Prevalence of Gastrointestinal Nematodes of Sheep in and Around Gondar Town, Northwest Ethiopia

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Abstract: A cross sectional study was conducted to estimating the prevalence and risk factors associated with sheep major GIT nematodes in and around Gondar town, northwest Ethiopia from November 2016 to April 2017. A total of 384 randomly selected sheep fecal samples were examined using flotation technique. Out of the total sampled sheep, 243 (63.3 %) had a GIT nematode infection. Coprological investigation revealed that sheep in the study area were infected with a variety of helminth nematodes. Strongyle were the most frequently 191 (49.7%) recovered nematode eggs followed by Trichuris species 15 (3.9%), Nematodirus spp 8 (2.1%) and Strongyloides 4 (1%). Strongyle and Trichuris spp commonly encountered as mixed infection followed by Strongyle and Strongyloides. The study revealed that a statistically significant difference (p<0.05) between male and female sheep was observed whereas there was not revealed the significant difference (p>0.05) between age and body condition of the animals. Gastrointestinal nematodes are one of the major problems that could hamper health and productivity of sheep in the study area. Therefore emphasis should be given for the control and prevention of GIT nematode infection with further studies on genus and species identification of Strongyle type eggs should be recommended in order to tackle the problem in the study area.

Key words: Gondar • Gastrointestinal Nematode • Prevalence • Risk Factor • Ovine

INTRODUCTION

Parasitic diseases remain a main constraint to animal production systems across all agro ecological zones throughout the world. The productive and reproductive potential of domesticated livestock is adversely impaired by clinical and sub-clinical helminthes diseases [1]. The epidemiology of GIT parasites in livestock varied depending on the local climatic condition, such as humidity, temperature, rainfall, vegetation and management practices. These factors largely determine the incidence and severity of various parasitic diseases in a region [2].

In Ethiopia, small ruminants are important sources of income for the agricultural communities, represent one of the country’s major sources of foreign currency through the export of skins and meat, and are a source of animal protein. They also play a major role in the food supply and social wellbeing of rural communities living in conditions of extreme poverty [3]. The infections are responsible for significant economic losses in general and significantly affect the production of sheep in particular due to reduction in appetite, loss of body condition, anemia, hypoproteinaemia, impaired digestive absorptive efficiency, other pathogenic complications and even death of animals [1]. The infection is responsible for immune-suppression and enhancing the susceptibility of the animals to other diseases [4].

In spite of huge population and importance of small ruminants, the country has benefited little from this enormous resource owning to a multitude of problems. Disease alone accounts for mortality of 30% in lambs and 20% in adults [5]. The share of parasitic diseases in this regard has been of paramount importance [6]. Although considerable work has been done on endoparasites of sheep in many parts of Ethiopia, there was no previous study carried out on prevalence and intensity of ovine gastrointestinal nematodes in the present study area. Therefore, the present study has been designed to estimate the overall prevalence of ovine GIT nematodes in the study area and identify risk factors associated with GIT nematode infections.

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MATERIALS AND METHODS

Description of the Study Area: Gondar town is located 750 Km away from Addis Ababa, northwest Ethiopia. Geographically, the study area is located at 35°7' N and 13°8' E and an altitude of 2200 meter above sea level. The annual mean minimum and maximum temperature of the area vary between 12.3-17.7°C and 22-30°C respectively with an annual average temperature of 19.7°C. It receives a bimodal rainfall, the average annual precipitation being 1000 mm that comes from the long and short rainy seasons. The short rainy season occur during the months of March, April and May while the long rainy season extend from June to September with mean annual rain fall of 1172 mm [7]. The soil type of the area consists of vertisoil and sandy type of soil with vegetation type which varies from larger tree to bushes. It is characterized by mixed crop livestock production farming system [8].

Study Animals: The study animals were sheep of local indigenous breeds which were presented to Gondar town Veterinary Clinic and Gondar University Veterinary Clinic for clinical purposes from various nearby areas. The sampled sheep were stratified by age, sex and body condition. 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 by Kumsa et al. [9] and ESGPIP [10] based on dental eruption pattern and information from the owners. Body condition scoring of sampled animal was carried out and categorized into three scores as poor, medium and good according to the method described by Kripali et al. [11] and Cooper and Thomas [12].

Study Design and Sample Size Determination: A cross-sectional study was conducted from November, 2016 to April, 2017 to estimating the prevalence and risk factors associated with sheep major GIT nematodes based on coprological examination. Simple random sampling technique was used to select study animals. Age, sex and body condition were considered as risk factors for the occurrence of GIT nematodes in indigenous sheep in and around Gondar town, northwest Ethiopia. Since there was no prior similar research work conducted in the study area, expected prevalence of 50% was assumed to get the maximum number of sample size required. The absolute precisions were decided to be 5% at 95% confidence level. Thus, for sample size estimation, the formula described in Thrusfield [13] and shown below was used:

\[
n = \frac{1.96^2 \times (P_{exp})(1 - P_{exp})}{d^2}
\]

where, \(n\) = total number of sample size; \(P_{exp}\) = Expected prevalence; \(d\) = Absolute precision

Since there had been no previous work reporting the prevalence of GIT ovine nematodes in the study area, the sample size was determined based on an expected prevalence of 50% and 5% absolute precision at a 95% confidence interval (CI). Accordingly, 384 sheep were sampled.

