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STUDY ON THE PREVALENCE OF OVINE GASTROINTESTINAL TRACT NEMATODES IN AND AROUND HAWASSA TOWN, SOUTHERN ETHIOPIA

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ABSTRACT

A cross sectional study from November 2017 to April 2018 was conducted to estimate the prevalence and risk factors associated with major sheep gastro-intestinal tract nematodes in and around Hawassa town of Southern Nation Nationalities and People region, Ethiopia. A total of 384 randomly selected sheep fecal samples were examined using flotation technique. Out of the total sampled sheep, 265(69%) had a gastrointestinal nematode infection. Coprological investigation revealed that sheep in the district were infested by a variety of helminth nematodes. Among nematode eggs Strongyles were most frequently (37.9%) recorded followed by Strongyloides (35.9%) and Trichuris species (11.4%).The study revealed statistically non-significant differences ($p>0.05$) between male and female sheep, even though, higher prevalence was recorded in females. There was also statistically no significant difference ($p>0.05$) between age groups of sheep and study sites. However, a significant difference ($p<0.05$) between body condition of the animals was recorded , with higher prevalence in animals with poor body condition being 1.72 times more exposed to gastrointestinal nematode infection than animals in good body condition with CI (1.08369-2.71624). Gastrointestinal nematodes are one of the major problems that could hamper health and productivity of sheep in the study area. Therefore, emphasis on the control and prevention of GIT nematodes should be given, with further studies on genus and species identification of nematode eggs followed by strong recommendations to tackle the problem in the study area.

Keywords: Hawassa, Gastrointestinal Nematodes, Prevalence, Risk Factors, Ovines

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1. INTRODUCTION

Sheep and goats are the most populous and closely associated with man among domesticated livestock and are especially, important in more extreme climates of the world. Africa hosts 205 and 174 million sheep and goats, representing 17 and 13 percent of the world's total small ruminant population, respectively. The population of small ruminants in sub-Saharan Africa is estimated to be 274 million (Samson and Frehiwot, 2010). Ethiopia is believed to have the largest livestock population in Africa (Tilahun and Schmidt, 2012) and (CSA, 2013).

Naturally endowed with different agro-ecological zones and suitable environmental conditions, the country is a home for many livestock species and suitable for livestock production. An estimate indicates that the country is home for about 54 million cattle, 25.5 million sheep and 24.06 million goats. With these figures the country is the second in Africa, and sixth in the world, in terms of sheep population (CSA, 2013).

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. Studies have revealed that ruminants contribute 80% of the total food production from livestock in tropical Africa, of which small ruminants account for about 22%. Sheep and goats are very important for poor-resource 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 providing food and generation of cash income. They serve as a living bank for many farmers, closely linked to the social and cultural life of poor-resourced farmers and provide security in bad crop years (Tsedeke, 2007).

Globally parasitic diseases continue to be a major constraint especially, for poor developing countries. Most of the losses that come from the parasites are shared by the gastro-intestinal helminthes. Therefore, helminth infections in small ruminants pose serious problems in the developing world particularly, where nutrition and sanitation are poor (Thrusfield, 2005).

Besides, gastro-intestinal nematode infection is also a major health problem in the world. Furthermore, these nematode infections affect the health of millions of people and animals, causing huge economic loss in livestock farming (Souls, 1982). In addition, nematode parasites are also a major problem for small ruminants. In these animals, a range of nematode infection present as a mixed infection that mainly invade the small intestine and abomasum of small ruminants. This group of parasites includes; Haemonchus, Cooperia, Ostertagia, Bunostomum, Trichostrongylus, Oesophagostomum and Nematodirus (Abebe and Esayas, 2001).

Small-holders and pastoralists may not easily detect the effect of helminthes because of the subclinical nature of the infections (Souls by, 1986) and (Urquhart *et al.*,1996). Thus, the sub-clinical nematode infections are responsible for significant economic losses. They are responsible for immune-suppression and enhancing the

