Prevalence Of Gastrointestinal Nematode Parasites Of Goats In Bedeno District Of Eastern Hararghe Zone, Eastern Ethiopia

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Abstract: Gastrointestinal nematode parasites are the major animal health constraints in goat production and contributing loss in productivity and economy. A cross-sectional study was conducted from November 2014 to April 2015 in Bedeno district of Eastern Hararghe Zone, Eastern Ethiopia, to determine the prevalence of major gastrointestinal nematodes of goat and to assess associated risk factors in the study area**.** The present study revealed the existence an overall 43.5% prevalence of GI nematode parasites, among the different nematodes, the prevalence of strongyle type was 30.5% followed by Strongloid species 6.8% and Trichuris species 1.8% using coprological examination. Prevalence of infection was greater (45.5%) in males than females (42.5%) and higher prevalence was observed in younger (48.3%) as compared to adult (42%). Difference in body condition score is statistically significant difference ($P < 0.05$) with gastrointestinal nematode infection such that highest prevalence in poor body condition (93.5%) when compared with good body condition (2.3%). Out of 384 sampled goats, 14.8%, 20.1% and 8.5% were infested lightly, moderately and massively respectively. The highest degree (17.2%) of infection was occurred in March while the least (0%) was in January and February. The finding suggests that Bedeno district is conducive for the successive maintenance and subsequent transmission of nematode parasites to susceptible hosts. Therefore strategic anthelminthic treatments of goat with broad spectrum anthelminthic at the beginning of rain and at the end of dry season should be recommended to reduce the worm burden and minimize pasture contamination with larvae.

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1. Introduction

Goat is important livestock species all over the globe and especially in tropical and subtropical regions. It has a pivotal role in small scale farming and rural economy of developing societies by generating employment and supplementing house hold income. Goats are primarily raised for milk, meat, hair and leather production (Hassan *et al*., 2011). Also, goats are of great importance as major sources of livelihood and contribute to the sustenance of landless, smallholder and marginal farmers especially to the poor in the rural areas throughout the developing countries. So, goats are very important for resource-poor smallholder systems of rural Ethiopia due to their ease of management, short generation cycles and high reproductive rates which lead to high production efficiency and significant role in provision of food and generation of cash income. They serve as a living bank for many farmers, closely linked to the social and cultural life of resource poor farmers and provide security in bad crop years (Tsedeke, 2007).

Globally parasitic diseases continue to be a major constraint for poor developing countries. They are rarely associated with high mortality and their effects are usually characterized by lower outputs of animal products, by-products, and traction all contributing to assure food security (FAO, 2002; Badran, *et al.,* 2012). Helminthes infections in goats are serious problems in the developing countries, particularly where nutrition and sanitation are poor (Odoi, *et al*., 2007; Bandyopadhyay, 2011). Gastro-intestinal nematode infection is one of the major health problems in the world. Nematode parasites of small ruminants are primarily parasites of the gastrointestinal tract. A range of nematodes are usually present as mixed infections. The most important species are those found in the abomasum and small intestine (Hutchinson, 2009).

Clinical diagnosis of GI nematode infection is difficult, since the signs are not pathognomonic. However, diagnosis plays a major role in investigating parasite epidemiology (Roeber, *et al.,* 2013). The ante mortem diagnosis of nematode infections in livestock has been based on the detection of nematode eggs or larvae in the faeces by microscopic examination using the methods of flotation and/or larval culture. Although a direct fecal smear can be examined, the mere presence of parasite eggs is not helpful in determining the parasite load of an animal or animals. Quantifying of the egg per gram of feces is the best way of estimating parasite load (Pugh, 2002).

Management of parasites, gastrointestinal worms in particular, is often a primary animal health issue on many farms and ranches. The tropical environment is an ideal habitat for parasite species, especially in wetter locations. Parasite control should form a central part of every small ruminant health management strategy. Which is a major element in ensuring the sustainability of goat production is currently achieved by the use of anthelmintics (Tsedeke, 2007).

Prevalence of GI nematodes varies in diverse geographical conditions and influenced by climate, management, vegetation and livestock density. Furthermore, stress, poor nutrition and coincidental diseases may aggravate the condition of affected animal (Odoi *et al.,* 2007). Number of studies reported on the prevalence of gastrointestinal nematodes in goats all over the world and infection rates ranged from 43.10% to 93.29% (Akhter *et al*., 2011; Tefera *et al.,* 2011).