Faecal Sample Collection and Coproscopic Examination: A fresh faecal sample of approximately 10 g was collected directly from the rectum of 384 sheep by using gloved fingers. Collected fecal samples placed in air- and water-tight sample vials and transported to the University of Gondar parasitology laboratory for fecal examination. All the necessary information including body condition, sex and age was labeled. Samples were immediately stored in the refrigerator at 4°C until processed. The collected samples were subjected to qualitative flotation parasitological techniques using saturated sodium chloride (Specific gravity of 1.2) as flotation fluid. The slides prepared were examined under microscope (X10) for the presence of nematodes egg.

Data Management and Analysis: The collected data from field level and laboratory investigation was coded in to appropriate variables and entered in to MS excel work sheet. All statistical analysis was performed using STATA version 11.0 statistical software package. The prevalence was calculated by dividing the number of positive animals by the total number of animals examined and then multiplied by 100. Chi-square (\(\chi^2\)) statistical tool was applied to measure association between prevalence of the parasite and different risk factors. \(P<0.05\) was considered as significant difference.

RESULTS

From the total 384 local sheep breed examined, 243 (63.3%) were found infected with different types of GIT nematodes. The identified parasites were Strongyle spp, Strongyloides spp, Trichuris spp and Nematodirus spp as single and mixed infection. Strongyles were the most frequently [191(49.7%)] recovered nematode eggs followed by Trichuris spp [15(3.9%)], Nematodirus spp [8(2.1%)] and Strongyloides [4(1%)]. Strongyle and Trichuris spp commonly encountered as mixed infection followed by Strongyle and Strongyloides (Table 1).
Fig. 1: Map of study area (Adapted from GIS desk top 10)

Fig. 1: Graphic representation of mixed GIT nematode infection with their respective percentage (%) where, T= Trichuris; N= Nematodirus

Table 1: Prevalence of GIT nematodes egg type of sheep encountered in the study area

<table>
<thead>
<tr>
<th>Parasite egg types</th>
<th>No. of animal examined</th>
<th>Positive Sample</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongyle spp</td>
<td>384</td>
<td>191</td>
<td>49.7</td>
</tr>
<tr>
<td>Trichuris spp</td>
<td>384</td>
<td>15</td>
<td>3.9</td>
</tr>
<tr>
<td>Nematodirus spp</td>
<td>384</td>
<td>8</td>
<td>2.1</td>
</tr>
<tr>
<td>Strongyloides spp</td>
<td>384</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Mixed type</td>
<td>384</td>
<td>25</td>
<td>6.5</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>243</td>
<td>63.3</td>
</tr>
</tbody>
</table>
Table 2: Prevalence of GIT nematodes on age, sex and body condition basis

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Number examined</th>
<th>Number Positive (%)</th>
<th>P-value</th>
<th>OR(95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>258</td>
<td>153(59.3)</td>
<td></td>
<td>Reference</td>
</tr>
<tr>
<td>Male</td>
<td>126</td>
<td>90(71.4)</td>
<td>0.021</td>
<td>1.72(1.08369-2.71624)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Young</td>
<td>157</td>
<td>98(62.4)</td>
<td></td>
<td>Reference</td>
</tr>
<tr>
<td>Adult</td>
<td>277</td>
<td>145(63.9)</td>
<td>0.771</td>
<td>1.66(0.69844-1.62266)</td>
</tr>
<tr>
<td>BCS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>116</td>
<td>68(58.6)</td>
<td></td>
<td>Reference</td>
</tr>
<tr>
<td>Medium</td>
<td>162</td>
<td>100(61.7)</td>
<td>0.601</td>
<td>1.14(0.69977-1.85233)</td>
</tr>
<tr>
<td>Poor</td>
<td>106</td>
<td>75(70.7)</td>
<td>0.060</td>
<td>1.71(0.97719-2.98456)</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>243(63.3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mixed nematode eggs were noticed in some of the slides examined. Out of the total 243 positive cases, 218 (56.8%) were infected with one nematode eggs type and 25 (6.5%) were infected with two or more nematode eggs type (Figure 1).

During the study, sex-wise analysis of the prevalence of the gastrointestinal nematodes of sheep have indicated that male sheep (Rams) were slightly more infected than the female (Ewes) counter parts (Table 2). This variation in susceptibility was statistically significant (P<0.05).

Male sheep (71.4%) had significantly (p = 0.021) higher prevalence than female (59.3%). In comparison of the frequency of infection between age groups, adult animals were more frequently affected than the young but there was no statistically significant difference (P>0.05).

