Small Ruminants Haemonchosis: Prevalence and Associated Risk Factors in Arsi Negelle Municipal Abattoir, Ethiopia

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Abstract: Haemonchus contortus (H.contortus), also known as the barber's pole worm, is very common parasite and one of the most pathogenic nematodes of ruminants. A cross sectional study was performed to determine the prevalence and associated risk factors of haemonchosis in sheep and goats slaughtered in Arsi Negelle municipal abattoir, Oromia region, Southeast Ethiopia from December 2014 to March 2015. Post mortem examination of the abomasum of sheep and goats were carried out according to standard procedures for characterization and identification of adult H. contortus. A total of 384 small ruminants (262 sheep and 122 goats) were examined during study period in study area and SPSS version 20 software using descriptive statistics was used for data analysis and @@< 0.05 was considered significant. Overall prevalence of haemonchosis in small ruminant was found 63.8% in study area. The specific prevalence of H. contortus infection between species was 67.2% and 56.6% in sheep and goats respectively. The difference in infection rates between the two species was statistically significant (p <0.05). The prevalence of haemonchosis in males and females was 66.0% and 59.7% respectively but, the difference was not statistically significant (p >0.05). Relationship between body condition and haemonchosis in sheep and goats showed no statistical difference (p >0.05) between medium (67.3%) and good (55.0%) body conditioned animals. The prevalence of haemonchosis in small ruminants was different with different months of study period. The highest and the lowest prevalence of the parasite infection was found in December (66.5%) and March (56.1%) month respectively. difference was not statistically significant (p > 0.05). The current finding revealed that significant numbers of sheep and goats were affected by the parasites. Hence strategic deworming with good husbandry practice should be implemented.

Key words: Arsi negelle • Haemonchosis • Prevalence • Small ruminants

INTRODUCTION

Small ruminants play a great role in the economy of the country, as sources of meat, milk, fiber, cash income and skin and they can live in extreme climatic conditions, they can use herbage, which is unsuitable for large ruminants and they require few labor-intensive inputs [1]. Ethiopia has the largest livestock and draft animal population in the African continent which is approximately 56, 706, 389 cattle, 29, 332, 382 sheep, 29, 112, 963 goat, 2, 033, 115 horses, 400, 329 mules, 7, 428, 037 donkeys, 1, 164, 106 camels and 56, 866, 719 chickens are found in the country [2].

In the tropics, the most important nematode species affecting small ruminants are H. contortus, Trichostrongylus species, Nematodirus species, Cooperia species, Bunostomum species and Oesophagostomum species. H. contortus is blood sucking nematode parasite, primarily occurring in the abomasum of small ruminants, notably sheep and goats. This nematode is also called the barber pole worm because of its red and white striped appearance in the female. The female is capable of producing over 5, 000 eggs a day, which are passed through the feces onto pasture. It has been ranked as the most important parasite of small ruminants in all regions across the
tropics and subtropics and causes great losses on production, weight losses and even mortality in young animals [3].

_Haemonchus_ is one of the important endoparasites of sheep and goats. The first and second stages of larvae are free-living organisms and the host ingests the third stage larvae starting the infection. Adults of the parasite are found on the surface of the mucosa (The lining of the stomach). Both the larvae (L4) and the adults of _Haemonchus_ species suck blood. The major impacts of _H. contortus_ in small ruminants is associated with the blood sucking activity of the parasites which responsible for extensive loss of blood, each worm suck 0.05 milliliter of blood per a day [4].

_Haemonchus contortus_ is the species with greatest pathogenic and economic importance in small ruminants. It is important to assess the nature and level of parasitism in ruminant livestock, in order to be able to determine the significance of parasite infection and to recommend the most beneficial and economically acceptable control measures. The determination of the risk factors associated with parasite occurrence can be used to design an effective control strategy [5].

Previously there was not any documented data with regard to the prevalence of the haemonchosis in small ruminants regardless of the high populations of sheep and goats in the study area and most previous studies in Ethiopia were based on coprological examinations, which are less sensitive in identifying the nematode species. Therefore, this study was conducted with the objectives to determine the prevalence of small ruminant haemonchosis based on postmortem examination and assess the influence of host related risk factors such as species, body condition and sex on the occurrence of small ruminant haemonchosis in Arsi Negelle town.