In Ethiopia, parasitological investigations of goats in the humid central highland regions of the country have demonstrated that nematodes of the genera Haemonchus, Trichostrongylus, Oesophagostomum, Bunostomum, Strongyloides, Cooperia, Nematodirus and Trichuris are the most common (Sisay, 2007). Gastrointestinal Nematode is one of the major constraints for goat production in the Ethiopia, however, enough data on the distribution of the parasites are lacking. Prevalence studies on gastrointestinal nematodes in goats have been conducted in different parts of the countries but no information is available from Bedeno district of Eastern Hararghe, Eastern Ethiopia. On the other hand knowing the current situation of GI nematode in the area could be the basis for all possible actions including its control and eradication.

Therefore, the main objectives of this study are to determine the prevalence of major gastrointestinal nematodes of goat and to assess associated risk factors in the study area**.**

2. Materials And Methods

2.1. Study Area

A study was conducted in Bedeno district of Eastern Hararghe Zone, Eastern Ethiopia from November 2014 to April 2015. It is located 567Km to the east of Addis Ababa, at an altitude of 1420-3050 meters above sea level and Latitude 10° 53'0"N Longitude 39° 48'0"E. The total area of the district is about 97,410 hectares. The climatic condition of the area is highland 20%, midland 48% and lowland 32% with the annual rain fall of 950-1720 mm and annual minimum and maximum temperatures of 14^0c and 28°C, respectively. The production system of the district is mixed type and communal grazing is in practice in the area.

2.2. Study Population and Determination of Sample Size

The estimated animal population in the area is about 270,300 cattle, 34,798 sheep, 298698 goats, 45,568 donkeys, 221 horses, 197 camels and 168562 chickens. The total sample size was calculated based on the 50% expected prevalence according to Thrusfield (2007), at 95% level of confidence interval, 5% desired level of precision and since there was no similar study done previously on the study area. Accordingly, 384 goats were sampled and the study was performed on all of which a local breed that consists of male and female with all age group, and kept under traditional extensive management system.

2.3. Study Design

A cross sectional study design was used. Out of 42 kebeles (PAs) of bedeno district, four were selected by simple random selection or lottery method. The selected sites were: dodota mojo, jiru balina, bela ija and kancha. Equal proportions of samples were collected from each site by random selection of animals. Fecal samples were collected throughout the study period. The body condition scores, estimated age group and sex were recorded. Conventionally, those animals with the age of less than one year were considered as young while those greater than or equal to one year were included as adults according to the classification of age groups (Tadesse *et al.,* 2011).

Body condition scoring of sampled animal was carried out according to the method described by Audige *et al* (1998) and categorized into three scores as poor, medium and good. The poor body condition was recorded when individual spinous process were sharp to touch and easily distinguished, in addition, the bony structure of the goat were easily noticeable. The eye muscles are of moderate depth. Medium body condition was recorded when the spinous process examined with very firm pressure and they were round rather than sharp. The eye muscle areas are full with moderate fat cover. Good body condition was recorded when the top and side of the back bone in loin area immediately behind the last rib and above the kidney were covered with muscles. The eye muscles were full and had a thick fat cover.

2.4. Sample Collection and Examination Procedure

Faecal sample was collected from the rectum of the animal using a plastic glove. Collected fecal samples were put in the sampling bottle containing 10% formalin and all the necessary information was labeled. The collected samples were transported to Dire Dawa veterinary Parasitology laboratory, where they were stored at refrigerated temperatures (4°C) until processing. In the laboratory, fecal samples were examined for the detection of nematode eggs using standard procedures of flotation as described by Charles (Charles, 2006).

Different investigators put their findings by identifying the nematode genera, but in this study the nematode eggs were identified in general terms as strongyle type, Strongloid spp. and Trichuris spp., since nematode eggs cannot be differentiated easily (Vanwyk *et al.,* 2004). In this study, the floatation solution used was sodium chloride. Those samples found positive for nematode were subjected to McMaster egg counting techniques. The degree of infection was categorized as light, moderate and severe according to their egg per gram of faeces (EPG) counts. Egg counts from 50-799, 800-1200 and over 1200 eggs per gram of feces were considered as light, moderate and massive infection, respectively (Soulsby, 1986).

