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Research Article

Prevalence of Ovine Gastrointestinal Nematodes in Jimma Horro District Kellem Wollega Zone, Oromia Regional State, Western Ethiopia

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Abstract

A cross-sectional study was conducted from November, 2015 to April, 2016 to determine prevalence and risk factors associated with ovine gastrointestinal nematode infestation by faecal examination of 384 sheep from four different Peasant Associations (PAs) of Jimma Horro district, Kellem Wollega Zone, Western Ethiopia. Out of the total sampled sheep, 69 (17.9%) had a gastrointestinal nematode infection. Coprological examination showed that Strongyloides (11.9%) were the most frequently recovered nematode eggs followed by Trichuris (5.9%). The Eggs per Gram (EPG) count were determined using modified McMaster technique. Accordingly, 27 (39.2%), 24 (34.8%) and 18 (26.1%) of the sheep were lightly, moderately and heavily infested respectively. There was a statistically significant difference between age, body condition scores and season ($p < 0.05$) with prevalence and eggs per gram (EPG) counts, but no between the sexes. In addition, there was a significant difference ($p< 0.05$) in prevalence among months of the study period. From all the sheep examined in the four PAs, Akko Jirru (31.3%) showed the higher GIT prevalence of nematode infection and samples from Nunnu Innaro (10.4%) showed lower pre-valence of GIT infection of nematodes. There was also statistically significant difference ($p<0.05$) in prevalence of gastro-intestinal nematode infection of sheep between the four PAs. 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.

Keywords: Gastro intestinal; Infection; JimmaHorro; Nematodes; Prevalence

Introduction

Livestock currently contribute about 30 percent of agricultural gross domestic product in developing countries [1] and is becoming the fastest growing sub-sector of agriculture [2]. Livestock systems in developing countries are characterized by rapidly changing, due to many factors such as population growth, increasing demand for livestock products as incomes rise and expansion of urbanization). Africa hosts 205 and 174 million sheep and goats representing 17% and 13% of the world total small ruminant population, respectively. The population of small ruminants in sub-Saharan Africa is estimated to be 274 million [3]. Among these total population of livestock found in Ethiopia, 53.4 million cattle, 25.5 million sheep and 22.78 million are goats [4].

Ethiopia is the second in Africa, and the sixth in the world, in terms of sheep population. In spite of huge population and importance of small ruminants, the country has benefited little from this enormous resource owning due to a multitude of problems like poor nutrition, poor animal production systems, reproductive inefficiency, management constraints, lack of veterinary care, and disease being the most important. Disease alone accounts for mortality of 30% in lambs and 20% in adults [5]. 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 characterized lower outputs of animal products, by-products, manure and traction all contributing to assure food security [6]. They are responsible for immune suppression, enhancing the susceptibility of the animals to other diseases. A loss of US $81.8 million is reported annually due to helminth parasites in Ethiopia [7] Helminthes infections in small ruminants are serious problems in the developing world, particularly where nutrition and sanitation are poor. Gastrointestinal nematode infection is one of the major health problems in the world. In developed world, the greatest component of impact by these nematode Parasites is probably found in the cost of control. 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 [8]. The epidemiology of Gastro-intestinal (GIT) parasites in livestock is 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 [9]. Nematode parasites of small ruminants are primarily parasites of the gastrointestinal tract. Alimited ranges of nematodes are usually present as mixed infections. The most important species are those found in the abomasums and small intestine. This includes; Haemonchus, Cooperia, Ostertagia, Bunostomum, Trichostrongylus,

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Oesophagostomum and Nematodirus [10]. Clinical diagnosis of GIT strongylosis is difficult, since the signs are not pathognomonic. However, diagnosis of gastrointestinal nematode infections plays a major role in investigating parasite epidemiology. 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. Quantifying of the egg per gram of faeces is the best way of estimating parasite loads [11]. Although considerable work has been done on endo parasites 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, where mixed crop-livestock Production system is the main form of agriculture. On the other hand knowing the current situation of GIT nematode infection in the area could be the basis for all possible actions including its control and prevention. Therefore, the current study was carried out:To determine the prevalence and intensity of ovine gastrointestinal nematodes and associated risk factor in the study area.

To provide base line data on the relative distribution of ovine nematode infection and its burden.