**MATERIALS AND METHODS**

**Study Area and Study Period:** This study was conducted in Arsi Negelle town, West Arsi Zone, Oromia regional state, southeast Ethiopia from December 2014 to March 2015. Arsi Negelle town is located at 225kms to the South East of Addis Ababa and situated between 38° 25’ to 38°54’E longitude and 07° 09’ to 07°42’ N latitude with altitude of 1500 to 2300 meters above sea level (Masl). About 80% of the district is sub-tropical, while 20% belongs to the temperate agro-climatic zone. It has annual rainfall and temperature ranging from 500 to 1150mm and 16°Cto 25°C respectively. The livestock population of West Arsi is estimated to be 1,957,066 cattle (Exotic, cross and local), 946,595 sheep, 404,118 goats, 214,744 horses, 6,304 mules, 210,339 donkeys, 555 camels and 1,105,688 chicken [2].

**Study Animals:** The study animals were 384 small ruminants in which 262 sheep (82 females and 180 males) and 122 goats (52 females and 70 males) slaughtered in Arsi Negelle municipal abattoir. Animals were indigenous breeds kept under traditional management system. The study animals were small ruminants of local breed with different sex and body condition brought for slaughter. In addition, the age of the sheep and goat was characterized using teeth eruption by Vatta et al. [6] and body condition scoring method as per ESGPIP [7].

**Study Design and Type of Study:** A cross-sectional study using simple random sampling technique was conducted from December 2014 to March 2015 to determine the prevalence and associated risk factors of Haemonchosis in sheep and goats slaughtered at the study area.

**Sample Size Determination:** To calculate the total sample size, the following parameters were used: 95% of confidence level (CL), 5% desired level of precision; and with the assumption of 50% expected prevalence of haemonchosis among sheep and goats in the study area, the sample size was determined using the formula given by Thrustfield [8].

\[ n = \frac{1.96^2 \times \text{Pexp} (1-\text{Pexp})}{\text{d}^2} \]

where: \(n=\)required sample size; \(\text{Pexp} = \) expected prevalence; \(\text{d} = \) desired absolute precision.

Hence, by using this formula, the sample size was calculated to be 384.

**Study Methodology:** Ante mortem examination was performed a few hours before slaughtering from randomly selected small ruminants (Sheep and goats). The age, sex, body condition and general health condition of the animals were properly recorded. The animals in the present study were adult and there were no poor body condition animals during study periods since the owners of hotels and restaurants preferred animals with better body condition for slaughter. As the animals were obtained from different markets, it was difficult to know the exact origin of the animals. The abomasum was
opened along its greater curvature and close visualization was made for the presence of adult *Haemonchus* parasite. The abomasum’s wall was carefully observed for any gross changes including its contents and the adult *H. contortus* worms were identified visually by standard method given by Urquhart *et al.* [4].

**Statistical Analysis:** Computation of descriptive statistics was conducted using SPSS version 20.0. Descriptive statistics such as percentages, proportions and frequency distributions were 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 ($\chi^2$) to measure association between prevalence of the haemonchosis with the species, age, sexes, body condition and months 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 were considered significant when the p-value was less than 0.05 ($P < 0.05$).

### RESULTS

**Overall Prevalence of Haemonchosis:** In this study a total of 384 sheep and goats were examined using postmortem for the presence or absence of *H. contortus* and the result revealed that 245 were positive and the overall prevalence of haemonchosis in small ruminants was found to be 63.8% (245/384) in the study area.

**Association of the Prevalence and Risk Factors:** Out of the total 384 small ruminants examined for the occurrence of haemonchosis, 245 animals were found positive of which 176 and 69 were sheep and goats respectively. The prevalence of haemonchosis was found higher among sheep (67.2%) than goats (56.6%) and statistically analysis of the data showed that there was statistically significant difference on the occurrence of haemonchosis between species ($P < 0.05$) (Table 1).

The prevalence of haemonchosis was different with different sex of small ruminants; and it was found that 66.0% and 59.7% in males and females respectively. The difference was not statistically significant ($P >0.05$) (Table 2).

