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Prevalence of gastrointestinal nematodes of small ruminants in and around Ambo Town of West Shoa , Oromia Regional State, Ethiopia

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ABSTRACT: The gastrointestinal nematodes of small ruminants are one of the important parasitic diseases that obviously result in reduced productivity. A cross-sectional study was carried out from November 2015 to April 2016 to determine the prevalence and risk factors associated with gastrointestinal nematode infestation by faecal examination of 384 small ruminants selected from five different sites in and around Ambo town of central Oromia, Ethiopia. The overall infection rate was 49.2% (189). Among the samples 49.8% (135) from sheep and 47.8% (54) from goats were detected positive for gastrointestinal nematode parasites. The sex wise prevalence was 52.9 and 47.9% in male and female animals, respectively while 52.5 and 48.4% in young and adult animals were found positive, respectively. Body condition score infection rate was 73.6, 37 and 26% in poor, medium and good body conditions, respectively. Coprological investigation revealed that sheep and goats in the district were infested by a variety of helminth nematodes. Strongyles were the most frequently (39.3%) recovered nematode eggs followed by *Nematodirus* (2.9%) and *Trichuris* species (1.6%). Animals with poor body condition were significantly more infected ($p < 0.05$) than those in medium or good body condition. There was no significant difference ($p > 0.05$) in prevalence between sexes, age and different study sites of the subject area. Due to its important health problem and impact on production in the study area, emphasis should be given for the control and prevention of gastrointestinal nematode infection with further studies on species identification and larval ecology.
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INTRODUCTION

Sheep and goats are the most numerous of man's domesticated livestock and are especially important in more extreme climates of the world. They are mainly found in arid and semi- arid areas of sub-Saharan Africa. Africa hosts 205 and 174 million sheep and goats representing 17% and 13% of the world total small ruminant population, respectively (Samson and Frehiwot, 2010).They 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. 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).

Ethiopia, with its great variation in climate and topography, possesses one of the largest small ruminant populations in Africa. The latest estimate of small ruminant population gives 23.6 million sheep and 23.3 million goats (CSA, 2009). Sheep are the second most important livestock species next to cattle in Ethiopia (Gizaw *et al*., 2007) and ranks second in Africa and sixth in the world in sheep population. However, poor animal production and management coupled with infectious and parasitic disease had lead to reduce productivity of small ruminants in the country (Haileleul, 2002).

The major gastrointestinal nematodes that affect sheep and goats include*: Haemonchus contortus, Teladorsagia (Ostertagia) circumcincta, Trichostrongylus* species, *Cooperia curticei, Nematodirus* spps and *Oesphagostomum* spp. *Haemonchus contortus* remains the most problematic infection, both in terms of animal general health and economic impact (Pugh and Baird, 2012). The life cycle of the nematode may be direct or include an intermediate host (Sissay, 2007). There are different factors that affect an infection of these GIT

nematodes including climate, management, host factors, and parasitic factors (Singla 1995; Kassai, 1999; Taylor *et al*., 2007; Singh *et al.,* 2016). Most of the clinical signs associated with GIN infections are not specific and can be described as parasitic gastroenteritis (PGE) (Tefera, 2007). In diagnosing helminthosis, the three pillars of veterinary diagnosis i.e. history, clinical signs, and laboratory aids are involved (Love and Hutchinson, 2003).

The treatment of nematode infection depends basically on the use of anthelmintics which also use for controlling of these parasites but the control strategies are still insufficient because of the potential resistance to the drug (Mickael*et al.,* 2003). Thus, alternative methods for control of gastrointestinal nematodes need to be developed. Knowledge of the seasonal population trends, nematode life cycle and the prevalence of larvae in sheep and goats is necessary for the developing of control programs (Menkir *et al*., 2006).

