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Major Gastrointestinal Nematodes of Small Ruminants in Dembia District, Northwest Ethiopia

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Abstract: A cross sectional study was conducted with the objectives of determining the prevalence and risk factors associated with small ruminant major gastrointestinal nematodes in Dembia district, northwest Ethiopia from November 2013 to April 2014. A total of 384 randomly selected small ruminants (315 sheep and 69 goats) were examined using standard parasitological procedure. The overall infection rate was 43.2%. Among the samples from sheep 132 (41.49%) and 34 (49.2%) from goats were detected positive for gastrointestinal nematode parasites. The study revealed that a statistically significant difference ($p<0.05$) was found in prevalence between sheep and goats. Sex, age and body condition of the animals were not associated with significant difference ($p>0.05$). The Sex wise prevalence was 46.2 and 42.3% in male and female animals respectively while that of age was 44.3, 42.4% in young and adult animals respectively. Body condition score infection rate was 48.1, 37.1 and 43% in poor, medium and good body conditions respectively. In this study the parasite eggs detected were strongyle-type, hence, further laboratory examination is recommended to identify parasite species in order to design appropriate control measures.

Key words: Dembia · Ethiopia · Gastrointestinal Nematodes · Prevalence · Small Ruminants

INTRODUCTION

Livestock systems in developing countries are characterized by rapid change, driven by factors such as population growth, increases in the demand for live stock products as incomes rise and urbanization. Livestock currently contribute about 30 percent of agricultural gross domestic product in developing countries, with a projected increase to about 40 percent by 2030 [1] and is becoming the fastest-growing sub-sector of agriculture [2].

Africa hosts 205 and 174 million sheep and goats representing 17 and 13 percent of the world total small ruminant population, respectively. The population of small ruminants in sub-Saharan Africa is estimated to be 274 million [3]. Livestock are an important component of nearly all farming systems in Ethiopia and provide draught power, milk, meat, manure, hides, skins and other products. Currently, the population of livestock found in Ethiopia is estimated to be 53.4 million cattle, 25.5 million sheep and 22.78 million goats [2, 4].

Despite the large livestock population of Ethiopia, the economic benefits remain marginal due to prevailing diseases, poor nutrition, poor animal production systems, reproductive inefficiency, management constraints and general lack of veterinary care [5].

Sheep and 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. Sheep and 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 [6].

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

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characterized by lower outputs of animal products, by-products, manure and traction all contributing to assure food security [7]. Helminthes infections in small ruminants are serious problems in the developing world, particularly where nutrition and sanitation are poor [8]. Gastro-intestinal nematode infection is one of the major health problems in the world. These nematode infections affect the health of millions of people and animals, causing huge economic loss in livestock farming [9]. 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. This includes; Haemonchus, Cooperia, Ostertagia, Bunostomum, Trichostrongylus, Oesophagostomum and Nematodirus [10].

Economic losses, lowered productivity, reduced animal performance and weight gain, retarded growth, cost of treatment and mortality are caused by parasites affecting the income of Smallholder farming communities. Most of the losses are caused by the gastro-intestinal nematodes [11].

Clinical diagnosis of GI strongylosis is difficult, since the signs are not pathognomonic. However, diagnosis of gastrointestinal nematode infections plays a major role in investigating parasite epidemiology [12]. 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 loads [13].

Management of parasites, gastrointestinal worms in particular, is often a primary animal health issue on many farms and ranches. Our tropical environment is an ideal habitat for parasite species, especially in wetter locations. Losses caused by heavy parasite burdens are both direct, in terms of death, poor gains and reproductive inefficiency and indirect, stemming from increased susceptibility to secondary infection and greater labor needs. Parasite control should form a central part of every small ruminant health management strategy. Which is a major element in ensuring the sustainability of sheep and goat production is currently achieved by the use of anthelmintics [7].

