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Prevalence and Associated Risk Factors of Haemonchosis among Small Ruminants Slaughtered in Bishoftu Elfora Export Abattoir, Ethiopia

[1]Belete Abdo, [2]Ahmed Nur, [3]Birhanu Abera, [3]Diriba Lemma and [3]Eyob Eticha

[1]Fantale District Pastoral Area Development Office, Matahara, Ethiopia
[2]East Shoa Zone Livestock and Fishery Resource Development Office, Adama, Ethiopia
[3]Asella Regional Veterinary Laboratory, P.O. Box 212, Asella, Ethiopia

Abstracts: Haemonchosis have been recognized as a major constraint to both small and large-scale small ruminant production in developing countries. A cross- sectional study was carried out in sheep and goats from November, 2015 to April, 2016 in BishoftuELFORA export abattor, with the objectives of evaluating the current status of *Haemonchus contortus* and the risk factors associated with the study area. The study animals were 845 small ruminants in which 425 male sheep's and 420 male goats slaughtered in BishoftuELFORA export abattoir. The study revealed that an overall infection rate was 63.4% and among the samples from sheep 296 (69.6%) and 240 (57.1%) from goats were detected positive for *H. contortus* with a statistical significant difference ($P < 0.05$) between the sheep and goat. The prevalence of haemonchosis in young and adult was 66.9% and 59%, respectively. There was statistical significance ($P < 0.05$) between age groups. There is no statistical significance ($P > 0.05$) among the body condition of small ruminants. In the current study, a high infection rate with *H. contortus* was observed in small ruminants during the study period affecting health of those animals and appropriate control measure should be instituted.

Key words: Abomasum · Bishoftu · *Haemonchus contortus* · Prevalence · Risk Factors · Small Ruminants

INTRODUCTION

Livestock production in Ethiopia's agricultural economy is an important sector providing a significant contribution to gross domestic and export products and raw materials for industries [1]. Among this livestock population, small ruminant constitute a major part [2]. There are about 25.5 million sheep and 24.06 million goats in the country playing an important role in the livelihood of resource poor farmers [3]. Small ruminants are important source of income for agricultural community and are one of Ethiopia's major sources of foreign currency through exportation of live animals, meat and skin [4].

The contribution from this huge livestock resource to the national income is small due to several factors. The major constraints of small ruminant production in Ethiopia are diseases of various etiological origins, feed shortage and poor management [1, 3]. Parasitic diseases are a global problem and considered as a major constraints in the health and product performance of livestock [5]. They cause lowered productivity and high economic losses affecting the income of small holder farming communities [6].

Haemonchosis is primarily a disease of tropical and sub tropical regions. However high humidity, at least in microclimate of the faces and the herbage is also essential for larval development and their survival. It is a serious health problem in farm animals. The frequency and severity of the disease largely depends on the rainfall in any particular area. Surveys in countries around the world have shown that amongst domestic animals, sheep and goats suffer more frequently from haemonchosis [7]. Farm animals are as whole integral parts of country agricultural system and raised both in the highland and lowland area. Various report shows that the live stock subsector contributes 12-16% of the total and 30-35% agricultural Gross Domestic Product (GDP), respectively [8]. 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

Corresponding Author: Birhanu Abera, Asella Regional Veterinary Laboratory, P.O. Box 212, Asella, Ethiopia.

smallholder farming communities. Most of the losses are caused by the gastro-intestinal nematodes [9].

Gastrointestinal nematode is one of the major constraints for small ruminant's production in the study area. Understanding the current situation of haemonchosis infections in the area could be the basis for all possible actions including its control and eradication. Most previous studies in the country were based on coprological examinations, which are less sensitive in identifying the nematode (haemochus) species and there was not any documented data on the distribution of the parasite in the area. Therefore, the objectives of this study were: to determine the prevalence of small ruminant haemonchosis and evaluate the influence of host related risk factors on the occurrence of small ruminant haemonchosis in the study area.

MATERIALS AND METHODS

Study Area: The study was conducted in Debre-zeit (Bishoftu) ELFORA export abattoir in Bishoftu town. Bishoftu town has an altitude of 1850 meter above sea level and experiences a bimodal rainfall pattern with a long rainy season from June to October and a short rainy season from March to May. The average annual rainfall and averages maximum and minimum temperature of the area are 800mm, 26 and 14°C, respectively. The geographical (astronomical) location of Bishoftu town is approximately located at 8° 44' N latitude and 38° 57' E longitudes, 47 km South East of Addis Ababa at an altitude of 1950 meter above sea level [10].