susceptibility of the animals to other diseases. Prior to the detection of clinical diseases, economic losses in terms of animal productivity are already in place. (Kaplan, 2006). In Ethiopia production losses due to helminth parasites are often substantial amounting to a loss of 81.8 million US$ annually (Demelash *et al.*,2006).
In the developed world, the greatest component of impact by these nematode parasites is probably the involvement of the cost for control measures. But their impact is greater in the sub-Saharan Africa in general and Ethiopia is particular due to ecological factors suitable for diversified hosts and parasite species (Ragassa *et al.*, 2006). The epidemiology of gastro-intestinal (GIT) parasites in livestock varies depending on the local climatic conditions, such as humidity, temperature, rainfall, vegetation and management practices (Takelye, 1991). These factors largely determine the incidence and severity of various parasitic diseases in different regions of the country. Thus, in the study area gastrointestinal nematode infection is one of the major constraints for small ruminant's production, however, data on the distribution of the parasite in this area are lacking. So that knowing the current situation of GI nematode in the area could be the basis for all possible actions including its control and eradication. Therefore, this study was conducted to determine the prevalence of major gastrointestinal nematodes of sheep in Hawassa district and to assess the potential risk factors associated with ovine gastrointestinal nematode infection in the study area and to generate base line data for further studies.

2. MATERIALS AND METHODS

2.1 Description of the Study Area

A cross sectional study was conducted from November 2017 to April 2018 in Hawassa town of the Southern Nation Nationalities and People region, to determine the prevalence of major gastrointestinal nematode parasites in small ruminants in Hawassa district. Hawassa is the capital of Sidama zone administration and Southern Nations Nationalities and Peoples' Regional State (SNNPRS) as well. It is located in the northern part of SNNPRS, 275 km South of Addis Ababa. It geographically lies between 4º27′and 8º30′ N latitude and 34º21′and 39º1′ E Longitude at an altitude of 1,790 m above sea level. The area receives an average annual rain fall ranging from 800 to 1,000 mm of which 67% falls in the long rainy season, extending from June to September. During the study period, the mean minimum and maximum temperatures of the area were 20.1ºC and 30ºC, respectively, and 51.8% mean relative humidity. The area is mainly covered by dry savannah and bush type vegetation (NMA, 2008). The total livestock population of Sidama zone (including Hawassa) is estimated at 1,721,341 cattle, 228,941 goats, 457,465 sheep, 57,643 horses, 54,066 donkeys, 725,540 poultry, and 44,492 beehives (CSA, 2008).Based on the 2007 census conducted by the CSA, this zone has a total human population of 2,954,136, of whom 1,491,248 are men and 1,462,888 women, with an area of 6, 538.17 square kilometers (CSA, 2007).

2.2 Study Animals

All the study animals were indigenous breeds, kept under traditional extensive and semi intensive 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*., 2011). Body condition scoring of sampled animal was carried out according to the method described by (Cooper and Thomas, 1985) and categorized into three scores as poor, medium and good. The poor body condition was recorded when individual spinous processes were sharp to touch and easily distinguished, in addition, the bony structure of the sheep was easily noticeable. The eye muscles had moderate depth. Medium body condition was recorded when the spinous processes examined with very firm pressure were round rather than sharp. The eye muscle areas were 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.

2.3. Study design

A cross sectional study was conducted from November, 2017 to April, 2018 to determine the prevalence of gastro-intestinal nematode parasites in sheep based on carpological examination of nematode eggs.

2.4. Sampling Method and Sample Size

Simple random sampling technique was employed to select the required number of the study population. Prior to sampling, each selected animal was given an identification number and data on each animal's sex, age, breed and origin was recorded. Age, sex, species and body condition were considered as risk factors for the occurrence of major gastrointestinal nematodes in sheep in and around hawassa town Southern Ethiopia. Since there was no such research work conducted in the study area, expected prevalence of 50% was assumed to get the maximum number of sample size required. The total sample size was calculated based on the pre-determination of the following parameters: 50% expected prevalence, 5% absolute precision and 95% confidence interval. The formula used to calculate the sample size is shown below,

$$N = \frac{(1.96)^2 \, Pexp \, (1-Pexp)}{d^2} \qquad \{Equ.1\}$$

Where: Pexp = expected prevalence (50%)
P = prevalence
N = required sample size
d = desired absolute precision
Since there have been no previous reports on the prevalence of GIT ovine nematodes in the study area, the prevalence of 50% and 5% absolute precision at a 95% confidence

interval (CI) was considered. Accordingly, 384 sheep were sampled and examined for GIT nematodes.

2.5 Sample Collection and Examination Procedure

Fresh faecal samples were collected directly from the rectum of selected animals and the samples were placed in labeled separate screw capped bottles. During sampling, age, sex, and body condition was recorded through observation. Finally, the collected samples were kept in a cool box until it reached Hawassa University Veterinary Laboratory for coprological investigation. The majority of samples were processed on the same day of sample collection. Samples not examined immediately after the arrival at laboratory were stored at +4°C and examined early in the morning on the next day. The collected faecal specimens were processed and examined by direct faecal floatation technique for qualitative investigation of the various types of gastro-intestinal nematode eggs following the standard procedure indicated by Urquhart *et al.* (Urquhart *et al*., 1996). Sodium chloride (NaCl) was used as floatation solution.