Small ruminants (goats and sheep) production systems worldwide are significantly constrained by gastrointestinal nematode (GIN) parasites (Piedrafita *et al*., 2010). Parasitic infections especially gastrointestinal nematodes pose a serious health threat and limit the productivity of small ruminants (Raza*et al.,* 2010). The consequences of nematode infection include: reduced feed intake and weight gain, reduced immunity, lower fertility, a reduction in milk production and work capacity, treatment expenses and death in critical infections (Regassa *et al*., 2006; Hale, 2006).

To better identify appropriate control strategies for GIN control of small ruminants in the smallholder systems, it is important to investigate the burden of GIN of small ruminants and identify specific risk factors in the present study. To the knowledge of the authors, no information published in refereed scientific journals on the burden of gastrointestinal tract (GIT) nematode infections of small ruminants in and around Ambo town is available.

Therefore, the main objective of this study was to determine prevalence and associated risk factor of gastrointestinal tract nematodes in sheep and goat in the study area.

MATERIALS AND METHODS

Study Area

The study was conducted in and around Ambo town of West Showa zone in Oromia Regional State, Ethiopia from November 2015 –April 2016. The town is located at 114 km west of Addis Ababa and has altitude of 2,185 meter above sea level (masl). The geographical location of Ambo town is approximately between 8°56'30"N and 8°59'30"N latitude and between 37°47'30"E and 37°55'15"E longitude. The mean annual temperature, the annual maximum and the annual minimum temperatures of the area were about 18.8, 26 and 10.76°C, respectively. The mean annual rainfall is about 1,143 mm and the highest rainfall occurs from June to September. The town and its surrounding areas are dominated by Eucalyptus trees. Major soils of the area are vertisols consisting of 67% clay, 18% silt, 15% sand and 1.5% organic matter (Nemomsa, 2013) Population of the town was 67,514, out of which 34,276 (50.8%) were males and 33,238 (49.2%) were females (CSA, 2007). There are approximately 112,236 heads of cattle, 24,966 heads of sheep and 16,399 heads of goats in Ambo district. In the study area, ruminants are managed by communal holding of all species such as cattle, sheep, goats and equines together (Lemma *et al*., 2001).

Study Population

For this study five study sites were selected. The selected sites were: Awaro, Gosukora, Sanqalefaris, Kebele 01and 03. A total of 384 small ruminants (271 sheep and 113 goats) of all ages and sexes were used in the study area and the sample was taken from both healthy and clinically diseased animal. They study animals were all local breeds, kept under traditional extensive management system. 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 as described by (Gatenby, 1991)**.** Body condition scoring of sampled animal was carried out according to Kripali *et al*. (2010) and categorized into three scores as poor, medium and good.

Sample Size Determination

The sample size was determined by the formula described by Thrusfield (2005). Accordingly, at 95% confidence level and precision of 5% the total sample size was determined to be 384 since there was no research carried out on the title previously in the study area. So, for this particular study the sample size was determined as following:

$$n = \frac{1.96^2 pexp\ (1-pexp}{d^2}$$

$$= \frac{1.96^2\ 0.5(1-0.5)}{0.05^2}$$

$$= 384$$

Where n= sample size required

1.96=the value of Z at 95% confidence interval

Pexp= expected prevalence

d= desired absolute precision

Hence, the required sample size was 384 sheep and goats.

Study Design

A cross sectional study was conducted from November 2015 –April 2016in and around Ambo

town of central Oromia, Ethiopia to determine the prevalence rate and the major gastrointestinal nematodes of sheep and goats by coproscopic examination.

Sample Collection and Examination Methods

Faecal samples were collected from the rectum of the animals using a plastic glove and then taken to Veterinary parasitological laboratory with in sampling bottle in ice box. During sampling date, origin, sex and animal code were labeled. Samples were preserved using 10% formalin or inside +4 °C refrigerator for examination until processing. In the laboratory, faecal samples were examined for the detection of nematode eggs using standard procedures of floatation technique (Gupta and Singla 2012).

