12	4	1.05	16	2.08
Strongyloides + Strongyles + *Trichuris*	6	1.56	0	0.00	6	0.78
Monezia + Strongyle	19	4.95	8	2.08	27	3.51
Total	**62**	**16.14**	**25**	**6.51**	**87**	**11.32**

sp. and *Paraphistomum* sp. From the nematodes helminths, strongyle type eggs account the highest and is significantly ($p<0.05$) different from the other genera in both species of animals. In sheep, among the trematode type, *Fasciola* eggs were quite prevalent compared with the other genera in this group. Mean while, only *Monezia* sp. was the only *Cestode* parasite egg observed in both sheep and goats in the present study. This shows that, all the helminths parasites were quite prevalent in the sheep than in the goats (Table 3).

Mixed helminths eggs were noticed in some of the slides examined beside the single type of helminth eggs, with an overall prevalence of 11.32% (87) in both host species. Among these, strongyle type eggs and *Trichuris eggs* coexist most of the time, with an overall prevalence of 4.95% (Table 4).

Fecal samples positive for GIT helminths were subjected to McMaster egg counting chamber for EPG count to determine the degree of severity of parasitic infection. An effort was made to compare the degree of severity with the various risk factors. Nonetheless, in the present study, there was no significance association ($p>0.05$) between all risk factors and the level of EPG. There was no association between the level of EPG and the degree of infection although higher EPG was recorded in the severe degree of infection (Table 5).

The results of the coprocultural examination revealed 5 nematodal parasites, namely *Hemonchus* sp., *Trichostrongylus* sp., *Oesophagostomun* sp., *Strongyloides* sp. *and Bunostomum* in a decreasing order in both host species. Among which *Hemonchus* sp. were the most predominant genera in both sheep (40.0%) and goats (40.8%) and *Bunostomum* sp. was the least among the identified parasites (Table 6).

DISCUSSION

The coprological examination performed revealed the existence of parasitosis with an overall prevalence rate of 61.46% in the small ruminants examined. The study showed that 67.45 and 55.47% of sheep and goats respectively are infested with one or more helminths. This finding is lower than the results of other surveys in sheep

Table 5. Degree of gastrointestinal helminths infection with different risk factors.

Risk factor		Degree of Infection			χ^2 (P-value)
		Low (%)	Moderate (%)	Severe (%)	
Species	Sheep	84 (32.45)	86 (33.2)	89(34.4)	4.60 (0.099)
	Goat	55 (25.8)	65(30.5)	93(43.7)	
Age	Adults	42 (26.5)	57 (35.4)	62 (38.5)	4.81 (0.090)
	Young	97 (31.2)	89 (28.6)	125 (40.0)	
Sex	Female	62 (26.4)	84 (35.7)	89 (37.9)	3.61 (0.164)
	Male	67 (28.3)	77 (32.5)	93 (39.2)	
Season	Dry	55 (27.9)	65 (33.0)	77 (39.1)	0.400 (0.891)
	Wet	84 (30.5)	86 (31.3)	105 (38.2)	

Table 6. Genera of nematodes recovered in coproculture in sheep and goats

Genera of nematodes	Sheep [No. sample (%)]	Goats [No. sample (%)]
Haemonchus sp.	54 (40.0)	49 (40.8)
Trichostrongylus sp.	33 (24.4)	28 (23.3)
Oesophagostomun sp.	22 (16.3)	17 (14.2)
Strongyloides sp.	17 (12.6)	13 (10.8)
Bunostomun sp.	9 (6.7)	13 (10.8)

and goat carried out in Eastern (Abebe and Esayasu, 2001; Sisay et al., 2007), Western (Regassa et al., 2006; Tefera et al., 2011), Central (Kumessa et al., 2011), Northern (Genene, 1994; Tesfaye, 1998) and Southern (Hailelue, 2002; Amenu, 2005) Ethiopia. The decreased in the GIT helminthiasis in the present study compared with the other studies in the country could be due to the existence of unfavorable climatic or environmental factors that could support prolonged survival and development of infective larval stage of most helminths (Rossanigo and Grunder, 1995; Andrews, 1999). Because most of these studies are conducted in the part of the country where there is a very favorable humidity and temperature which generally supports parasitic growth and development (Regassa et al., 2006; Dagnachew et al., 2011). There existed direct relationship between moisture and prevalence of parasitosis (Regassa et al., 2006) while desiccation suppress the development and growth of parasite (Dagnachew et al., 2011) thereby reducing the infection rate. Furthermore, management system (Regassa et al., 2006) could also contribute in the difference in the prevalence. Nonetheless, the present study was higher in prevalence in sheep and consistent in goats compared with the report by Dagnachew et al. (2011) from Northwest Ethiopia. This discrepancy could be attributed to difference in the management system.