2.5. Data Analysis

Data of the coprological examination were entered in a Microsoft excel spread sheet and analyzed by SPSS version 20. Descriptive statistics was used to determine the prevalence of the parasites and P-value was used to assess the association of the potential risk factors with the prevalence of the parasites and logistic regression was also used to assess the strength of association. For statistical analysis, a confidence level of 95% and a P-values less than 5% were considered significant.

3. Results

Of the total 384 goats examined, 167 (43.5%) were found infected with different types of gastro-intestinal nematodes. Of the total positive cases, 117(30.5%), 26(6.8%), 7(1.8%), and 17(4.4%) were infected with strongyles, Strongyloides species, Trichuris species and mixed of nematode respectively (Table 1).

Table1. Prevalence of gastrointestinal nematodes of goat encountered in the study area

Parasite egg types	**No. animals examined**	**No. positive**	**Prevalence%**
Strongyle spp	384	117	30.5
Strongloid spp	384	26	6.8
Trichuris	384	7	1.8
Mixed	384	17	4.4

In this study, assessment was made to see the effect of sex, age and body condition on disease prevalence. Higher prevalence of GI nematode infection was observed in male animals (45.5%) as compared to females (42.5%). However, the difference in prevalence between the two sexes was not statically significant ($p>0.05$) association (Table 2).

The prevalence was greater 48.3% in younger than 42% in adults (Table 2). Of the total 384 goat examined the infection prevalence according to body condition grades, 93.5%, 51.6% and 2.3% with poor, medium and good, respectively. The prevalence was statistically significantly higher in animal with poor body condition when compared to that of medium and good body condition scores ($P < 0.05$) (Table2).

Table 2: Prevalence of the GI nematodes in relation to Sex, Age and Body condition as risk factors

Risk factor	**Total examined animals**	**No positive and prevalence N (%)**	**P-value**	**Odd ratio (B)**	**95% CI**
Sex					
Female	261	111(42.5)	0.58	1.13	0.73-1.74
Male	123	56(45.5)			
Age					
Young	89	43(48.3)	0.29	0.77	0.48-1.25
Adult	295	124(42%)			
Body condition					
Poor	77	72(93.5)	0.0	604.8	140.40-260.15
Medium	178	92(51.6)	0.0	44.93	13.77-146.52
Good	129	3(2.3)			

Analysis of prevalence of gastrointestinal nematode infections of goat by months showed that there was statistically significant variation between months ($P < 0.05$). The higher infection prevalence was recorded in months (March and April) during wet seasons; whereas the lower was in months (January and February) during dry seasons (Table 3).

Table 3. Prevalence GI nematode in study of each month

Month	No. animals examined	No. positive (N %)	P-value	95% CI
November	64	30(46.9)	0.05	0.49-1.01
December	64	23(35.9)	0.00	0.15-0.65
January	64	15(23.4)	0.00	0.08-0.37
February	64	22(34.4)	0.00	0.14-0.61
March	64	36(56.3)	0.37	0.35-1.47
April	64	41(64.5)		

An attempt was also made to see the existence of difference in degree of parasitic infestation with the variation of sex, age and months. The results of quantitative faecal examination using the modified McMaster technique for GIT nematodes of 167 infected goats were 14.8%, 20.1% and 8.5% for light, moderate and heavy infection, respectively. Most of the infected goat had a faecal egg count in a range of 801 to 1200 EPG (Table 4).