Data Analysis

All the data collected were entered in a Microsoft excel spread sheet and summarized. Then analysis was done by using SPSS version 20 software of the computer programmed for the statistical analysis. Descriptive statistics were used to quantify the problems and Chi-square test and Odds ratio was used to compare association between independent variables (sex, age and body condition scores) and parasitism. Confidence interval was set at 95% and statistically significant association between variable was considered to exist if the computed p-value is less than 0.05.

RESULTS

Out of the total 384 small ruminant examined, 189 (49.2%) were found infected with different types of gastrointestinal nematodes. Of the total positive cases, 151 (39.3%), 11 (2.9%), 6(1.6%),were infected with strongyles , *Nematoduris* spp *and Trichuris* spp, respectively while 10 (2.6%) were identified as mixed type of infection with both strongyles and *Nematodirus* spp, 7(1.8%) *strongyles* and *Trichuris* spp and 4 (1.0%) of total positives were identified as a combination of the three above gastrointestinal nematodes (strongyles + *Nematoduris* spp + *Trichuris* spp). From the total 271 sheep examined, 135 (35.2%) and out of the total 113 goats examined, 54 (14.1%) were infected with the above major gastrointestinal nematodes. The prevalence was apparently higher in sheep (49.8%) than goats (47.8%) with a statistically not significant (p>0.05) between them (Table 1).

Males and females were found to be infected with the prevalence of 52.9% and 47.9%, respectively, but the difference in prevalence between the two sexes was not statically significant (P> 0.05) (Table 1). Age wise prevalence showed 48.4% and 52.5% adult and young animals, respectively. However, the difference in prevalence between the age groups was not statistically significant (p>0.05) (Table 1). Infection prevalence was significantly higher in animal with poor body condition when compared to that of medium and good body condition scores (P < 0.05). The infection prevalence of poor, medium and good body condition of the animals were 73.6%, 37.0% and 26.6%, respectively (Table 1).

Table 1: Prevalence of gastrointestinal nematodes of small ruminants by species, sex, age and body condition.

Risk factors	No of examined	No of infected	Prevalence (%)	x^2 (chi-square)	P-value
Species					
Sheep	271	135	49.8	0.131	0.717
Goats	113	54	47.8		
Sex					
Male	102	54	52.9	0.77	0.380
Female	282	135	47.9		
Age					
Young	80	42	52.5	0.435	0.509
Adult	304	147	48.4		
Body condition					
Poor	155	114	73.6	66.288	0.000
Medium	135	50	37.0		
Good	94	25	26.6		
Total	384	189	49.2		

The predominant GIT nematodes identified in small ruminants in study area were strongyle egg type followed by *Nematodirus* species (Table 2) and coexistence of strongyle and *Nematodirus* (Table3) with overall prevalence of 39.3%, 2.9% and 2.6%, respectively. The prevalence of *Trichuris* species was 1.6% in the study area (Table 2).

Table 2: Prevalence of ovine gastrointestinal nematodes encountered in the study area.

Nematode egg type	No of animals examined	No of positives	Prevalence (%)
Strongyle	384	151	39.3
Nematodirus spp	384	11	2.9
Trichuris spp	384	6	1.6
Total	384	168	43.8

Table 3: Prevalence of mixed types of nematodes egg in small ruminants.

Strongyle + *Nematodirus* spp	384	10	2.6
Strongyle + *Trichuris* spp	384	7	1.8
Strongyle + *Nematodirus* spp + Trichuris spp	384	4	1.0
Total	384	21	5.4

Mixed nematode eggs were noticed in some of the slides examined beside the single type of nematode eggs, with an overall prevalence of 5.4% (21). Among these, mixed strongyle type eggs with *Nematodirus* eggs rank first than other forms of coexistence, with an overall prevalence of 2.6% (Table 3).

Table 4: Prevalence of gastrointestinal nematodes of small ruminants at different sites of the study area.