In the present study, a higher prevalence of GIT parasites was observed in sheep than in the goats which is in agreement with other works in Ethiopia (Teklye, 1991) and elsewhere in the world (Waruiru et al., 2005; Asif et al., 2008) and this is assumed to be due to the grazing habit of the sheep where they graze closer to the ground fostering opportunity of exposure to parasites. However, it is in contrary to reports from Western (Regassa et al., 2006) and Eastern (Abebe and Esayasu, 2001) parts of Ethiopia and elsewhere (Keyyu et al., 2006; Raza et al., 2007). In this regard, beside the grazing habit of the sheep, the communal grazing area of sheep and goats practiced in the study area could put the goats in a risk of acquiring the infection from the sheep (Dagnachew et al. 2011); furthermore, it is assumed that sheep do have a considerably higher imuunological response to gastrointestinal parasites compared with that of goats (Urquhart et al., 1996).

In the present study, age seems to have significant influence on the prevalence of helimenthiasis, which could be related to the higher susceptibility of younger animals. These report is in agreement with reports in

Ethiopia (Regassa et al., 2006; Dagnachew et al., 2011), and elsewhere (Fritsche et al., 1993; Keyyu et al., 2003; Melkamu, 1991; Ng'ang'a et al., 2004; Githigia et al., 2005). Age was considered an important risk factor in GIT helminthiasis (Raza et al., 2007). Several authors have documented that adult and old animals develop acquired immunity (Urquhart et al., 1996; Taswar et al., 2010) against helimenth infections as they get mature due to repeated exposure (Dagnachew et al., 2011) and this will help expel the parasite before it establish itself in the GIT (Dunn, 1978; Shah-Fischer and Say, 1989). On the contrary, there are instances where younger animals were reported to be resistant to parasitic infection (Belem et al., 2005).

The study further revealed that sex of the animal did not show significant association with the prevalence of the parasites and degree of EPG. The absence of association between sexes is consistent with previous reports (Keyyu et al., 2003; Regassa et al., 2006; Ghanem et al., 2009). However, Dagnachew et al. (2011) reported a higher prevalence of helminth infection in females. In contrast, Gualy et al. (2006) and Raza et al. (2007) have documented higher prevalence of helminth infection in rams. The present study have shown that the parasitic load in the wet season is significantly higher than the dry season owing to the general understanding that moisture is one of the bionomic factor that support the development of the infective stage of most parasites (Hansen and Perry, 1994; Urquhart et al., 1996) which is also true phenomenon in sub-Saharan Africa (Teklay, 1991).

The coprological investigation in the present study revealed that out of 768 small ruminants, 295 (76.81%) sheep and 234 (60.94%) goats were positive for GIT helminths which can be classified as nematodes, trematodes and cestodes. Six and five genera of helminth eggs were examined in the sheep and goats, respectively. Genera-wise prevalence in sheep for strongyle type eggs, Strognyloides sp., *Trichuris* sp., *Fasciola* sp., *Paraphistomum* sp*. and Monezia* sp. were 39.84, 17.45, 7.81, 1.82, 5.21 and 0.78, respectively in a decreasing order. In goats *Paraphistomum sp.* were not detected at all times and the prevalence of the other genera is lower than that of sheep. The prevalence of these helminths in goats for strongyle type eggs, *Strognyloides* sp., *Trichuris* sp., *Fasciola* sp. and *Monezia* sp. were 32.55 15.36, 6.77, 3.64 and 0.78%, respectively in a decreasing order.

The helminths found in this study have also been reported previously in other part of the country (Hailelul, 2002; Regassa et al., 2006; Dagnachew et al., 2011; Kumsa et al., 2011) and else were (Agyei, 2003; Githigi et al., 2005; Waruiru et al., 2005). Among the helminths recorded in this study, the nematodes account the highest followed by trematodes and then the list were cestodes. This finding is in full agreement with other studies (Raza et al., 2007; Kumsa et al., 2011). Further, strongyle type eggs were highly prevalent in both host species in the area, this is in coherence with other reports in the country (Abebe and Esayasu, 2001; Kumsa et al., 2011) and elsewhere (Biu et al., 2009). In the present study, only one genera of cestode, namely *Moneizia* sp. was recorded in both sheep and goats. This finding was consistent with reports of Kumsa et al. (2011), but it was in disagreement with other reports in the country (Abebe and Esayasu et al. 2001; Tefera et al., 2011). The disagreement might be due to use of treatments against cestodes in the area. The present finding also revealed that among the trematodes, *Fasciola* sp*.* and *Paraphistomum* sp*.* was present only in sheep but was absent in goats. Zero percent prevalence of *Fasciola* sp*.* in goats was also reported in the country (Dagnachew et al., 2011; Kumsa et al., 2011). This might be due to the difference in the feeding habit of the two species, where sheep graze close to the ground and can efficiently feed upon even the small amount of parasites/eggs that reside in the ground. Similar observations were made by Kumsa et al. (2011) and Raza et al. (2007).