In Ethiopia, parasitological investigations of small ruminants 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 [5]. Gastrointestinal nematode is one of the major constraints for small ruminants production in the study area, however, data on the distribution of the parasite in the area are lacking. 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 small ruminants in the study area to assess the main risk factors associated with gastrointestinal nematode infection in the study area and to forward base line data for further studies.

MATERIAL AND METHODS

Study Area: A cross sectional study was conducted from November 2013 to April 2014 to determine the prevalence of major gastrointestinal nematode parasites in small ruminants in Dembia district, North Gondar Administrative Zone, Northwest Ethiopia. The District lies close to Lake Tana (The largest lake in Ethiopia) and the majority of the population depends on subsistence farming. The altitude ranges from 1700 to 2700 matter above sea level. The area receives a bimodal annual rain fall which a range between 700-1160 mm. Communal grazing is in practice in the area. The livestock population of the district is comprised of 247,237 cattle (243,842 local and 3,395 cross breed), 58,601 sheep, 18,659 goats, 269 mules, 20,205 donkeys, 58 horses, 148,695 poultry (147,720 local and 975 exotic) and 21,318 colony of bees [14].

Study Animals: A total of 384 small ruminants (315 sheep and 69 goats) of all sexes and ages were used in the study. The 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 according to the classification of age groups by Kumssa *et al*. [15]. The body condition score was determined according to Kripali *et al*. [16] and were grouped as poor, medium and good.

Study Design and Sample Size Determination: A cross-sectional study design was used to determine the prevalence of gastrointestinal nematodes of small ruminants in Dembia district based on coprological examination. Simple random sampling technique was used to select study animals. Age, sex, species and body condition were considered as risk factors for the occurrence of major gastrointestinal nematodes in small ruminants. The total sample size was calculated based on the predetermination of the following parameters: a 95% level of confidence, 5% desired level of precision and 50% expected prevalence according to Thrusfield [17] since there was no similar study done previously on the study area. Accordingly, 384 small ruminants were sampled.

Sample Collection and Examination Procedure: 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 Parasitology laboratory, Faculty of Veterinary Medicine, University of Gondar where they were stored at refrigerated temperature (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 [18].

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 statistical software packages for social science (SPSS). The prevalence was calculated by dividing the number of positive animals by the total number of animals examined and times 100. Percentage (%) to measure prevalence and Chi-square (x^2) to measure association between prevalence of the parasite and species of animals, age, sex, body condition score were the statistical tools applied. In all the analyses, confidence level was held at 95% and $P<0.05$ was set for significance.

RESULTS

Out of the total 384 small ruminant examined, 166 (43.2%) were positive for strongyle-type of nematode eggs. From the total 315 sheep examined, 132 (41.9%) and out of the total 69 goats examined, 34 (49.2%) were infected with major gastrointestinal nematodes. The prevalence was higher in goats (49.2%) than sheep (41.9%) with a statistical significant difference ($p<0.05$) between them (Table 1).

In this study, assessment was made to see the effect of sex on disease prevalence. Higher prevalence of major GI nematode infection was observed in male animals (46.2%) as compared to females (42.6%). However, the difference in prevalence between the two sexes was not statically significant ($p>0.05$) (Table 2).

In the present study, prevalence of major gastrointestinal nematodes was 44.3% and 42.4% in young and adults, respectively. However, the difference in prevalence between the two age groups was not statically significant ($p>0.05$) (Table 3).

The prevalence of major gastrointestinal nematode in different body condition scores of the study animals was also presented in (Table 4).The slightly higher prevalence of nematode infection was observed in poor body condition animals (48.1%) followed by good (43.0%) and medium (37.1%) body conditioned animals. But, there was no a statistical significant difference ($p>0.05$) between them (Table 4).