Study sites	No of samples examined	No of positives	Prevalence (%)	X^2 (Chi-square)	P-value
Awaro	81	41	50.6	0.822	0.936
GosuKora	99	46	46.5		
SanqaleFaris	79	39	49.4		
Kebele 01	59	28	47.5		
Kebele 03	66	35	53.0		
Total	384	189	49.2		

Even though there was no statistically significant difference (P >0.05) in prevalence of gastrointestinal nematode infection between the five sites, samples from kebele 03 (53.0%) showed the higher GIT nematodes while samples from Gosukora (46.5%) showed lower infection prevalence (Table 4).

DISCUSSION

Many studies showed that gastrointestinal nematodes are the leading causes of productivity losses in small ruminant production in Ethiopia (Demelash *et al.*, 2006). The present study revealed the existence of major GIT nematode parasites with an overall

prevalence of 49.2% in small ruminants originating from this area which were being parasitized at least by one type of gastrointestinal nematodes. This finding is lower than the results of previous studies in sheep and goats from different parts of Ethiopia including 98.9% in Southern Ethiopia (Amenu, 2005), 95.6% in eastern part of Ethiopia (Abebe and Esayas, 2001), 86.7% in DebreZiet (Gonfa *et al*., 2013) and 68.1% in Asella (Diriba and Birhanu, 2013) and also this finding is higher than the previous result including 16.4% in Central Ethiopia (Bekele *et al*., 1992) and 24.7% in Western Oromiya, Ethiopia (Takele *et al.*, 2013). This difference could be due to extensive use of anthelmintics by the farmers, difference in agro-climatic conditions that could support prolonged survival and development of infective larval stage of most nematodes (Rossanigo and Grunder, 1995). Furthermore, management system of animals could also contribute in the difference of the prevalence (Regassa*et al*., 2006).

In the present study, a higher prevalence of major gastrointestinal nematode parasites was observed in sheep than in goats which is in agreement with the other reports (Nganga *et al*., 2004 and Taylor, 1985). The reason that goats are kept on semi-intensive grazing system (Nganga *et al*., 2004) and prefer to browse shrubs but, grazing habit of sheep where they graze closer to the ground fostering opportunity of exposure to parasites (Taylor, 1985).

The present study shows no statistically significant differences ($P > 0.05$) between different sex groups. This finding agrees with report by Assefa and Sissay (1998), with gastrointestinal helminthes affecting both sex groups equally. This indicated that male and female ovine have equal chance of infection if they are exposed to the same contaminated communal grazing pasture. Yet, it is in disagreement with other reports including (Maqsood *et al*., 1996) and (Urquhart *et al.*, 1996) who found higher infections in female animals than males with a significant difference between them. 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 peri-parturient period due to stress and decreased immune status (Urquhart *et al*., 1996; Keyyu *et al.*, 2003; Regassa *et al.*, 2006).

When infection rate on age was subjected to analysis, the age of the animal did not show significant association with the prevalence of the parasites which is contrary with previous reports (Regassa *et al.*, 2006; Dagnachew *et al*., 2011) in Ethiopia and elsewhere (Keyyu *et al.*, 2003; Fritsche *et al*., 1993; Melkamu, 1991) . Age was considered an important risk factor in GI nematodes (Raza *et al*., 2007). The reason is that as new born and younger animal, they lack strong immunity as in the adults. The possible explanation is that in adult animal, after primary infection, rapid solid immunity is acquired. In fact, animal continually exposed to infection are at low risk provided the rate of acquisition of infective larvae is sufficient to stimulate satisfactory response, and no cause of clinical illness (Diriba and Birhanu, 2013).

Difference in body condition score is statistically significant ($P < 0.05$) with gastrointestinal nematode infection such that shedding of nematodes eggs increased with poor body condition (73.6%) than in good body condition (26.6%). This finding agrees with Bisset *et al*. (1986) who suggest that well-fed animals develop good immunity that suppresses the fecundity of the parasites.

