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Prevalence and Associated Risk Factors of Gastrointestinal Nematodiasis in Small Ruminants in North East Ethiopia

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ABSTRACT

A cross-sectional study was conducted on 384 small ruminants in and around Kombolcha , north east Ethiopia from November 2014 to April 2015 to determine the prevalence of gastrointestinal nematode and to observe the association of GIT nematodes with age, body condition, history of anthelmintic treatment and species of small ruminants. Screening and generic identification of observed gastrointestinal nematodes was done by coprological methods including floatation and faecal culture technique. The fecal samples examined revealed an overall prevalence of 42.2% (162/384) GIT nematodes in the small ruminants with 47.2% (111/384) in sheep and 34.2% (51/384) in goats. During fecal culture examination, five different genera of nematodes were identified. The most prevalent nematode was the *Haemonchus* 15.9% (OR=3.57, CI=2.46-5.16) as single infection and mixed infections of *Haemonchus* with *Trichostrongylus* 6.8% (OR=3.17, CI=2.71-3.68) followed by *Trichuris* 19.7% (OR=1.92, CI=1.20-3.07). The prevalence of gastrointestinal nematode infection showed a significant difference ($p < 0.05$) between young and adult age groups, in both sheep and goats, and animals with poor/moderate body condition and good body condition scores ($p<0.05$). In addition, there was a significant difference ($p < 0.05$) in prevalence among anthelmintic treated and non- treated animals and also between sexes of study animals. The present study highlights the higher prevalence of GIT nematodes in small ruminants in the study area and associated risk factors of small ruminant nematodiasis. Therefore, effective strategic treatment and public awareness creation should be instituted in the study area.

Keywords: Gastrointestinal nematode, Kombolcha, Ethiopia, prevalence, small ruminant

Ethiopia possesses over 25 million sheep and 21 million goats (CSA 2006), parallel to its diverse ecology, production systems and ethnic communities. The CSA of Ethiopia estimated in 2007 that farmers in Amhara region, north eastern Ethiopia, had a total of 6.4 million sheep and 4.2 million goats which are representing 25% and 23% of the total sheep and goats population of the country respectively. According to FAO (2004), the total annual meat production comes from cattle (63%), sheep (25%) and goats (12%). At the national level, sheep and goat account for about 90% of the live animal/meat and 92% of skin and hide (FAO 2004) export trade value of the country.

Small ruminants in Ethiopia are well adapted to local climatic and nutritional conditions and contribute greatly to the national economy however, poor animal production and management (Ademosun, 1992) coupled with infectious and parasitic disease had reduced productivity of small ruminants (Hailelell, 2002). GIT nematodes of sheep and goats are among the major endoparasitic infections that are responsible for heavy 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 GIT nematodes (Pedreira *et al.* 2006; Chaudhary *et al.* 2007; Odoi *et al.* 2007). The effect of infection by gastrointestinal parasites varies according to the parasite concerned, the degree of infestation and other risk factors such as species, age, season and intensity of worm burden (Perry *et al.* 2002). 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). However, no report has been published, so far on the prevalence and

generic identification of GIT nematodes of small ruminant in and around Kombolcha, north eastern, Ethiopia, where sheep and goats are important assets to local farmers.

Keeping in view the paucity of information regarding GIT nematodes in the study area, present work was undertaken to determine the prevalence of GIT nematodes and associated risk factors in small ruminants in and around Kombolcha, Northeastern Ethiopia.

MATERIALS AND METHODS

A cross-sectional study was carried out to determine the prevalence and identification of small ruminants gastrointestinal nematodes from November 2014 to April 2015 in and around Kombolcha which is located 375 Km away from Addis Ababa in South Wollo, North eastern Ethiopia at an altitude of 1500-1847 m.a.s.l. The study area has latitude and longitude of 11°4 N 39°44 E and 11.06° N 39.733°E and its elevation is between 1500-1847 above sea level. The area is characterized by bimodal rain fall with the average rain fall of 6000 mm and the minimum and maximum temperature varies 11.7°C to 24°C and the soil type of the area consists of vertisoil and sandy type of soil with vegetation type which varies from larger tree to bushes (CSA, 2009). Generally, the climate of south wollo zone is divided in to sub humid, semiarid, arid, and semi desert climatic conditions. The livestock population of the study area is 90,664 cattle, 12975 sheep, 31043 goat, 489 horse, 28 mule, 7758 donkey 866 camel and 49010 poultry (KWADO, 2006).

Indigenous sheep and goats reared under small holder farming system and extensive management systems in the study area were used during the study period with different age and sex groups. A total of 384 fecal samples were collected and examined for GIT nematodes. All sheep and goats were selected at random and species, age, sex, body condition scores and history of anthelmintic treatment were recorded. The risk factors were assessed for the presence of possible association with presence of GIT nematodes.

Simple random sampling strategy was followed to collect feaces from the individual animals. To calculate the total size, the sample size was decided based on the formula described by Thrusfield (2007) with 95% confidence interval at 5% desired absolute precision and assumption of the expected prevalence of 50% since no previous work has been reported in the study area, accordingly the calculated sample size was 384.