Study Animals: The study animals were 845 small ruminants in which 425 male sheep's and 420 male goats slaughtered in Debre-zeit (Bishoftu) ELFORA export abattoir. The study animals were small ruminants of local breed with different age, origin and body condition those were brought to slaughter. In this study, the origins of the animals were recorded from the history of the animal merchants that provide animals for the abattoir.

The age of the sheep and goat was characterized using teeth eruption. 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 [11]. The body condition score was determined and grouped as medium and good [12].

Study Design: A cross-sectional study was carried out from November, 2015 to April, 2016. It was performed by collecting samples associated with haemonchus in small ruminant in Debre-zeit (Bishoftu) ELFORA export abattoir in Bishoftu Town, East Shoa Zone, Oromia National Regional State, Ethiopia.

Sample Size and Sampling Methods: To maximize the number of animals and to evaluate the system at the prevalence level the sample size was determined by using the formula given by Thrusfield [13].

$$n = \frac{1.96^2 * Pexp\ (1\text{-}Pexp)}{d^2}$$

Where: n= required sample size; P_{exp}=Expected prevalence=Desired absolute precision. There is a not previous study on the prevalence of small ruminant haemonchosis in the area. Thus, 50% expected prevalence was used to determine the minimum sample size, 95% confidence interval and 5% desired precision. In this study, the sample size was increased from required calculated sample size (384) to 845.

Simple random sampling technique was employed to estimate the prevalence of small ruminant haemonchosis. A simple random sampling method was used to select the representative sample of the subject in this study.

Study Methodology

Ante Mortem Examination: Ante mortem examination was performed a few hours before slaughtering from randomly selected small ruminants (sheep and goats). The age and body condition of small ruminants were determined before the animals were slaughtered by standard methods given by Vatta *et al*. [11] and ESGPIP [12], respectively. The animals in the present study were young and adult. There was no poor body condition animals during study periods since only animals with better body condition brought for slaughter.

Postmortem Examination: During postmortem examination, the abomasums was ligated at both ends to avoid leakage and separated from omasum and duodenum. Then the abomasums was opened along its greater curvature and close visualization was made for the presence of adult *Haemonchus* parasite. The abomasums wall was carefully observed for any gross changes including its contents and the adult *H. contortus* worms were identified visually by standard method [14].

Data Analysis: Microsoft excel software was used to store the data and analysis of simple descriptive statistics. Computation of descriptive statistics was conducted

using IBM-SPSS version 20.0. Descriptive statistics such as percentages, proportions and frequency distributions are applied to compute some of the data. The prevalence of the haemonchosis was calculated by dividing the number of sheep and goats harboring the parasite by the number of sheep and goats examined. Pearson's chi-square ($\div^2$) to measure association between prevalence of the haemonchosis with the species, age, origin and body condition was used as the statistical tool. Confidence level was held at 95% and statistical analysis for the difference in prevalence of *H. contortus* among risk factors are considered significant when the P-value was less than 0.05 ($P < 0.05$).

RESULTS

A cross sectional study was carried out to determine the prevalence of haemonchosis in small ruminant from November, 2015 to April, 2016 in Debre-Zeit (Bishoftu) ELFORA export abattoir. In this study a total of 845 sheep and goats were examined using postmortem examination for the presence or absence of *H. contortus.* The overall prevalence of haemonchosis in small ruminants was found 536 (63.4%) in the study area (Table 1).

The prevalence of haemonchosis was found higher in sheep (69.6%) compare to goats (57.1%). There was statically significant difference ($P < 0.001$) on the occurrence of haemonchosis between species of animals (Table 1).

Table 1: Relative prevalence of Haemonchosis between sheep and goats

Species	No of examined animals	No of positive	Prevalence (%)	x^2	P-value
Sheep	425	296	69.6	14.239	<0.001
Goat	420	240	57.1		
Total	845	536	63.4		

In the present study, higher prevalence of haemonchosis infestation was observed in young animals (66.9%) as compared to adult (59.0%). There was statically significant difference ($P = 0.019$) between the two ages groups (Table 2).

Table 2: Relative prevalence of Haemonchosis based on ages.

