European Journal of Biological Sciences 12 (3): 93-99, 2020
ISSN 2079-2085

DOI: 10.5829/idosi.ejbs.2020.93.99

Haemonchosis: Prevalence and Associated Risk Factor in Small Ruminant Slaughtered at Asella Municipal Abattoir

Endale Teshome, Tadele Tolosa, Sitota Tesfaye and Belay Gadisa

School of Veterinary Medicine,
College of Agriculture and Veterinary Medicine,
Jimma University, P.O. Box: 307, Jimma, Ethiopia

Abstract: *Haemonchus* is economically important parasite of small ruminants, causing anemia, emaciation and reduced weight gain, resulting in increased in cost of production and mortality. A cross-sectional study was conducted between November 2016 and March 2017 to estimate the prevalence and associated risk factors of haemonchosis in sheep and goats slaughtered at Asella municipal abattoir. Four hundred small ruminants (277 sheep and 123 goats) were randomly selected; the sex, age and body condition score of the animals were properly recorded and postmortem examination of the abomasum of sheep and goats were carried out according to standard procedures for characterization and identification of adult *H. contortus*. Overall prevalence of haemonchosis in small ruminant was found to be 67.2%. Statistically significant (p = 0.007, 95% CI = 1.183-2.949) differences were observed in prevalence of *H. contortus* infection between species (sheep and goats). There was higher prevalence in sheep (71.1%) than in goats (58.5%). Even though higher prevalence of haemonchosis were observed in females (69.2%) than in males (63%), the difference was not statistically significant (p =0.118). Prevalence of haemonchosis also varies among different age groups of small ruminants; 70.4% and 66% in young and adult respectively; however, the difference was statistically insignificant (P =0.567). In this study highest prevalence of haemonchosis was recorded in animals with poor body condition (74.5%), followed by medium body condition (68.7%) and the lowest were recorded in animals with good body condition (56.2%). This differences was statistically significant (P = 0.015). During the study period, the prevalence of the parasite infection was found to be high in November (75%) and low in January (60.7%) and difference was statistically not significant (p > 0.05). In the present study, the prevalence of *H. contortus* is found to be high and strategic deworming with good husbandry practice should be implemented to reduce further loss of production.

Key words: Asella Municipal Abattoir · Haemonchosis · Prevalence · Risk Factors Small Ruminants

INTRODUCTION

Ethiopia is endowed with wide range of climatic features and multitude agro-ecological zones which make the country suitable for different agricultural production systems. This in turn has contributed to the survival of a large diversity of farm-animal genetic resources in the country [1]. According to Central Statistical Agency [2], Ethiopia has the largest livestock and draft animal population in the African continent. There are approximately 57.8 million cattle, 28.89 million sheep, 29.70 million goats, 2.08 million horses, 7.88 million donkeys, 0.41 million mules, 1.23 million camels and 60.51 million poultry in the country.

Regardless of large livestock population of Ethiopia, the economic benefits of the country is insignificant because of prevailing diseases, poor nutrition, poor animal production systems, reproductive inefficiency, management constraints and general lack of veterinary care. There are about 30–50% of annual livestock products losses in the country because of diseases and related constraints [3]. In the country, farm animals are

Corresponding uthor: Sitota Tesfaye, School of Veterinary Medicine, College of Agriculture and Veterinary Medicine, Jimma University, P.O. Box 307, Jimma, Ethiopia. Tel: +251910535031.

kept on pasture throughout the year, while sharing common pasture, animals are exposed to a variety of parasites. This also creates favorable climatic conditions for the development and survival of infective stages of helminth parasites [4]. Health disorders in all classes of small ruminants represent the major problems and greatly affect the economics of sheep and goat production [5].

Helminthes infections in domestic ruminants are of major importance in many agro-ecological zones of Africa and had the highest index as an animal health constraint to the poor keepers of livestock in worldwide through losses due to; reduced weight gains and growth rate, reduced nutrient utilization, lower meat, wool and milk production, involuntary culling, cost of treatment and mortality [6].

Among the GI parasites, *Haemonchus contortus* is well known species by its greatest pathologic and economic importance [7]. It is commonly known as 'red stomach worm' or 'wire worm' and primarily occur in the abomasum of small ruminants. It is one of the most prevalent pathogenic abomasal worms of sheep and goats. Major impacts of *H. contortus* is associated with blood sucking activity of the parasites which is responsible for extensive loss of blood resulting decrease in erythrocyte, lymphocyte, hemoglobin, packed cell volume, body weight and wool growth [8].