Materials and Methods

Study area

The study was conducted from November, 2015 to April, 2016 in four selected PAs: AkkoJirru, NunnuInnaro, Nunnu and Ilukitae, of JimmaHorro District, Kellem Wollega Zone, and Western Ethiopia. The area is located, at about 665km west of Addis Ababa. The area is densely populated with livestock. The livestock population of the area is estimated to be about 100,110 heads of cattle, 5,761 mules, 22,786 donkeys, 25,352 sheep, 56,575 goats and 61,975 species of poultry. The area is located at an elevation of 1701-1830m above sea level. The climatic condition alternates with long summer rain fall (June to September), short rainy season (March to May) and winter dry season (December to February). The minimum and maximum annual rain fall and daily temperature ranges from 800 to 1200 mm and 15 to 25°C, respectively. The total land coverage of the study area is about 50,176 ha, from this 23,472.5 ha is used for crop production, 1679.347 ha can use for production, 902.5 ha for irrigation, 1,977 ha for animal grazing, 13,730.2 ha covered with forest and 2113.76 ha for construction, 6300 ha is not used for agricultural activities [12]. The farmers in the area practice mixed farming system.

Study population

The study subjects include all grazing sheep of different groups kept under extensive management system of both different age, sex and body conditions from, selected PAs of JimmaHorro District.

Study design

A cross-sectional study was used to determine the prevalence of sheep GIT nematode by coproscopic examination.

Sampling method and Sample size determination

The sample size was determined by the formula described by [13]. Accordingly, it was set at 95% Confidence level and precision of 5% so that the total sample size was determined to be 384. Since there was no research carried out previously in the study area, the expected 50% prevalence was taken. Four peasant associations were purposively selected and equal proportions of samples were collected from each four PAs.

$n=(1.96^2 xpexp\ (1-pexp))/d^2 = (1.96^2 \text{ x } 0.5(1-0.5))/(0.05)^2 = 384$ sheep

where: n= sample size required

P_{exp}= expected prevalence=50%

1.96= the value of Z at 95% confidence interval

d= desired level of precision at 95% confidence interval

Study design

A cross-sectional study was used to determine the prevalence of sheep GIT nematode infection by coproscopic examination.

Study methodology

The samples were collected from different sex, age and body condition within two seasons (dry and wet). Age was determined for both sexes based on dentition. Those animals with the age of less than one year were considered as young while those greater than or equal to one were considered as adults according to the classification of age groups by [14]. Body condition scoring of sampled animal was carried out according to the method described by [15] and categorized into three scores as poor, medium and good.

Parasitological study

A sample was collected directly from the rectum of sheep using hand gloves. Each sample was clearly labeled with animal identification, date and place of collection. The faecal samples were placed in a universal bottle, labeled and 10 % formalin was added to preserve parasite eggs and transported to Wollega University Veterinary Parasitological Laboratory and Clinical Pathology to detect eggs of nematode parasites. Those samples which were not examined within 24 hour of arrival at laboratory were stored at +4°C and examined the next day early in the morning. The collected samples were subjected to qualitative flotation and quantitative McMaster egg counting parasitological techniques using saturated sodium chloride (specific gravity of 1.2) as flotation fluid. The eggs of parasite species were identified [16]. Those samples found positive for gastrointestinal nematode was subjected to EPG counting to determine the number of Egg Per Gram of feces (EPG) and performed according to the procedure described by [17]. The degree of infection was categorized as light, moderate and severe (massive) after positive samples subjected to EPG counting. Egg counts from 50-799, 800-1200 and greater than 1200 eggs per gram of feces were considered as light, moderate and massive infection, respectively [18].

Data management and analysis

The raw data was entered into Microsoft excel spread sheet, coded and analyzed using Statistical Package for Social Students (SPSS) version 20.0 Statistical software. Descriptive statistics were used to quantify the problems and Chi-square test was used to compare association between independent variables (sex, age, body condition scores and season) with the result. Confidence interval was set at 95% and with 5% degree of precision. Statistically significant association between variable was considered to exist if the computed p-value is less than 0.05.

Table 1: Prevalence of gastro-intestinal nematodes of sheep in different PAs of the district.

Pas	No of examined	No of positive	Prevalence (%)	X^2 (P value)
Akko Jirru	96	30	31.3	20.388 (0.000)
Nunnuinnaro	96	12	12.5	
Nunnu	96	10	10.4	
Ilu kittae	96	17	17.7	
Total	**384**	**69**	**17.9**	

Table 2: Prevalence of ovine gastrointestinal nematodes by body condition.