Age	No of examined animals	No of positive	Prevalence (%)	x^2	P-value
Young	474	317	66.9	5.526	0.019
Adult	371	219	59.0		
Total	845	536	63.4		

The prevalence of haemonchosis was different with different body condition of small ruminants. It was found slightly higher in medium (64.8%) than good body condition (61.5%). There was no significant difference ($P > 0.05$) between body conditions of small ruminants (Table 3).

Table 3: revalence of Haemonchosis based on body condition scores (BSC).

BCS	No of examined animals	No of positive	Prevalence (%)	x^2	P-value
Medium	494	320	64.8	0.928	0.335
Good	351	216	61.5		
Total	845	536	63.4		

November 30, 2006The highest prevalence was observed in animals that were brought from Yabello (69.6%) followed by Ginka (59.1%) and Negelleborana (55.2%). There was statistical significance variation ($P = 0.001$) in prevalence of *H. contortus* in the different origin of the animals (Table 4).

Table 4: Prevalence of Haemoncosis based on origin.

Origin	No of examined Animals	No of positive	Prevalence (%)	x^2	P-value
N. Borana	212	117	55.2	14.944	0.001
Ginka	208	123	59.1		
Yabello	425	296	69.6		
Total	845	536	63.4		

DISCUSSIONS

The present study revealed an overall prevalence of haemonchosis infestation in small ruminants was found to be 63.4%. The prevalence among species was 69.6% in sheep and 57.1% in goats. Still it is a high prevalence of haemonchosis in the small ruminants. This finding is lower than the results of previous works in sheep and goats from different parts of Ethiopia. Argaw *et al.* [15] reports 90.1% in sheep and 81.8% in goats in the prevalence of abomasal nematodes in sheep and goats slaughtered at Haramaya municipal abattoir, eastern Hararghe; Wossene and Gelaye [16] report 96.5% in sheep and 100% in goats in the arid and semi arid zone of eastern Ethiopia; Kumsa and Wossene [17] report 91.2% in sheep and 82.9% in goats of Ogaden region slaughtered at Debre-zeit (Bishoftu) ELFORA export abattoir; Mengist *et al.* [18] in the study conducted in and around Finoteselam has reported prevalence of

haemonochosis among small ruminants as 71.03% and Shankute *et al.* [19] also reported higher prevalence in the study of an Abattoir Survey on Gastrointestinal Nematodes in Sheep and Goats in Helmex-Export Abattoir as 77.38%. This deference could be due to difference in agro-climatic conditions that could support extended survival and development of infective larval stage of *H. contortus*. Moreover, this difference might be due to the difference in management system of examined animals, sample size and environmental location of the area. And also might be due to small ruminants are managed under extensive managements system with the high stocking density, where large numbers of animals graze together throughout the year in collective grazing land and insufficient nutritional status [20]. A variety of factors such as, age, host, level of education and economical capacity of the community, the standard of management and anthelmentics usage, presence or absence of inter-current infections are critical elements influencing the development, distribution and survival of parasites [21]. Other factors that provoke this variation might be due to frequency of adequate rainfall and wetness during the study period was favored the survival of infective larvae in grazing land and higher chance of uptake of the infective larvae that basis for higher prevalence.

The percentage prevalence of *H. contortus* in sheep and goats was recorded as 69.6% and 57.1% respectively. There was significant difference ($P<0.05$) in the prevalence of haemonchosis between sheep and goats, indicating that sheep's are more susceptible to the infection than goats. The results of the present study are supported by Tewodros and Girja [20] who reported 81.2% and 73.5% in sheep and goats respectively in Gonder town; Mulugeta *et al.* [22] who reported 69.5% and 65% in sheep and goats in and around Bedelle, Haileleul [23] who reported 61.63% and 54.76% in sheep and goats respectively in and around WolaitaSoddo. However the current study is disagree with Mengist *et al.* [18] who reported that the rate of the parasite was higher in goat compared to sheep with the prevalence of 71.3% and 67.57% respectively. The higher prevalence of haemonchosis in sheep than goats also might be due to a diversity of factors like ground grazing habit of sheep and usually graze very close to the soil which might be helpful in the acquisition of more infective larvae (L3) of *H. contortus* from the contaminated herbage. Additionally high prevalence of haemonchosis in sheep than goat might be due to the fact that goats browse on bushes and small trees where translation of infective larvae to such height seems impossible.