2.6. Data Management and Analysis

The collected data was coded into appropriate variables and entered into MS excel worksheet. All statistical analysis was performed using statistical data packages for social science (SPSS) version 20. 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 ($\chi 2$) was used to test the existence of differences in prevalence between age groups, sex, body condition scores and site of collection. In all the analyses, confidence level was held at 95% and $P<0.05$ was set for significance.

3. RESULTS AND DISCUSSION

The gastrointestinal nematodes of sheep are one of the most important parasitic diseases that obviously resulted in reduced productivity of sheep raised by small-holders using traditional husbandry management systems in and around Hawassa district.

From a total 384 sheep examined, 265 (69.0 %) were infected with different types of gastro-intestinal nematodes. Among total positive cases, 74 (37.9%) were infected with strongyles, 70(35.9%) with Strongyloides spp, 23 (11.8%), with Trichuris species and 28(14.4%) had mixed type. Strongyle and Trichuris species were commonly encountered as mixed infections followed by Strongyle and Strongyloides. The predominant GIT nematodes identified in sheep in the study area were strongyles, strongyloides, mixed type and Trichuris species (Table 1).

The coprological examination done for this study using direct faecal floatation method, revealed an overall gastrointestinal infection prevalence of 69.0% of sheep originating from this area which were being parasitized at least by one type of gastrointestinal nematodes. However, an apparent difference was noted. The present findings to some extent agree with previous studies on coprological examination in

some areas of Ethiopia including in and around Asella (68.1%) by (Diriba and Birhanu, 2013), Eastern Hararghe Zone (64.6 %) by (Abdurezak *et al*., 2015) and in Pakistan (62.8%) by (Ahmad *et al*., 2012). However, higher rate of prevalence contrary to the results in previous surveys in sheep in some areas of Ethiopia, such as Gondar Town, Northwest Ethiopia (37.7%) by (Meaza *et al*.,2012) and Pakistan (49.47%) by (Hamdullah *et al*., 2013) has been recorded.

Morever, the findings of previous surveys in sheep do not corroborate with our results showing higher prevalence in some areas of Ethiopia ; 98.9% Southern Ethiopia by (Amenu, 2005), 76.3% Welinchity by (Moti, 2008), 86.9% Debre Ziet by (Gonfa *et al*., 2013), and 74.56% Serbia by (Kulisic *et al*., 2013) from abroad. 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 (Getachew *et al*., 2017). Furthermore, management system of animals and sample size could also contribute to the differences of the prevalence rates (Regassa *et al*., 2006).

Table1: The prevalence of particular ovine gastrointestinal nematode infection.

Nematode egg type	No.of animal examined	No of positive	Prevalence (%)
Strongyle	384	74	37.9%
Strongloides	384	70	35.9%
Trichuris	384	23	11.8%
Mixed	384	28	14.4%
Total	384	265	69%

From the total sheep population examined in the four sites of origin, samples from dato (27%) showed higher prevalence and samples from chaffe showed lower infection prevalence (22.6%). The chi-square ($\chi 2$) test value indicated that there was no statistically significant difference ($P > 0.05$) in prevalence of gastro-intestinal nematode infection of sheep between the four sites(Table 2). In the present study there is no statistical significant difference ($P< 0.05$) between the different study sites and corroborate with (Lemma and Abera, 2013) and (Armour, 1980) where no significant difference in animals reared in similar geographical areas was reported. This similarity might be due to the similar nature of management systems of examined animals, geographical and environmental location of the area having same agro-ecology. Meanwhile, effects of different agro-ecology and geographic areas showing significant difference in the prevalence of nematode infection rate (Demelash *et al*., 2006) has been recorded.

Table2: Prevalence of major gastrointestinal nematode in different sites of study area using coprological examination.