Dissimilar findings were reported in different parts of the country in the prevalence of genus of gastrointestinal nematodes including 97.03% strongyles type, 30.25% *Trichuris* species in eastern part of Ethiopia (Abebe and Eseyas, 2001) and 35% *Nematodirus* species in Northern Italy (Zanzani *et al.*, 2014) as compared with the present study that revealed the prevalence of 39.3% strongyle type , 1.6% *Trichuris* spp., 2.9% *Nematodirus* spp. and an overall prevalence of 49.2% of major GIT nematode parasites in small ruminants. This difference could be due to the sample size considered and the prevalence varies greatly from region to region, corresponding to ecological and climatic diversity as well as the existing host ranges (Njau *et al.*, 1990). Therefore, the current prevalence of gastrointestinal nematodes results agrees with reports of previous studies conducted in Ethiopia as 37.6% strongyles, and 4.5% *Trichuris* spp in North Gonder (Dagnachew *et al*., 2011); 52.3% strongyles type and 1.8% *Trichuris* species in Eastern Hararghe (Abdurezak *et al*., 2015); 43.2% strongyles type (Jejaw *et al.*, 2014) in Dembia District, Northwest Ethiopia, 42.25% strongyles type in Kelela (Tesfaye, 1998) and 54.1% gastrointestinal nematodes in Gechi District, Southwest Ethiopia (Bikila *et al*., 2013) .

This study showed that strongyles were the most prominent among those gastrointestinal nematode parasites of sheep and goats. The high prevalence of strongyles may be due to the suitability of the climatic condition of Ambo district for survival and transmission of the parasites. *Nematodirus* and *Trichuris* species were poorly represented. This agrees with the idea of Urquhart *et al*., (1996); Diriba and Birhanu, (2013) which indicates only young are more susceptible to these parasites while adults usually develop certain immunity.

The prevalence of *Trichuris* species in the present study was 1.6% which agrees with the work of various authors (Abdurezak *et al*., 2015; Temesgen 2008, Regassa *et al.* 2006, Diriba and Birhanu, 2013); with prevalence of 1.8%, 3.3%, 4.5% and 3.7%, respectively. The current finding however was lower as compared to

30.3% from Eastern part of Ethiopia by Abebe and Eseyas (2001).

The present study has shown, the presence of mixed infection of two or more nematodes genera in single host and this is in agreement with the findings of other researchers in the country (Abebe and Esayasu, 2001; Haileleul, 2002; Regassa *et al.*, 2006; Tefera *et al.*, 2011; Kumsa *et al.*, 2011; Agyei, 2003; Githigi *et al*., 2005; Waruru *et al*., 2005).

CONCLUSION

Gastrointestinal nematode parasites are the major animal health constraints in sheep and goats production and contributing loss in productivity and economy. In the present study, the overall prevalence of gastro intestinal nematodes was 49.2% in small ruminants which was based solely on coproscopic examination for detection of the nematode eggs. The predominant GIT nematodes parasites identified were strongyles, *Nematodirus* and *Trichuris* species. Body condition is the most prominent risk factors associated with gastrointestinal nematode infection. The farmers give the first line to draught animals and forced sheep to graze behind on overstocked areas and most of the time goats were tied on grazed land which lead them to graze close to the ground and on fecal materials, causing in the uptake of higher numbers of infective larvae. Put together, the finding suggests that Ambo district is favorable for the continual maintenance and successive transmission of helminth parasites to the sheep and goats.

Based on the above conclusion the following recommendations are forwarded:

- Detailed study should be conducted to clearly identify parasitic fauna using faecal culture and postmortem examination in the study area.
- Strategic treatment of small ruminants with anthlmentics should be practiced in the study area to minimize the impact of gastrointestinal nematodes on the health of animals.
- Using pasture management: Applying rotational grazing system for different seasons would reduce pasture contamination.
- Separating the most susceptible young animals from adults, which is a possible source of contamination.
- Awareness should be given for the farmers on the risk of the parasitic infestation. Education of farmers on the importance of the parasitic diseases, its economic losses and the correct ways to improve animal husbandry system need to be applied.

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