Table 1: Prevalence of major GI nematodes in sheep and goats

Species	No. examined	No. infected (%)	x^2	P-value
Sheep	315	132(41.9%)	29.103	0.000
Goats	69	34(49.2%)		
Total	384	166(43.2%)		

Table 2: Prevalence of major GI nematodes on sex basis

Sex	No. examined	No. infected (%)	x^2	P-value
Male	93	43(46.2%)	2.311	0.315
Female	291	123(42.3%)		
Total	384	166(43.2%)		

Table 3: Prevalence of small ruminant major GI nematodes by age category

Age	No. examined	No. infected (%)	χ^2	P-value
Young	160	71(44.3%)	0.147	0.702
Adult	224	95(42.4%)		

Table 4: Prevalence of small ruminant major GI nematodes based on body condition category

Body condition	No. examined	No. infected (%)	χ^2	P-value
Poor	160	77(48.1%)		
Medium	124	46(37.1%)	3.965	0.411
Good	100	43(43.0%)		
Total	384	166(43.2%)		

DISCUSSION

The present study revealed the existence of major GI nematode parasites with an overall prevalence of 43.2% in small ruminants. This finding is lower than the results of previous surveys in sheep and goats [19-21] from different parts of Ethiopia. This deference 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 [22]. Furthermore, management system of animals could also contribute in the difference of the prevalence [23]. But, this result is much higher than the work of Amenu [24] who reported a prevalence of 1.1% in sheep and goats of three different agro ecological zones of southern Ethiopia. This difference might be due to the difference between the management system of examined animals and geographical and environmental location of the area.

In the present study, a higher prevalence of major GI nematode parasites was observed in goats than in sheep which is in agreement with the other reports [19, 23] in western and eastern parts of Ethiopia and abroad [25]. This might be due to 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 sheep [26]. Furthermore, it is assumed that sheep do have a considerably higher immunological response to gastrointestinal parasites compared with that of goats [27]. However, it is in contrary to other reports [28, 29]. The reason that goats are kept on semi intensive grazing system [28] and prefer to browse s hrubs but, grazing habit of sheep where they graze closer to the ground fostering opportunity of exposure to parasites [29] which might reduce the infection rate was not found in the present study.

The present study revealed that sex of the animal did not show significant association with the prevalence of the parasites. The absence of association between sexes and prevalence is consistent with previous reports [21, 23, 25, 30]. This indicated that male and female sheep have equal chance of infection if they are exposed to the same contaminated communal grazing pasture. However, Dagnachew *et al*. [26] reported that female animals are more susceptible to parasitism. It is assumed that sex is a determinant factor influencing prevalence of parasitism [31, 32] and females are more prone to parasitism during pregnancy and peri-parturient period due to stress and decreased immune status [27]. In contrast, Gualy *et al*. [33] and Raza *et al*. [34] had documented higher prevalence of nematode infection in rams. 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 [33].

The study further revealed that age of the animal did not show significant association with the prevalence of the parasites. Absence of association between age groups is contrary with previous reports [23, 26] in Ethiopia and elsewhere [25, 35, 36]. Age was considered an important risk factor in GI nematodes [34]. Several authors have documented that adult and old animals develop acquired immunity [26, 27, 37, 38] against nematode infections as they get mature due to repeated exposure and this will help expel the parasite before it establish itself in the gastrointestinal tract.

In the present study, an animal with poor body condition seems to have higher prevalence of major gastrointestinal nematodes. However, it was not statically significant (x^2=3.965 and p>0.05). This could be related to their higher susceptibility to infection than other groups. This agrees with Nigatu [21], Keyyu *et al*. [25], Kanyari *et al*. [39]. 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.

CONCLUSION

Gastrointestinal nematode parasites are the major animal health constraints in sheep and goats production and contributing loss in productivity and economy. The present study showed that gastrointestinal nematode of small ruminants is prevalent disease in the area affecting the wellbeing of the animals. During the present study an overall prevalence of 41.9% and 49.2%in sheep

and goats respectively were harboring by strongle parasites. The role of species in the occurrence of GI nematodes found to be significant. Body condition and age of the animals were shown to have association with prevalence but significant difference was not found.

RECOMMENDATIONS

The parasites detected as strongyle-type should be identified at genus and species level using further laboratory techniques. Predisposing factors such as poor management and concurrent chronic diseases should be avoided. 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.

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