Site of origin	No of animal examined	No of animal infected	Chi square (p-value)
Tulla	96	70(26.4%)	
Chaffe	98	60(22.6%)	

Dato	96	67(27.7%)	3.978 (0.264)
Tikurwuha	94	68(25.7%)	
Total	384	265(69%)	

Females and males were found to be infested with a prevalence of 60.4% and 39.6%, respectively, but there was no statistically significant variation (P>0.05) between the two sexes (Table 3). Young and Adult animals were found to be infested with a prevalence of 60.8% and 39.2% respectively, with no statistically significant difference (p>0.05) (Table 3). Infection prevalence was significantly higher in animals with poor body condition as compared to that of medium and good body condition scores (P < 0.05) and animals being poor in body condition were 1.72 times more exposed to infection than in good body condition with CI (1.08369-2.71624). The overall infection prevalence according to body condition grades recorded was, 43%, 30.9% and 26% with poor, medium and good, respectively (Table 3).

In this study, no significant variations were observed between males and females despite higher infection noticed in female sheep. This finding is in agreement with that of (Diriba and Birhanu, 2013) in Asella, (Abdurezak *et al*., 2015) in Eastern Hararghe Zone, (Dagnachew *et al*., 2011) in North Gondar and (Hamdullah *et al*., 2013) in Pakistan. Yet, contradicting other reports including (Tesfalem, 2016) in Meskan district, Gurage zone, (Regassa *et al*., 2006) in Western wolega, and (Raza, *et al*., 2007) in southern Punjab abroad. It is assumed that sex is a determinant factor influencing prevalence of parasitism and females are more prone to parasitism during pregnancy and per-parturient period due to stress and decreased immune status (Keyyu *et al*.,2003; Regassa *et al*.,2006).

Table3: Prevalence of ovine gastrointestinal nematodes by sex, age, body condition.

Risk factor	No. of animal examined	Positive (%)	Prevalence (%)	Chi-square(p-value)	
Sex					
Male	151	105	39.6	0.032(0.885)	
Female	233	160	60.4		
Body condition					OR (95% CI) 1.72(1.08369-2.71624)
Good	131	69	26	30.369(0.000)	
Medium	117	82	30.9		
Poor	136	114	43		
Age					
Young	234	161	60.8	0.012(0.913)	
Adult	150	104	39.2		

From gastrointestinal nematode egg types encountered in the study area, Tulla recorded higher prevalence in Strongloides spp. (34%) and lower prevalence in trichures spp. (18.9%), from Chaffe higher prevalence was recorded in trichures spp. (32.4%) and lower prevalence was recorded in Strongloides spp. (18.4%), from Dato higher prevalence was recorded in trichures spp. (32.6%) and lower prevalence was recorded in Mixed type spp. (16.7%) and from Tikur wuha higher prevalence was recorded in strongyle spp. (36%) and lower prevalence was recorded in trichures spp. (16.2%) (Table 4). The chi-square ($\chi 2$) test value indicated that there was no statistically significant difference ($P > 0.05$) in prevalence of gastro-intestinal nematode egg type infection of sheep between the four sites (Table 4).

Table 4: Prevalence of gastrointestinal nematodes egg type encountered in the study area.

Origin	No.of animal positive	Strongyle	Strongloides	trichures	Mixed type	Chi-square (P-value)
Tulla	70	18(20.2%)	35(34%)	8(18.9%)	9(25%)	20.699 (0.14)
Chaffe	60	25(27%)	20(18.4%)	13(32.4%)	12(27.8%)	
Dato	67	16(16.9%)	30(30.1%)	14(32.6%)	7(16.7%)	
Tikurwuha	68	32(36%)	18(17.5%)	7(16.2%)	11(30.6%)	

From the gastrointestinal nematodes, egg types encountered sex-wise, males showed higher prevalence of Strongloides spp. (38%) and lower prevalence in Trichuris spp. (11.1%) and in females higher prevalence was recorded in Strongloides spp. (38.9%) with lower prevalence in Trichuris spp. (14%). But there was statistically no significant difference ($P > 0.05$) in prevalence of gastro-intestinal nematode egg type infection of sheep between sexes. From the gastrointestinal nematodes egg types encountered in age-groups, young ovine's recorded higher prevalence in Strongloides spp. (40.9%) and lower prevalence in mixed type spp. (11%) and in adults higher prevalence was recorded in Strongloides spp. (36%) with lower prevalence in Trichuris spp. (13.5%). But there was no statistically significant difference ($P > 0.05$) in prevalence of gastro-intestinal nematode egg type infection of sheep between age groups. Egg type encountered in the poor body condition of ovine higher prevalence was recorded in strongyle spp. (39.4%) and lower prevalence was recorded in mixed type spp. (8.7%), in medium higher prevalence was recorded in strongloides spp. (39.3%) and lower prevalence was recorded in mixed type spp. (19%) and in good body condition higher prevalence was recorded in strongloides spp. (46.8%) and lower prevalence was recorded in Trichuris spp. (11.7%). But there was no statistically significant difference ($P > 0.05$) in prevalence of gastro-intestinal nematode egg type infection of sheep in different body condition grades (Table5).