Body condition					
Poor	91	29	30.2		
Medium	166	24	14.5	16.803(0.002)	0.000-0.008
Good	127	16	12.6		
Total	384	69	17.9		
Season					
Dry	248	42	16.9	10.772(0.005)	0.127-0.201
Wet	136	27	19.3		
Total	384	69	17.9		

Results

The overall prevalence of ovine gastrointestinal nematodes was 17.9% (69/384) of all the sheep examined in the four PAs, samples from Akko Jirru (31.3%) showed the higher GIT nematodes prevalence and samples from Nunnu (10.4%) showed lower infection pre-valence recorded. There was statistically significant difference P <0.05, (p=0.00) in prevalence of gastro-intestinal nematode infection of sheep between the four PAs (Akko Jirru, Nunnuinnaro, Nunnu, Ilu kittae) and briefly summarized in (Tables 1 & 2).

The predominant GIT nematodes identified in sheep in the study area were Strongyloides and Trichuris with overall prevalence of 11.9% and 5.9% respectively (Table 3).

During the study period prevalence was assessed between the risk factors. Accordingly, 16.7% and 13.8% in females and in males, 26.7% and 11.3% in young and adult respectively. Similarly, 30.2%, 14.5% and12.6% in poor, medium and good body condition respectively (Table 4).

Females and males were found to be infested with a prevalence of 16.7% and 13.8%, respectively, but there was no significant variation (P>0.05) between the two sexes (Table 4). Young and adult animals were found to be infested with a prevalence of 26.7% and 11.3%, respectively with statistically Significant difference (p<0.05) (Table 4). 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 overall prevalence of infection according to body condition grades, 30.2%, 14.5% and 12.6% with poor, medium and good, respectively. Analysis of prevalence of gastrointestinal nematode infections of sheep by season also showed that there was statistically significant variation between the two seasons (P< 0.05). The higher infection prevalence was recorded during wet season than dry season. Egg counts from 50-799 (light), 800-1200 (moderate) and over 1200 (massive) [18]. A total of 69 fecal

Table 3: Prevalence of ovine gastrointestinal nematodes infection in the study area.

Nematode egg types	No. of animals examined	No. of positive	Prevalence (%)
Strongyloides	384	46	11.9
Trichuris	384	23	5.9
Total	**384**	**69**	**17.9**

Table 4: Prevalence of ovine gastrointestinal nematodes by sex, age, body condition and season.

Risk factor	No.of examined	No. of positive	Prevalence (%)	X^2 (P-value)	[95% Conf. Interval]
Age					
Young	172	46	26.7	15.246 (0.000)	0.000-0.008
Adult	212	24	11.3		
Total	**384**	**69**	**17.9**		
Sex					
Female	210	35	16.7	2.405 (0.301)	0.151-229
Male	174	34	13.8		
Total	**384**	**69**	**17.9**		

Table 5: Degree of severity of nematodes in infected sheep based on FEC at the study area.

Intensity of infection	No. of positive (%)
Light	27(39.2)
Moderate	24(34.8)
Heavy	18(26.1)
Total	69 (100)

samples that were positive by qualitative parasitological techniques were subjected to EPG count using McMaster egg counting technique. Accordingly, 24(34.8%), 27(39.2%), and 18(26.1%) were found to be lightly, moderately and massively infested respectively (Table 5). This study has shown that parasite burden is highly related to the body condition of the animals and the difference was statistically significant (p<0.05). This can be shown by the fact that severely affected animals were high in numbers with poor body condition as compared to good body condition. As well, the difference in the degree of EPG between young and adult sheep was statistically significant (p<0.05), younger animals were found to harbor heavier parasite load than adult ones. On the other hand, sex had no significant association with EPG (p>0.05) in the study (Table 4). The difference in the degree of EPG between dry and wet season was statistically significant (p<0.05). Fecal egg output increased during rainy season as compared to dry season (Table 4).

Discussion

Many research findings showed that gastrointestinal nematodes are the major causes of losses in production and productivity of small ruminant production in Ethiopia [7]. The present study revealed the presence of major GIT nematode parasites with an overall prevalence of 17.9% in sheep. The current finding is slightly greater than 16.4% in Central Ethiopia reported by [19] but lower than 24.7% in Western Oromiya, Ethiopia [20]. Even the current finding couldn't agree with other reports which were reported from different parts of the Ethiopia including 30.3% from Eastern part of Ethiopia by [21] and 98.9% in Southern Ethiopia [22].