H. contortus also causes retarded growth, low productivity, loss of appetite, decrease in protein, impaired digestive efficiency and poor reproductive performance which can lead to loss of meat and wool production [9, 10]. On global basis *H. contortus* causes more losses than any other species of nematode in small ruminants [8]. According to [11], haemonchosis is considered as one of the top ten constraints to sheep and goats rearing in east Africa. *Haemonchus contortus* alone is responsible for annual loss ranging from USD 26 million to 45 million in Kenya and South Africa [12].

Several studies have been conducted on prevalence and its associated risk factors in different parts of the Ethiopia; however, Haemonchosis are still series economically important disease of small ruminant. In the current study area, previously [13] reported the prevalence of haemonchosis as 63% in sheep and goats. However, the status of haemonchosis in the area is currently unknown.

Therefore, this study was conducted with the objectives to:

- Estimate the prevalence of small ruminant haemonchosis based on postmortem examination
- Assess major risk factors associated with haemonchosis in sheep and goat slaughtered at Asella municipal abattoir.

MATERIALS AND METHODS

Study Area: The study was conducted in Asella town of Arsi zone, Oromia region. Asella is located in South East of Ethiopia; the city has a latitude and longitude of 7°57'N 39°7'E and is located at 175 kilometers (km) South East of Addis Ababa. The town has an elevation of 2400 m.a.s.l and the annual temperature ranges 10-22.6°C. It has a daily maximum temperature can reach up to 28°C and minimum temperature of 10°C. The area has a bimodal rainfall occurring from March to April (short rainy season) and July to October (long rainy season) and the annual average rainfall is 3500 mm and mostly with clay type of soil and in rare case black soil are the main soil type found in the area [14, 15].

Most of sheep and goats are indigenous breeds kept under traditional management system. They have a great value in the socioeconomic activity of the area, as they are source of meat, skin and generate cash income by selling them and their product. Diseases, poor nutrition, poor animal production systems, reproductive inefficiency and general lack of veterinary care are the main constraints of livestock production system.

Study Population and Design: The current study comprised sheep and goats of local breed with different age groups and are managed under traditional extensive management system. Regarding sex composition of study animals, both males and females' small ruminants were included. Most of sheep slaughtered in Asella municipal abattoir were originated from Sagure, Bekoji and Itiya while most goats were brought from Habura. A cross-sectional study was conducted between November, 2016 and March, 2017 in Asella municipal abattoir Animals included in this study were small ruminant with different body condition.

Sample Size Determination and Sampling Technique: The sample size was determined as described by Thrustfield [16] with 50% expected prevalence, 5% desired level of precision and 95% of confidence interval and calculated using the following formula.

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

where: n = required sample size; Pexp = expected prevalence; d = desired absolute precision.

Accordingly, the required samples for this study were 384 animals. However, 400 animals were examined. About 23-30 small ruminant were slaughter at Asella municipal abattoir daily and the data for this study was collected by visiting abattoir twice a week during study period. The study animals were selected from sheep and goats slaughtered during each visit day by using simple random sampling technique.

Ante-Mortem and Post-Mortem Examination: During antemortem examination, each selected animal was identified by providing a unique temporary identification number that could be used for post mortem examinations. Furthermore, the animals' species, sex, age and body conditions were recorded on special format prepared for this purpose. The age of the sheep and goat was characterized using teeth eruption by Vatta *et al.* [17] and body condition scoring method as per Ethiopia Sheep and Goat Productivity Improvement Program [18]. During postmortem examination, the stomach was removed from the abdominal cavity and the abomasums was legated in both side and separated from omasum and duodenum. Then it was opened along its greater curvature and close visualization will be made for the presence of adult Haemonchus parasite. The adult *H. contortus* worm was identified visually by standard method given by Urquhart *et al.* [19].

Data Management and Analysis: The data was entered and edited in a Microsoft Excel spread sheet and analyzed using Statistical Package for Social Sciences version (SPSS) 20. Descriptive statistics was used to determine frequencies and percentages of the data. Prevalence of *Haemonchus contortus* related to specific risk factors was determined as the proportion of *H. contortus* positive animals out of the total sample. The strength of association of factors to presence of *H. contortus* was investigated using logistic regression. The 95% confidence interval of odd ratio (OR) and p-values were used to describe statistical significance associations and value of $p<0.05$ was considered as significant. Furthermore, chi-square test was used for determining prevalence of haemonchosis in different months of study period.