In the current study young sheep were more frequently infected than adult sheep. But there was no statically significant difference ($P > 0.05$) between the two age groups. This finding has concurrence with (Abdurezak *et al*., 2015) in Eastern Hararghe Zone,

(Hamdullah *et al*., 2013) in Pakistan and (Diriba and Birhanu, 2013) in Asella. On the contrary, this observstion is in disagreement with the findings of (Dagnachew *et al*.,2011) in North Gondar who recorded higher prevalence in adults, (Tesfalem, 2016) in Meskan district, Gurage zone, and (Kulisic *et al*.,2013)in Serbia from abroad who reported equal chances of exposure for both the age groups. The possible reason for this finding might be that new born and younger sheep lack strong immunity than the adults. The possible explanation is that in adult sheep, after primary infection, rapid solid immunity is acquired. In fact, sheep 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).

There are also special conditions encountered during peri-parturient rise in nematode eggs excretion, as early as two weeks before lambing, and persisted up to eight weeks post-partum after lambing, and occurs mostly during the wet seasons. Thus, pregnant or lactating ewes became the major source of infections for the newborn lambs (Ng'ang'a *et al*., 2006).

In this study, a significant difference was observed in prevalence of nematode infection in relation to body condition score, where a higher prevalence of gastrointestinal nematodes parasites was recorded in poor and moderate body condition as compared to the animals with good body condition and it was statistically significant ($p<0.05$). This finding has coherence with (Vanwyk *et al*., 2006; Negasi *et al*., 2012; Gonfa *et al*.,2013; Radostits *et al*.,2006; Odoi *et al*., 2007; Knox *et al*.,2006). however , these results contradict with (Tesfalem, 2016) and (Jejaw *et al*.,2014), with a possible reason for higher prevalence in poor animals of the host species because comparatively, weaker immune system in these animals to fight with the infections than that of a healthy animal's immune system (Kuchai *et al*., 2011).

Table5: Prevalence of ovine gastrointestinal nematodes egg type encountered in sex, age and body condition

Variables	No. Of animal positive	Strongyle	strongloides	trichuris	Mixed type	Chi-square (p-value)
Sex						
Male	105	39(37.1%)	40(38.9%)	12(11.1%)	14(13%)	1.760(0.624)
Female	160	49(31.2%)	62(38.9%)	26(15.9%)	23(14%)	
Age						
Young	161	54(33.8%)	63(40.9%)	25(14.3%)	19(11%)	2.179(0.536)
Adult	104	36(33.3%)	38(36%)	12(13.5%)	18(17.1%)	
Body condition						
Good	69	21(27.3%)	33(46.8%)	6(11.7%)	9(14.3%)	11.549(0.073)
Medium	82	27(32.1%)	32(39.3%)	8(9.5%)	15(19%)	
Poor	114	43(39.4%)	37(32.7%)	23(19.2%)	11(8.7%)	

4. CONCLUSION

Gastrointestinal nematodes are the major animal health constraints in sheep production contributing to the loss in productivity and economy. The present study results indicated that gastrointestinal nematodes lead to major helminthosis of sheep in and around Hawassa district, with an overall prevalence of 69%. The high prevalence of GIT nematode parasites of sheep thus recorded is indicative of the abundance and importance of the disease in the study area and its potential contribution in limiting the productivity of sheep. This study was based solely on coproscopic examination for detection of gastrointestinal nematode eggs. The results have provided an insight to the current prevalence rate and associated risk factors. Age, sex and body condition were potential risk factors associated with prevalence of gastrointestinal nematode infection in the study area. But only body condition significantly influenced the prevalence of the infection. These variations need to be taken into account while devising control and prophylactic strategies for GIT infection of sheep.

A strategic anthelminthic treatment of sheep with broad spectrum anthelminthics at the beginning of rainy season and at the end of dry season to reduce the worm burden and minimize larval pasture contamination, good managemental practices, rotational grazing system for different seasons, separating the most susceptible animals especially pregnant and lactating ewes from flocks, support of veterinarians and animal health extension workers in giving professional advice regarding preventive and control measures against gastrointestinal helminth parasites in the area is highly desirable.

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