Out of the total 384 examined animals for presence or absence of *Haemonchus*, 245 animals were positive in which 185 and 60 were medium and good body condition respectively. The prevalence of haemonchosis was different with different body condition of small ruminants; and it was found that 67.3% and 55.0% in medium and good respectively. The difference was statistically significant ($P <0.05$) (Table 3).

Out of the total 245 positive animals for Haemonchosis, 107, 73, 42 and 23 were found positive in December, January, February and March respectively. The prevalence of haemonchosis was different with different months of study period in small ruminants; and it was found that 66.5%, 64.0%, 61.8% and 56.1% in December, January, February and March respectively and the difference was not statistically significant ($P >0.05$) (Table 4).

### DISCUSSION

The present study revealed a high overall prevalence of small ruminant’s haemonchosis (63.8%) with the specific prevalence between species found to be 67.2% in sheep and 56.6% in goats in the study area. The study showed a lower prevalence than the previous studies conducted by different individuals in different study areas of Ethiopia. Mengist *et al.* [9] in his study conducted in and around Finoteselam has recorded prevalence of haemonochosis among small ruminants as 71.03%. The current finding was found to be lower than Abebe and

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**Table 1:** Relative prevalence of haemonchosis between sheep and goats

<table>
<thead>
<tr>
<th>Species</th>
<th>Positive</th>
<th>Examined</th>
<th>Prevalence (%)</th>
<th>$\chi^2$</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep</td>
<td>176</td>
<td>262</td>
<td>67.2</td>
<td>4.064</td>
<td>0.044</td>
</tr>
<tr>
<td>Goat</td>
<td>69</td>
<td>122</td>
<td>56.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>245</td>
<td>384</td>
<td>63.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 2:** Relative prevalence of haemonchosis between sexes

<table>
<thead>
<tr>
<th>Sex</th>
<th>Positive</th>
<th>Examined</th>
<th>Prevalence (%)</th>
<th>$\chi^2$</th>
<th>P - Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>165</td>
<td>250</td>
<td>66.0</td>
<td>1.499</td>
<td>0.221</td>
</tr>
<tr>
<td>Female</td>
<td>80</td>
<td>134</td>
<td>59.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>245</td>
<td>384</td>
<td>63.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 3:** Relative prevalence of haemonchosis based on body condition

<table>
<thead>
<tr>
<th>BCS</th>
<th>Positive</th>
<th>Examined</th>
<th>Prevalence (%)</th>
<th>$\chi^2$</th>
<th>P - Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>185</td>
<td>275</td>
<td>67.3</td>
<td>5.053</td>
<td>0.025</td>
</tr>
<tr>
<td>Female</td>
<td>60</td>
<td>109</td>
<td>55.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>245</td>
<td>384</td>
<td>63.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 4:** Association of the prevalence in relation to months

<table>
<thead>
<tr>
<th>Month</th>
<th>Positive</th>
<th>Examined</th>
<th>Prevalence (%)</th>
<th>$\chi^2$</th>
<th>P - Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>December</td>
<td>107</td>
<td>161</td>
<td>66.5</td>
<td>1.671</td>
<td>0.643</td>
</tr>
<tr>
<td>January</td>
<td>73</td>
<td>114</td>
<td>64.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>42</td>
<td>68</td>
<td>61.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>23</td>
<td>41</td>
<td>56.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>245</td>
<td>384</td>
<td>63.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Esayas [10] who reported 96.5% in sheep and 100% in goats in the arid and semi-arid zone of eastern Ethiopia, Kumsa and Wossene [11] who found a prevalence of 91.2% in sheep and 82.9% in goats of Ogaden region slaughtered at Debrezeit ELFORA abattoir and Tewodros and Girja [12] who reported 80.2% prevalence in Gonder town. 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 environmental factors, host, age, breeding status, grazing habits and level of education and economical capacity of the community, the standard of management and anthelmintics usage which influences the development, distribution and survival of parasites. The other possible explanation for high prevalence may also be due to the existence of a direct relationship between prevalence and rainfall, humidity and temperature. That means the presence of sufficient rainfall and moisture during the study period was favored the survival of infective larvae in pasture and higher probability of uptake of the infective larvae leading to higher prevalence. The high prevalence of haemonchosis in the study area may be due to the fact that sheep and goats are managed under extensive management systems with the high stocking density, where large numbers of animals graze together throughout the year in communal grazing land, inadequate nutritional status and lack of community awareness.