The common nematodes found in the study area were strongyloids (11.9%) and Trichuris 5.9(%) which is not similar with 45.22% strongyloides and 30.25% Trichuris species in eastern part of Ethiopia

[21]. This difference could be due to the variation in sample size, types of techniques utilized and of the prevalence from region to region in addition to ecological and climatic diversity [23]. But, the current result of gastrointestinal nematodes prevalence agrees with reports of previous studies conducted in Ethiopia as, 8.2% strongyloides and 5% trichuris in DebreZeit [24], 7.4% strongyloides and 3.7 Trichuris [25] in a sella. The prevalence of Trichuris species in the present study was 5.9% and this finding agrees [26] and [8] with prevalence of 3.3% and 4.5% respectively. The present study showed that Strongyloides and Trichuris species were poorly represented. This agrees with the idea of [17,25] which indicates only young are more susceptible to these parasites while adults usually develop certain immunity.

In the current study sex was taken as a risk factor but no significant variation was observed between male and female despite slightly higher infection noticed in female sheep. The absence of statistical association between sex and prevalence of GIT nematodes is in agreement with that of [27-29].

But it disagrees with other reports including [30] and [17] 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 [30] and females are more prone to parasitism during Pregnancy and per-parturient period due to stress and decreased immune status [28,30]. In the current study young were found more frequently infected than adult sheep with statistically significant difference ($P < 0.05$). This might be due to in new born and younger sheep; the immunity is less developed than 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 that the rate of acquisition of infective larvae is sufficient to stimulate satisfactory response, and no cause of clinical illness [25]. There may be also peri-parturient rise in nematode eggs excretion, as early as two weeks before lambing, and persisted up to eight weeks post-partum when lambing, and took place during the wet seasons [31]. Thus, pregnant or lactating ewes became the major source of infections for the newborn lambs. In the same manner, other studies in Africa have shown that the age and immune status of the host animal have significant influences on nematode egg output [32-35].

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 were recorded in poor and moderate body as compared to animals sheep with good body condition. This finding agrees with [36-39]. In the present study, there is also record of significant difference ($p<0.05$) between the prevalence and season. High prevalence was observed during rainy seasons as compared to dry seasons which is in agreement with [40,41]. This is because renewal of rainy season is the most favorable period for larval development and transmission on pasture [42].

In the present study, the EPG were also examined between young and adult. Accordingly the EPG was higher in young than adult with significant difference ($p<0.05$). This result agrees with report of [5,43] in Eastern Ethiopia.

Conclusion and Recommendations

In the present study, the overall prevalence of gastro intestinal nematodes was 17.9% in sheep. The predominant GIT nematodes parasites identified were strongyloides and trichuris species. Conclusively gastrointestinal nematodes were prevalent in JimmaHorro District and sheep were infected with varied gastrointestinal nematodes that can affect the health and productivity of the animals. These parasites affected all age and sex groups and fluctuation of gastrointestinal nematode infections were associated with seasonal changes, exhibiting highest prevalence in wet season. Age, body condition and seasonal changing aspects are the most noticeable risk factors related with gastrointestinal nematode infection. Furthermore, weak status of animal health services and lack of proper management, crop livestock mixed farming is highly practiced, and most land is cultivated so that many species of animals are kept together on communal grazing. They give the first line to draught animals and forced sheep to graze behind on over stocked areas 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 JimmaHorro district is favorable for the continual maintenance and successive transmission of helminthes parasites to vulnerable hosts. Many animals were sub-clinically infected without attracting awareness of farmers to undertake control measures. So depending on the above conclusions the following recommendations are forwarded:

1. Awareness creation should be taken for animal owners to conduct regular deworming.

2. Well management should be given for sheep through giving supplementary and cut carry system to reduce burden of infection with nematodes.

3. Definitive diagnosis should be conducted to clearly identify parasitic fauna using faecal culture and postmortem examination in the study area.

4. Further study should be carried out on the efficacy and resistance of the anthelminthic drugs.

5. Epidemiological study should be conducted to promote effective, strategic control and prevention of nematode infection in sheep.

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