Similarly, infection was slightly higher in animal with poor body condition (70.75%) when compared to that of medium (61.72%) and good body condition scores (58.62%). However, the value indicated there was no statistically significant difference (P>0.05) in prevalence of GIT nematode infection of sheep between different body condition score (BCS) (Table 2).

**DISCUSSION**

The coprological examination done for this study using faecal floatation method revealed an overall GIT nematode prevalence of 63.3% of sheep which were being parasitized at least by one type of nematodes. Even if apparent difference was noted, the present finding agrees with previous studies by coprological examination in some areas of Ethiopia include Asella (68.1%); in Meskan district, Gurage zone (60.6%); Eastern Hararghe Zone (64.6%); Kaffa and Bench Maji Zones (55.1%); Pakistan (62.8%) [14-18] respectively.

This finding is slightly higher than the results of previous surveys in sheep in some areas of Ethiopia, such as, Gondar Town (37.7%), Northwest Ethiopia (44.8%), Dembia District 43.2%, Western Hararghe (61.9%) and Pakistan (49.47%) [19-23] respectively.

However, this study finding is slightly lower than the results of previous surveys in sheep in some areas of Ethiopia: 98.9% Southern Ethiopia [24] 76.3% Welinchity [25] 86.9% Debre Ziet [26] 72.16% Gondar town [27] and 74.56% Serbia from abroad [28]. The possible explanation of this difference could be due to difference in agro-climatic conditions that could support prolonged survival and development of infective larval stage of most nematodes [21]. Furthermore, management system of animals and sample size considered could also contribute in the difference of the prevalence [29].

The current study has shown the presence of mixed infection (Polyparasitism) characterized by the presence of more than one nematode parasite in sheep of the study area. This agrees with the findings of other researchers in the country [9, 15, 29, 30] and elsewhere in the world [28, 31, 32]. These mixed infections have been suggested to be an important cause of morbidity and loss of production in sheep [9]. 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 [33].

This study further revealed that sex of the animal showed significant association with the prevalence of nematode infection. The presence of association between sexes is consistent with previous reports of Tesfalem [15] in the country and Gauyl et al. [34] and Raza et al. [35] from abroad that had documented higher prevalence of nematode infection in male sheep. However [14, 16, 23, 36] who found higher infections in female animals than males without a significant difference.
between them. The possible reasons for the differences between females and males in susceptibility to parasite infection are probably caused by a difference in behavior, morphology or physiological status of sex suggested that the different hormonal status of sexes may affect the immunological responses [34] due to estrogen stimulatory effect on immune response against GIT nematodes while androgen suppresses the immune response [37]. In addition male animals are known to have high natural tendencies of acquiring diseases generally because they tend to move in search of mates for courtship and breeding purposes [38].

In the present study, age wise observation revealed that there was not statistically significant difference in infection of the parasites. In contrary, according to different researchers in different part of world who predicted that nematode infection was higher in adult sheep than the younger [36, 39, 40]. The result also disagrees with the finding of Diriba and Birhanu [14], Abdurezak et al. [16], Hamdullah et al. [23] and Kelemework et al. [41]. However, this finding is in agreement with reports such as, Tesfalem [15], Kulisic et al. [28], Fritsche et al. [42] and Waruiru et al. [43] in Kenya that indicated GIT helminthes affect and have equal chance of exposure for both age groups to the infective stage of the parasite as all are allowed to graze under extensive management and house feeding and nearby home system.

The current study indicated that animals with poor body condition had slightly higher prevalence of nematode infection than good and medium body condition of sheep. Even if, the difference in prevalence among the condition, there was no statistical discrepancy (p>0.05) between the three conditions related to the prevalence of nematode were observed. This result agrees with Tesfalem [15], Jejaw et al. [22], Keyyu et al. [44], Nigatu [45] and Kanyari et al. [46]. But in disagreement with Bisset et al. [47] who suggest that well-fed animals develop good immunity that suppresses the fecundity of the parasites. Similarly, Gonfa et al. [26] in Debre Zeit was found a difference in prevalence in sheep. The possible reason of absence of significant difference might be due to lack of good management system, other coexisting disease rather than nematode which lead to poor immunological response to infective stage of the parasites [15].

CONCLUSION

In conclusion, GIT nematodes are of the major helminthosis of sheep in and around Gondar town. The high prevalence of GIT nematode parasites of sheep recorded is indicative of the abundance and importance of the disease in the study area and its potential contribution to limiting the productivity of sheep. The present study indicated age, sex, body condition and as important factors that influence risk of GIT nematode infection in sheep, but only sex significantly influences the prevalence of the infection. These variation need to be taken into account while scheming control and prophylactic actions for GIT infection of sheep. Thus, Strategic use of anthelmintics and good management should be practiced in the study area to minimize the impact of GIT nematodes on the health of animals; 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; The parasites detected as Strongyle-type should be identified at genus and species level using further laboratory techniques should be recommended in order to tackle the problem in the study area.

Competing Interests: The authors declare that there is no conflict of interests regarding the publication of this paper.

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