RESULTS

In this study, a total of 400 small ruminants (277 sheep and 123 goats) were investigated to estimate the prevalence and its associated risk factors of haemonchosis. The overall prevalence of 67.2% was recorded. In this investigation, significantly higher prevalence of haemonchosis was observed in sheep (71.1%) than in goats (58.5%). The odd ratio of *H. contortus* occurrence in sheep was 1.868 times more likely higher than goats (Table 1). The prevalence of haemonchosis related to sex was 63% and 69.2% in males and females, respectively. This variation was not statistically significant although prevalence in female was higher than male in which female was 0.694 times more likely to be positive for *H. contortus* than male (Table 1).

Table 1: Logistic regression analysis output of factors associated with small ruminant haemonchosis in Asella municipal abattoir

Risk factors	Categories	No Examined	Positive	Prevalence (%)	OR	CI 95% of OR	p-value
Species	Sheep	277	197	71.1	1.868	1.183-2.949	0.007
	Goats	123	72	58.5			
Sex	Male	127	80	63	0.694	0.438-1.097	0.118
	Female	273	189	69.2			
Age	Young	115	81	70.4	1.155	0.710-1.878	0.563
	Adult	285	188	66			
BCS	Poor	94	70	74.5	2.608	1.357-5.011	0.015
	Medium	217	149	68.7	1.661	0.992-2.780	
	Good	89	50	56.2	Ref.[a]		

a= Reference OR= Odd Ratio CI= Confidence Interval

Table 2: Proportion of haemonchosis related to months.

Months	No. Examined	Positive	Prevalence (%)	χ^2	P-Value
November	48	36	75	4.07	0.397
December	108	73	67.6		
January	107	65	60.7		
February	89	60	67.4		
March	48	35	72.9		
Total	400	269	67.2		

Prevalence of haemonchosis was insignificantly higher in young (70.4%) than in adult (66%) ($p>0.05$). Young animals were 1.155 times more likely to be positive for haemonchosis than adult was. Regarding the prevalence of *Haemonchus contortus* in different body conditioned small ruminant, the highest percent of haemonchosis was encountered in animal with poor body condition score (74.5%) followed by medium (68.7%) and good body condition animals (56.2%). There was statically significance deference between deferent body conditioned sheep and goats ($p<0.05$). Small ruminants with poor body conditioned were 2.608 time more likely to be positive for *H. contortus* than good body conditioned. Similarly the odd of *H. contortus* occurrence in medium body conditioned sheep and goats were 1.661 times more likely than good body conditioned sheep and goats (Table 1).

Prevalence of *H. contortus* in Relation to Months: The prevalence of haemonchosis was found to be different with different months of study period and it was found that 75%, 67.6%, 60.7%, 67.4% and 72.9% in November, December, January, February and March respectively. The prevalence of haemonchosis was different with different months of study period in small ruminants. However, the difference was statistically insignificant ($p >0.05$) (Table 2).

DISCUSSION

The current study showed an overall prevalence of 67.2% (269/400) haemonchosis in small ruminant slaughtered at Asella municipal abattoir. This result is in line with the finding of Belete *et al.* [20], Tibeso and Mekonnen [21] and Mengist *et al.* [22] who reported an overall prevalence of haemonchosis as; 63.4% in Debra-Zeit Elfora export Abattoir; 63.8% in Arsi Negelle municipal abattoir; and 71.03% in and around Finoteselam, respectively. The result of current study is higher than the finding of Mesele *et al.* [8] who reported an overall prevalence of 26.8% in sheep slaughtered at Abergele Export Abattoir. This variation in prevalence of haemonchosis in small ruminants in different parts of the country may be due to the differences in variety of factors such as husbandry practices, environmental factors, host age, breeding status, grazing habits, method of examination, level of community awareness and anthelmintics usage which may influences the development, distribution and survival of parasites.