Statistical analysis of the data on the prevalence of haemonchosis between species showed that there was significant difference (P < 0.05) in the prevalence of haemonchosis between sheep (67.2%) and goats (56.6%), indicating that both species were not equally susceptible to the infection and in which sheep are more infected than goats. This was in agreement with Hailelul [13] who reported 61.63% and 54.76% in sheep and goats respectively in and around Wollaita Soddo, Tefera et al. [14] who reported 69.5% and 65% in sheep and goats in and around Bedelle and Tewodros and Girja [12] who reported 81.2% and 73.5% in sheep and goats respectively in Gonder town. The present finding disagrees with previous research conducted in and around Finoteselam in Amhara region by Mengist et al. [9] in which sheep (67.57 %) were less infected than goats (71.39 %) to Heamonchus. In the present study the higher prevalence of haemonchosis in sheep than in goats might be due to the fact that sheep are generally grazer in their feeding habit 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. On the other hand, goats browse on shrubs and small trees where translation of infective larvae to such height seems impossible.

Similarly, the prevalence of haemonchosis in small ruminants was different between sexes. It was found that the prevalence of the parasite was 66.0% and 59.7% in male and female sex groups respectively. The difference was not statistically significant (p > 0.05). The present finding on the prevalence of haemonchosis between sexes was in line with previous findings which were reported by Tewodros and Girja [12] as 80.9% and 77.1% in males and females respectively in Gonder town and Mengist et al. [9] who reported 73.22% and 64.71% in male and females respectively in and around Finoteselam in Amhara region. It is assumed that sex is a determinant factor influencing prevalence of haemonchosis and females are more susceptible to parasitism during pregnancy and Per-parturient period due to stress and decreased immune status [4]. However, in present study males were more affected than females even if the difference was not statistically significant (p > 0.05). This might be due to the fact that female animals in study animals were not in reproductive stress, a factor that mainly predisposing female animals to a high parasitic infection and the practice of the society and moral point of slaughtering of the male animals, as most of the female animals are kept for production purposes.

The study also revealed that there was a difference in prevalence of haemonchosis in small ruminants with different body condition of animals and it was found 55.0% and 67.3% in good and medium body condition animals respectively. There was statistically difference (P < 0.05) between body condition and haemonchosis in sheep and goats which agrees with previous research reported by Tasawar et al. [15]. However it disagrees with the study reported by Ragassa et al. [16]. In the present study prevalence of haemonchosis was found to be higher in medium body condition than good body condition. This might be due to differences in seasonal change of feed, poor management system and the presence of other concurrent diseases that decreases the ability of the host to cope with the adverse consequences of parasitism and resistances of the host to overcome parasitism by limiting the establishment, development and fecundity of the parasites.
The prevalence of haemonchosis was found to be different with different months of study period in small ruminants; and it was found that 66.5%, 64.0%, 61.8% and 56.1% in December, January, February and March respectively. The difference was not statistically significant (p > 0.05). The results revealed that the infected small ruminants (Sheep and goats) harbour *H. contortus* infection throughout the study period. This findings was agrees with previous research reported by Ragassa et al. [16]. The present study conducted during dry months and the variation of prevalence of haemonchosis between months might be due to the sample size of examined animals in particular months of study periods in line with religious impacts on consumption of meats and environmental condition.

**CONCLUSION**

This study showed that prevalence of haemonchosis was higher in small ruminants in the study area. The high prevalence of *Haemonchus* parasites in small ruminants could be responsible for the loss of production and mortality in small ruminants. The distribution of the parasite were higher in sheep (67.2%) than goats (56.6%), medium body condition animals (67.3%) than good body condition (55.0%) and males (66.0%) than females’ (59.7%) animals, which needs great attention when designing the control programs of the parasite. The high prevalence of haemonchosis in small ruminants in the study area might be attributed to extensive grazing system adopted in the area.

**Conflict of Interests:** The authors declare that they have no competing interest

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**REFERENCES**