The present study revealed that there was significant difference based on age ($P < 0.05$) with the prevalence of 66.9% and 59.0% in young and adults, respectively. The present finding on the prevalence of haemochosis between two ages was in line with previous findings which were reported by Shankute *et al.* [19] as 86.9% and 86.57% in adult and young respectively in Helmex-export abattoir and Meselea *et al.* [24] who reported 37.9% and 49% in young and adult respectively in and around Alameta Woreda. This might be due to that; the more infection in young is because of their low resistance or greater susceptibility due to the fact that these small ruminants have not been exposed earlier in the infection. During the first year of their life they fed, grazed and browse on grasslands, thus the first stage of their exposure to infection with parasites occurs. It was also explained that low level of parasitism reported in the adult animals is due to the development of significant immunity with the course of time. Gradually, as the exposure to parasitic infection increases, the immune system of host animals builds up to against *Haemonchus spp* and age resistance develops [25].

With regard to the body condition of the examined small ruminants the prevalence rate was higher in medium body condition small ruminants compared to the good body condition small ruminants with the prevalence of 64.8% and 61.5%, respectively. There was not statistically significant ($P > 0.05$) between body condition and haemonchosis in small ruminants this indicated that both body condition animals were equally susceptible for haemonchosis. This current study was agree with the previous works of Shankute *et al.* [19] who reported prevalence of 77.21% and 84.44% in medium and good body condition animal; and Tibeso and Mekonnen [26] indicated that the rate of the parasite was higher in medium body condition small ruminantscompared to that of good body condition with the prevalence of 67.3 and 55% respectively in small Ruminants Haemonchosis: Prevalence and Associated Risk Factors in ArsiNegelle Municipal Abattoir, Similarly,Tewodros and Girja[20] indicated that the rate of the parasite was higher in medium body condition small ruminants than that of good body condition small ruminants with the prevalence of 81.2% and 73.6%, respectively; but disagrees with the research reported by Ragassa *et al*. [27] who report prevalence of haemonchosis was found to be higher in good body condition than that medium body condition. This could be explained by the fact that loss of body condition in the study animals might be due to other

factors, such as seasonal change of forageable feed staff, Poor management system and the presence of other concurrent diseases which lead to poor immunological response to infective stage of the parasites.

The prevalence of the *H. contortus* in small ruminants that originated from different sites of the study area indicated different prevalence. The prevalence of the haemonchosis was higher in those small ruminants originated from Yebello with the rate of 69.6% followed by shoat originated from Ginka and Negelleborana with the rates of 59.1% and 55.2%, respectively and there is statistical difference of the prevalence of the parasite (??< 0.05). This is might be due to the fact that sheep and goats are managed under extensive management system with high stocking density where large numbers of animals graze together thought the year in communal grazing land which leads to more contamination of the pasture by eggs and then increases the number of worms spread on a pasture. Another possible explanation might be due to inadequate nutritional status, poor veterinary infrastructure and services of the area. This difference also might be due to the difference between the geographical and environmental location of the area, the standard of management and anthelmentics usage are crucial elements influencing the development, distribution and survival of parasites.

CONCLUSION

Gastrointestinal nematode parasites are the major animal health constraints in small ruminants' production. *Haemonchus contortus* has been ranked as the most important parasite of small ruminants in all regions across the tropics and subtropics and causes an insidious drain on production, weight losses and even mortality in young animals. The current study revealed that prevalence of haemochosis was higher in small ruminants 69.6% and 57.1% in sheep and goats respectively. This might due to fact that, the sheep usually graze very close to the soil which might be helpful in the acquisition of more infective larvae from the contaminated herbage and goats browse on shrubs and small trees where translation of infective larvae to such height seems impossible. The distribution of Haemonchosis was higher in young compare to adult shoats. It was also explained that low level of parasitism reported in the adult animals is due to the development of significant immunity with the course of time. In this finding, there was statistical significance ($P < 0.05$) between species, origin and age groups. The prevalence rate was higher in medium body condition than good body condition. This might be due to poor management system and poor immunological response to infective stage of the parasites.

Based on the above conclusion the following recommendations are forwarded:

- The strategic deworming of the parasite should be focus on small ruminants in spring at the beginning of the grazing period to prevent the contamination of the pasture and at the end of summer when the animals with high adult worms.
- An appropriate strategic control and prevention methods of haemonchosis parasite should be designed in young sheep and goat.
- Decreasing the stocking rate should be applied to decreases the number of worms spread on a pasture.
- Grazing sheep and goat in a rotation with cattle should be practiced in order to reduce internal parasite problems.

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