In the present study, sheep are found to be more susceptible to *H. contortus* infection than goats. Similar findings were reported from different areas of Ethiopia [6, 21, 23-26]. The higher prevalence of haemonchosis in sheep than goats might be because of a variety of factors like ground grazing habit of sheep that it usually grazes very close to the soil, which might be helpful in the acquisition of more infective larvae (L3) of *H. contortus* from the contaminated herbage. This also might be due to the fact that goats browse on shrubs and small trees, where movement of infective larvae to such height seems impossible. Another possible reason is that browsing on shrubs and small trees may give rise to goats to browse medicinal plants like tanniferous plants which have anthelmintics activity and reduce *H. contortus* faecal egg counts and the number of eggs per female worm in goats and worm number and fecundity [27].

Argaw *et al.* [28] reported 90% in sheep and 81.8% in goats, Kumsa and Wossene [6] reported 91.2% in sheep and 82.9% in goats and Wossene and Gelaye [29] reported 96.5% in sheep and 100% in goats which is by far higher than the present study. This difference might be due to the difference between the management system of examined animals, sample size and environmental location of the area. Factors like presence of sufficient rainfall and moisture during the study period may favor the survival of infective larvae in pasture and higher probability of uptake of the infective larvae leading to higher prevalence. While environmental condition like prolonged dry period and extreme cold season affect the longevity of parasite leading to stage of hypnosis. This intern reduces the contamination of pasture by larvae and decreases the uptake of parasite by susceptible host.

In this study, the prevalence of haemonchosis differs between sexes. It was found that the prevalence of the parasite was higher in female than male. But the difference is not statistically significant ($p > 0.05$). It is assumed that sex might be determinant factor influencing prevalence of haemonchosis and females are more susceptible to parasitism, especially during pregnancy and perparturient period due to stress and decreased immune status [30].

The present study revealed higher prevalence of haemonchosis in young small ruminants (70.4%) than adult (66%). However, the difference was statically insignificant ($P > 0.05$). This finding on the prevalence of *H. contortus* between two ages was in line with previous findings [8, 20]. This might be because of low resistance or greater susceptibility of young's than adults due to

lack of pervious exposure to *H. contortus* infection and adult animals might develop significant immunity with the course of time. Gradually, as the exposure to parasitic infection increases, the immune system of host animals builds up especially against *Haemonchus* spp and age resistance develops [31, 32].

In this study, statistically significant variation ($p < 0.05$) in prevalence of *H. contortus* among different body condition was recorded, in that poor body condition animals were highly susceptible for haemonchosis than medium and good body condition. This report agrees with the previous works of Mesele *et al.* [8]; who reported prevalence 33.6%, 21.7% and 19.7 % in poor, medium and good body condition respectively and Tibeso and Mekonnen [21] indicated that the rate of the parasite was higher in medium body condition small ruminants compared to that of good body condition with the prevalence of 67.3% and 55% respectively. Similarly, Tewodros and Girja [23] reported higher parasitic infection in medium body conditioned small ruminants than that of good body conditioned small ruminants with the prevalence of 81.2% and 73.6%, respectively. This may be due to differences in management system and the presence of other concurrent diseases that decreases the ability of the host to survive with the adverse consequences of parasitism and altered resistances of the host to overcome parasitism by limiting the establishment, development and fecundity of the parasites.

During the study period, monthly prevalence of *H. contortus* was corresponds with wet, humid and warm season. It was observed that highest prevalence of *H.contortus* was recorded during the month of November (75%) and the lowest prevalence was recorded during the month of January (60.7%). This finding was agreed with previous research reported by Mesele *et al.* [8], Tibeso and Mekonnen [21] and Ragassa *et al.* [33]. The monthly difference in prevalence of haemonchosis in present study might be because of slight climatic change such as rain, humidity and temperature at study area.

CONCLUSION AND RECOMMENDATIONS

This study showed high prevalence of haemonchosis in small ruminants (67.2%). The specific prevalence was recorded as 71.1% and 58.5% in sheep and goats respectively, higher prevalence in females than male. This finding revealed highest prevalence in poor body conditioned animals than medium and good body condition animals and higher infection in young animals than adults. It is also different in different study months. Hence, based on the above conclusions the following recommendations are forwarded:

- Strategic treatment using broad-spectrum anthelmintic should be practiced at the beginning and after the end of rainy season, the deworming should focus on young and poor body conditioned animals.
- Improvement of husbandry practices is very important and adequate and well-balanced nutrition should be provided to improve resistance of animal.
- Pasture improvement and rotational grazing practice should be implemented with special care for female animals
- Further study on the possible risk factors should be conducted.

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