Fecal sample was collected directly from the rectum of each 384 sampled animals and placed in a sample collecting bottle (screw capped bottle) and transport to Kombolcha animal health diagnostic laboratory. For coproscopic examination of the fecal samples, a simple test tube flotation technique described by Hansen and Perry (1994) was employed and the slides prepared were examined under microscope (x10). Eggs of the different nematodes were identified on the base of morphological appearance and size of eggs (Foreit, 1999). Faecal samples from each animals of whenever positive for nematode eggs was cultured for harvesting third stage larvae and identification of the most important genera of non-distinguishable nematode eggs in sheep and goats according to Hansen and Perry (1994). Finally larvae were recovered using the Baermann technique (Hansen and Perry, 1994). From each culture, the third-stage larvae (L_3) was morphologically differentiated and identified according to keys provided by Hansen and Perry (1994). Data collected from the study were entered to MS Excel sheet and analyzed by using SPSS version 20 software. Descriptive statistics was used to determine the prevalence of the GIT nematodes and Pearson chi-square test (χ^2) was used to assess the degree of association between each risk factors and GIT nematodes. In all analyses confidence level was held at 95% and P value less than 0.05 was considered as significant. Factors with $P<0.2$ were analyzed with binary logistic regression to determine strength of association by their odd ratios.

RESULTS AND DISCUSSION

The overall prevalence of gastrointestinal nematodes in sheep and goats during the study period was 42.2% and among these sheep and goat account for 47.2% and 34.2% respectively (Table 1), which is in comparable with the study conducted by Walemehret *et al*. (2012) in sheep (56.25%) and in goat (35.33%) at Mekelle town in northern Ethiopia.

In the present study a higher prevalence of GIT nematode parasites were observed in sheep than in goats and ovine was 1.72 times at risk (OR=1.72, CI=1.32-4.21) than goat (Table 1).

Table 1. The prevalence of GIT nematodes in relation to species sex, age and body condition of the study animals

Variables	No of animal Examined	No of positive with %	X^2 (P)	OR (95% CI)
Sex				
Male*	188	68(36.2)		
Female	196	94(48)	.47(0.02)	1.67 (1.07- .14)*
Total	384	162(42.2)		
Species				
Caprine*	149	51(34.2)		
Ovine	235	111(47.2)	6.3(0.012)	1.72 (1.32-.21)*
Total	384	162 (42.2)		
Age				
Adult*	212	70(33.0)		
Young	172	92(53.5)	16.3(0.000)	2.28 (1.51-3.45)*
Total	384	162 (42.2)		
BCS				
Good*	51	16(31.4)		
Medium	259	96 (37.1)	13.6(0.000)	3.54 (2.1-6.12)*
Poor	74	50(67.6)	24.8(0.004)	4.17 (1.95-8.90)*
Total	384	162 (42.2)		
History of treatment				
Treated*	81	18 (22.2)		
Not treated	303	144 (47.5)	16.8(0.000)	3.21 (1.82-5.68)*
Total	384	162 (42.2)		

* Determinant factor, statically significant at 95%CI BCS refers to body condition score

This could be attributed to the grazing habit of sheep which graze closer to the ground fostering opportunity of exposure to parasites. A significant difference was observed in GIT nematode infection in relation to body condition (BCS) where a higher prevalence of nematodiasis was recorded in poor body condition animals (67.6%) compared to animals with medium (37.1%) and good body condition (31.4%) ($p<0.05$). Animals with poor BCS were 4.17 times at risk (OR=4.17, CI=1.95-8.90) than good BCS animal and similarly animals with medium BCS were 3.54 times at risk (OR=3.54, CI=2.1-6.12) than with good BCS animals (Table 1). The high prevalence of nematodiasis in animals with poor body condition was relatively similar with the finding of Keyyu *et al*. (2006) and Regassa *et al*. (2006). Animals with poor body condition might be due to malnutrition, other concurrent disease or the current parasitic infection which lead to poor immunological response to infective stage of the parasite.

In the present study, the prevalence was significantly higher ($P<0.05$) in young animals (53.5%) as compared with adult animals (33.0%). Young animals were 2.28 times at risk (OR=2.28, CI=1.51-3.45) than adults (Table 1) for nematodiasis which could be related to their higher susceptibility to infection than adults. This is in agreement with reports in Ethiopia (Regassa *et al.* 2006 and Dagnachew *et al.* 2011) and in other part of the world (Nganga *et al.* 2004, Githigia *et al.* 2005 and Keyyu *et al.* 2006). Urquhart *et al*. (1996) and Dagnachew *et al*. (2011) have documented that adult animals develop acquired immunity against nematode infections as they get mature due to repeated exposure and this help to expel the parasite before it establishes itself in the GIT.