The result of the coprological examination revealed five common helminth genera, namely *Hemonchus* sp*.,* *Trichostrongylus* sp*.,* *Oesophagostomun* sp*.,* *Strongyloides* sp*.,* and *Bunostomum* in a decreasing order in both species. Other authors have similarly reported these genera in the country, *Hemonchus* sp. being the most prevalent (Abebe and Esayasu, 2001), and elsewhere (Gethigie 2005; Kumsa et al., 2010); however, it is contrary to the reports of other authors (Ng'anga et al., 2004; Ghanem et al., 2009; Kumsa et al., 2011) who documented a higher prevalence of *Trichostrongylus* sp*.* Although the phenomenon of resistance of *Trichostrongylus* sp*.* to adverse environmental condition relative to *Hemonchus* sp*.* (Ageyi, 2003; Ng'anga et al*.,* 2004) does not exist in the present study, the higher prevalence of *Hemonchus* sp*.* in the present study could be the high biotic potential of this nematode parasite to acquire resistant faster than *Trichostrongylus* sp*.* (Torres-Acosta et al., 2003). Moreover, the tremendous contribution of climate and agro ecology (Regassa et al., 2006) should also be considered among the factors responsible for this variation.

The current study has shown the presence of mixed infection characterized by the presence of two or more helminth genera both in sheep and goats and this is in agreement with the findings of other researchers in the country (Genene, 1994; Abebe and Esayasu, 2001; Haileleul, 2002; Regassa et al., 2006; Tefera et al., 2011; Kumsa et al., 2011) and elsewhere (Asif et al., 2008; Agyei, 2003; Githigi et al., 2005; Waruru et al., 2005). These polyparasitism has been suggested to be an

important cause of morbidity and loss of production in sheep and goats (Kumsa et al., 2010). Moreover, the presence of interaction and compromization of the immune system of the host by polyparasitism has been described to increase their susceptibility to other diseases or parasites (Wang et al., 2006). Hence, polyparitism is an important problem of sheep and goats production in the current study area.

The result of EPG in this study showed a non significant difference ($p>0.05$) even though sheep harbor the most of nematode eggs compared with goats. This finding is in agreement with previous reports in other localities (Abebe and Esayasu, 2001; Tefera et al., 2011). This is in direct proportion with the feeding habit of the two host species. The present study also revealed no significant difference ($p>0.05$) in the degree of EPG between young and adult groups of animals. These finding is in full agreement with the observations of Regassa et al. (2006), who reported no association between EPG and age of animals. Moreover, no significant difference ($p>0.05$) was recorded between the degree of EPG with sex and season, which was similarly reported by Tefera et al. (2011) in Ethiopia. These finding was supported by the fact that even though the animals are expected to acquire high number of infective larvae during rainy season and harbor higher prevalence of GIT nematodes (Lima, 1998; Githigi et al., 2005), the animal do have an access to ample amount of pasture which would increase the plane of nutrition and consequently increase the immunity of the animals, thereby reducing the fecundity (Bisset et al., 1996) which prevent the rise in EPG during the rainy season.

Conclusion

In general, the overall prevalence of gastrointestinal helminth parasites in the study area indicates gastrointestinal helminthosis to be important heath problem due to its high prevalence and occurrence of polyparasitism. The present study showed a considerable relation between species of animals, study period (season) and age groups. In both sheep and goats, the nematode parasites were the most predominant parasites followed by trematodes and the cestode. The majority of sheep and goats were infected by two and more parasite types with some animals showing pure infection. Strategic deworming of animals, when conditions are most favorable for larval development on the pasture, using broad spectrum anti-helminthics since polyparasitism is a common problem. Moreover, proper pasture and animal management is a key component to managing gastrointestinal helminths in sheep and goat operations. Rotation grazing is used in interval and avoids communal grazing with other animals to avoid cross parasite contamination. The role of veterinarians in giving professional advices regarding preventive and control measures against gastrointestinal helminths should be prominent to prevent drug abuses.

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