Table 4: Degrees of GI-Parasitic infestation with different risk factors

Variables		Total samples examined	Level of infection		
			Light n (%)	Moderate n (%)	High n (%)
Goats		384	**57(14.8)**	**77(20.1)**	**33(8.5)**
Sex	Female	261	41(15.7)	52(19.9)	18(6.9)
	Male	123	16(13)	25(20.3)	15(12.2)
Age	Young	89	8(10)	25(28.1)	10(13.5)
	Adult	295	49(16.6)	52(17.6)	23(7.8)
Months	November	64	8(12.5)	16(25)	6(9.1)
	December	64	7(10.9)	11(17.2)	5(7.8)
	January	64	9(14.1)	6(9.4)	0
	February	64	11(17.2)	9(14.1)	0
	March	64	10(15.6)	13(20.3)	15(23.4)
	April	64	12(18.8)	22(34.4)	7(10.9)

4. Discussion

The present study revealed the existence of major GI nematode parasites with an overall prevalence of 43.5% which was in line with 43.10 % prevalence in Hyderabad in goats (Akhter *et al.,* 2011). This finding is lower than the results of previous study in goat that is 49.2% Muluneh et *al.,* (2014) and 54.69% Tesfaheywet, (2012) from Ethiopia, and 46.33% in southern Punjab Lashari and Tasawar, (2011), 52% in Southern Punjab-Pakistan (Raza *et al*., 2007). In the present study overall lower prevalence of GIT nematodes was recorded as compared with above mentioned studies, this may be attributed to the fact that prevalence and intensity of parasitic infection is very high in rainy season and low in dry season (Raza *et al*., 2007; Pathak and Pal, 2008). Additionally low infection rate in this study is might be due to lower environmental temperature during the study period which is not conducive for larval development. Also, this deference could be due to extensive use of anthelmintics by the farmers. Furthermore, management system of animals could also contribute in the difference of the prevalence.

However, this result is higher than the prevalence 40.67% in goats in Pakistan (Nabi *et al.,* 2014). This difference might be due to the difference between the management system of examined animals and geographical and environmental location of the area. High prevalence of goat parasites in different regions is mainly due to the tropical environment and high humidity due to which infections persist throughout the year and difference in agro-climatic conditions that could support prolonged survival and development of infective larval stage of most nematodes (Rossanigo and Grunder, 1995). The high prevalence observed in different parts of Ethiopia could be ascribed to over stocking, poor nutrition (starvation), poor management practice of the animals (lack of sanitation) and frequent exposure to the communal grazing lands that have been contaminated (Muluneh *et al.,* 2014).

In this study among the different nematodes, the prevalence of strongyle type was 30.5% followed by Strongloid species 6.8%, and Trichuris species 1.8% using coprological examination. This is in line with the work of Gebeyehu *et al.,* (2013) and Tesfaheywet (2012) who reported most prevalent GI nematode observed was the strongyle group that was the most prevalent nematode encountered in goat, compared to

Strongyloides and Trichuris spp. The current study has shown the presence of mixed infection characterized by the presence of two or more nematode genera in the goats and this is in agreement with the findings of other researchers in the country (Abebe and Esayas, 2001; Haileleul, 2002; Regassa e*t al*., 2006; Tefera *et al.,* 2011; Kumsa *et al.,* 2011).

These polyparasitism has been suggested to be an important cause of morbidity and loss of production in sheep and goats (Kumsa *et al.,* 2011). 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 goats' production in the current study area.

Prevalence of infection was greater (45.5%) in males as compared with females (42.5%). The present results were supported by Seli and Arici, (2002) stated that males were more susceptible to parasitic infections than females. Effect of sex on the resistance level against GI parasites was reviewed and reported that difference in resistance level were significant after puberty only. The difference in resistance level after puberty is due to estrogen stimulatory effect on immune response against GI nematodes while androgen suppresses the immune response (Seli and Arici, 2002) and this is the reason that males are more susceptible to infectious diseases including nematode parasites than female.

Age wise observation revealed higher prevalence was observed in younger (48.3%) as compared to adult (42%), but, statistically significant difference in infestation of parasites between ages not observed. This finding agrees with reports from Gambia and Semi-arid part of Kenya that indicated that GI helminthes affect both ages equally (Waruiru *et al.,* 2005).

On the other hand, the present finding disagrees with other literatures (Fikru *et al.,* 2006) that young animals are more susceptible to parasite infection than goats older than 1year of age. The researchers justified the result that it could be because adult animals may acquire immunity to the parasite through frequent challenge and expel the ingested parasite before they establish infection. Additional, Asanji and Williams (1987), who stated that young animals are susceptible due to immunological immaturity and immunological unresponsiveness. However, in this study we ascribe the absence of significant difference in parasites infestation between ages of animals to the small number of young animals used and the imprecise determination of age of the animals.