Small ruminant which were not treated with antihelmintic drugs showed a significantly higher ($p>0.05$) nematode infection (47.5%) than those which were treated (22.2%). Untreated animals were 3.21 times at risk (OR=3.21, CI=1.82-5.68) than those treated ones (Table 1) .This is in agreement with the findings of Regassa *et al*. (2006) and Dagnachew *et al*. (2011). This is assumed due to inhibition to the growth of nematode parasite in treated small ruminants and multiplication of the nematode parasites in untreated sheep and goats.

The present study also showed female animals 48% had higher infection rates than males 36.2% and the difference was statistically significant ($p<0.05$) females were 1.67 times at risk (OR=1.67, CI=1.07-5.14) than male small ruminants (Table 1). It is assumed that sex is a determinant factor influencing prevalence of parasitism (Maqsood *et al.* 1996) and females are more prone to parasitism during pregnancy and per-parturient period due to stress and decreased immune status (Urquhart *et al.* 1996). Dagnachew *et al*. (2011) also reported a higher prevalence of nematode infection in female small ruminants.

Table 2. Prevalence and proportion of identified larvae of GIT nematodes in small ruminants

Identified Genera-	Larvae Count	Prevalence (%)	X^2(P)	OR (CI)
Haemonchus				
Goat*	10			
Sheep	14		19.34 (0.00)	3.57 (2.46-.16)
Total	24	14.8		
Trichostrongylus				
Goat*	8			
Sheep	14		19.63 (0.00)	1.9 (1.31-.86)
Total	22	13.6		
Trichuris				
Goat*	24			
Sheep	10		20.12 (0.00)	1.92 (1.20-.07)
Total	34	21		
Oesophagostomum				
Goat*	7			
Sheep	14		19.16 (0.00)	4.04 (2.89-.55)
Total	21	13		
Bunostomum				
Goat*	5			
Sheep	6		18.65 (0.00)	3.17 (2.71-.68)
Total	11	6.8		
Haemonchus and Trichostrongylus	13			
Goat*	14		(0.00)	2.14
Sheep	27		19.86	(1.38-.32)
Total		16.6		
Trichostrongylus and Oesophagostomum	1			
Goat*-	3		18.65	3.96
Sheep	4		(0.00)	(2.34-.71)
Total		2.5		
Haemonchus and Oesophagostomum	2			
Goat*	9		17.55	1.91
Sheep	11		(0.00)	(1.71-.27)
Total		6.8		
Haemonchus and Bunostomum	2			
Goat*	4		18.25	2.37
Sheep	6		(0.00)	(2.37-.38)
Total		3.7		
Trichostrongylus and Bunostomum	0			
Goat*	2		16.75	1.28
Sheep	2		(0.00)	(1.01-.24)
Total		1.2		
Total	**162**	**100**		

The nematode parasites identified in this study were: The genus *Trichuris* (21%), *Haemonchus* (14.8%), *Trichostrongylus* (13.6%) and Oesophagostomum (13%) (Table 2). According to this study the genus *Haemonchus* was at higher prevalence both at single and mixed infection with other nematodes (21.6%) in sheep and goats. Sheep were 3.57 times at risk (OR=3.57, CI=2.46-5.16) with *Haemonchus* infection compared with goats as single infection and 3.17 at risk (OR=3.17 CI=2.71-3.68) with mixed infection of *Haemonchus* and *Trichostrongylus* (Tabel 2). Similarly those sheep infected with *Trichostrongylus* & *Oesophagostomum* were 3.96 times at risk (OR=3.96, CI=2.34-6.71) compared with goats (Table 2). A number of previous studies noted the high prevalence of *Haemonchus* species infestation in sheep and goats in many parts of Ethiopia: Kumsa and Wossene (2006) and Abunna *et al.* (2009) reported respective prevalence of 91.2 and 83.6% in sheep in Eastern and Central Ethiopia, respectively. It is also in agreement with Fakae (1990) who found a prevalence rate of *Haemonchus,* 77.8 - 100 % in Nigeria.

The current study has shown the presence of mixed infection characterized by the presence of more than one nematode parasite both in sheep and goats which agrees with the findings of other researchers in the country (Abebe and Esayasu, 2001; Regassa *et al*. 2006 ;

Kumsa *et al.* 2011) and Tefera *et al.* (2011). These mixed infections have 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 mixed infections increase their susceptibility to other diseases or parasites (Wang *et al.* 2006).

The present study was based solely on coproscopic examination and fecal culture for detection of gastrointestinal nematode eggs and larvae; it has provided an insight to the current prevalence and associated risk factors. It is suggested that gastrointestinal nematodes in small ruminant are highly prevalent in the study area. Mixed infections of small ruminants with more than one genus nematodes was identified during the study. Therefore during the control and treatment of small ruminant nematodiasis; age, BCS and Species should be considered as risk factors for the occurrence of the disease. Further studies on the economic importance of helminthiasis and drug resistance patterns of anthelmintics should be conducted for the holistic implementation of nematodes control in addition to effective strategic treatment and public awareness creation.

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