In the present study, an animal with poor body condition seems to have higher prevalence of major gastrointestinal nematodes. Difference in body condition score is statistically significant difference ($P < 0.05$) with gastrointestinal nematode infection such that highest prevalence in poor body condition (93.5%) when compared with good body condition (2.3%). This could be related to their higher susceptibility to infection than other groups. This agrees with (Nigatu, 2008: Keyyu *et al.,* 2006: Kanyari *et al*., 2009). This poor body condition might be due to malnutrition or other concurrent disease and parasitic infection which lead to poor immunological response to infective stage of the parasites.

The highly statistical significant difference ($P < 0.05$) result obtained on monthly study revealed that the highest percentage of infection of the study subjects was 64.5% on April during the short rainy season and the lowest was 23.4% recorded in January during the dry season. In the rest of the months, almost a close similarity records were obtained. This could be due to the development, survival and transmission of free living stage of nematode parasites which is influenced by micro-climatic factors within the faecal pellets and herbage which is in agreement with (Urquhart *et al.* 1996). These include sunlight, temperature, rainfall, humidity and soil.

The degree (severity) of parasitic infestation was determined from the total fecal egg count (EPG). Out of 384 sampled goats, 14.8%, 20.1% and 8.5% were infested lightly, moderately and massively respectively. Majority of infected animals had fecal egg count in the range of 800-1200 and only few proportions of animals had fecal egg count of over 1200. This is in line with the work of Tefera *et al.,* (2011) who reported infestation level of 10.95%, 48.52% and 40.53% as massive, moderate and light level of GI infestation respectively in and around Bedelle. The maintenance of high infestation of GI-nematode in goats in the study areas was associated with the presence of favorable environmental conditions for the existence and development of the GI- parasites larvae.

An attempt was also made to see the existence of difference in degree of parasitic infestation with the variation of sex, age and months. High degree of infection occurred in male (12.2%) when compared with female (6.9%). Highest degree of infection occurred in young (13.5%) when compared with adult (7.8%). This agrees with the idea of Urquhart et al. (1996) which indicates only youngs are more susceptible to these parasites while adults usually develop certain immunity. Soulsby (1986) also indicated the presence of resistance for Trichuris in goat over eight month and not usually severe enough to cause clinical disease. Clinical signs are seen mainly in the young and appear only in case of severe infection.

The highest degree (17.2%) of infection was

occurred in March while the least (0%) was in January and February. The seasonal fluctuations in numbers and availability of the infective larval stages are influenced by the level of contamination of pasture. Larvae of important gastro-intestinal nematodes are able to undergo a period of arrested development (hypobiosis) in host following infection; larvae may become metabolically inactive for several months. The greatest proportion of larvae usually becomes arrested at times when conditions in the external environment are least favorable for development and survival of eggs and larva (Michael *et al.,* 1975). This suspension of development helps some nematode to survive the dry seasons. Resumption of rainy season is the most favorable period for larval development and transmission on pasture (Agyei *et al.,* 1991).

5. Conclusion And Recommendations

Gastrointestinal nematode parasites are the major animal health constraints in goat production and contributing loss in productivity and economy. The present study was based solely on coproscopic examination for detection of gastrointestinal nematode eggs. The faecal examination evidenced the presence of GI nematode infection in the study areas. Body condition and seasonal dynamics are the most prominent risk factors associated with gastrointestinal nematode infection. Weak status of animal health services and lack of proper management with giving low priority to goat forced goat to graze behind on overstocked areas which lead them to graze close to the ground and on faecal materials, resulting in the uptake of higher numbers of infective larvae. Put together, the finding suggests that Bedeno district is conducive for the successive maintenance and subsequent transmission of nematode parasites to susceptible hosts.

On the basis of the above conclusion and, the following recommendations are forwarded:

- Strategic anthelminthic treatments of goat with broad spectrum anthelminthic at the beginning of rain and at the end of dry season should be recommended to reduce the worm burden and minimize pasture contamination with larvae
- Support role of veterinarians and animal healthy extensions in giving professional advices especial to prevent anthelmintic resistance
- For comprehensive and clear epidemiological picture, all month included study should be conducted

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