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Haemonchosis in Small Ruminant and the Associated Risk Factors in and around Gondar, Northwest Ethiopia

Tsegaye Tariku[1] Birhanu Ayele[2] Fraol Chala[3]
1.Livestock Agency, Southern Ethiopia
2.College of Veterinary Medicine and Animal Sciences, University of Gondar, Ethiopia
3.Livestock Agency, Oromia regional state, Ethiopia

Abstract
A cross sectional study was conducted in Gondar town, Amhara regional state of Ethiopia from November 2016 to May 2017 with an attempt to estimate the prevalence and associated risk factors of haemonchosis in sheep and goats slaughtered at randomly selected restaurants and hotels. A total of 250 animals were examined (216 sheep and 34 goats) and the overall prevalence was 73.6%. Specific prevalence in Haemonchus contortus infection in sheep was (65.6%) and it was (8%) in goats; and the difference was statistically significant ($p<0.05$). Prevalence of Haemonchosis in male and female animals was (57.6%) and (16%) respectively and the difference was not statistically significant ($p>0.05$). Prevalence of the disease in medium body conditioned animals was found to be higher (46%) when compared to good body condition animals (27.6%) and the difference was statistically significant ($p<0.05$). There was also statistically significant difference in Haemonchosis prevalence between age groups in that adults of greater or equal to one year age have higher prevalence (52.8%) than young animals (20.8%). Overall, the present study revealed haemonchosis as a very important parasitic disease of small ruminants that warrant urgent control measure to tackle the disease incidence before the onset of adverse economic impacts.
Keywords: Haemonchosi, Prevalence, Risk factors, Small ruminants

I. Introduction

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 [1]. Small ruminants are kept for various purposes. Their role for income generation, food supply (meat and milk), and financial security for the rural poor population is documented [2]. These animals also provide 46 % of the value of national meat production and 58 % of the value of hide and skin production and play an integral part in the production systems of the country [3].

Although sheep and goat are potential source of income for the daily life and livelihoods of lots of local community in Ethiopia, productivity is constrained by several factors from which disease being the most important. Haemonchosis caused by *Haemonchus contortus* is one of the major parasitic infections causing tremendous economic losses to small ruminant productivity in Ethiopia [4]. The etiologic agent *H. contortus* is a blood sucking nematode parasite, primarily occurring in the abomasums of small ruminants, notably sheep and goats. This nematode is also called as 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 the pasture [5].

Haemonchosis has worldwide distribution. The disease has long been recognized as one of the most economically important parasitic diseases of cattle, sheep and goat in the tropical and subtropical countries [3]. The major impacts of *H. Contortus* in small ruminants is associated with the blood sucking activity of the parasites which is responsible for extensive blood loss. Each worm sucks 0.05 milliliter of blood per day [6]. The high mortality in affected groups, decreased weight gain, and increased risk of anthelmintic resistance due to the repeated treatment are the added effects the disease wields on animal productivity [5].

Although seasonal epidemiology of *H. contortus* infection is well-studied in the majority of climatic zones in Ethiopia, there is no detail information to Haemonchosis in and around Gondar town where small ruminants are important assets to the local community. Thus, provision of pertinent information on the epidemiological aspect of the disease is crucially important in order to be able to determine the significance of parasite infection so that the most beneficial and economically acceptable control measures would be recommended. Hence, this study was aimed to estimate the epidemiological aspect of Heamonchosis in small ruminant and the associated risk factors in and around Gondar town, Northwest Ethiopia.

II. Materials and Methods

2.1. Study Design and Study Area

A cross sectional study was conducted to determine the prevalence of small ruminant haemonchosis and the associated risk factors in and around Gondar town, north Gondar zone, Amhara regional state of Ethiopia from November 2016 to May 2017. Gondar town is located at a distance of 740km away north of Addis Ababa, the

capital of Ethiopia. The town is found at latitude of 12 °4North, longitude of 27 °2East and with an altitudinal range of 1800-2500 meter above sea level. The mean annual temperature of the area is 20.5 ^{0}C (17.2-23.9 ^{0}C) and annual rainfall of about 1000mm (600-1400mm). The region receives a bimodal rainfall, the average annual precipitation rate being 1000mm that comes from the long and short rainy season. The short rainy season occurs during March, April and May, while the long rainy season extends from June to September [7]. Livestock population of the area is estimated to be 1,936,514 cattle (both local and crossbred), 524,083 sheep, 682,264 goats, 36,828 horses, 12, 473 mules, 223,116 donkeys and 3,165,068 poultry [8].

2.2. Study population

The study population comprises of 250 animals (216 sheep and 34 goats) slaughtered at different hotels and restaurants in Gondar town. All animals were indigenous breeds kept under traditional management system.

2.3. Sample size determination and sampling technique

Previous study conducted in the area reported an overall haemonchosis prevalence of 81.2% in small ruminant [9]. We used this finding as a base to estimate the number of animal needed to start the present study. Thus, the total number of animals included in this study using the standard formula described by Thrusfield [10], was 236. However; to increase the accuracy of information generated, the sample size was increased up to 250 animals.

$$n=\frac{1.96^2\,(p)\,(1-p)}{d^2}$$

Where
n = the sample size what I am going to calculated
p = overall prevalence from the previous work (81.2%)
1.96 = the value of Z of 95% confidence level
d = Desired absolute precision = 5%
n= 236

Due to lack of formally established small ruminant abattoir in Gondar town, hotels and restaurants slaughter animals by themselves with no involvement of trained personnel. Simple random sampling technique was used to select the study animals. During sampling, haemonchosis infection was compared between the different host parameters as species, age, sex and body condition score of the animals. Age was estimated using the teeth eruption procedures described by Vatta et al. [11], and body condition scoring method as per ESGPIP [12].

2.4. Sample collection and worm recovery

The abomasums of every animal was extirpated from all other abdominal viscera after a double ligation of both ends and immediately taken to the University of Gondar Veterinary Parasitological Laboratory for examination. There, the content was carefully collected in a container. The mucosa of the organ and its folds were thoroughly washed in tap water above the container so as to collect all content (food juice, waste, worms, etc.). The container was slightly stirred to wash the parasitic elements. The supernatant was then declined to reveal the macroscopic worms. The worms are then harvested in a fixing solution of 5% formalin for identification and counting following the diagnosis keys provided by Zajac et al. [13]. Any abomasums hosting at least one (1) worm of Haemonchus genus was considered positive.

2.5. Statistical analysis

All the data were entered in to MS excel spread sheet and analyzed using SPSS version 20 software. Descriptive statistics was used to characterize the disease nature in affected groups. Haemonchosis prevalence 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 (X^2) test was used to measure the association between prevalence of haemonchosis with animal species, age, sexes, and body condition scores. 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 ($P < 0.05$).

III. Results

From the total of 250 sheep and goats examined for the presence of H. *contortus* infection in the present study, 184 animals were found to be positive for the parasite with the overall prevalence of 73.6%.

3.1. Association of potential risk factors

Prevalence of haemonchosis was found to be higher among sheep (65.6%) than goats (8%) and the difference was statistically significant ($P < 0.05$) (Table 1).

Table 1. Prevalence of haemonchosis between species of small ruminant

Species	Total examined	Number of positive	Number of negative	Overall prevalence (%)	df	X^2	*P-Value*
Sheep	216	164	52	65.6	1	4.422	0.035
Goat	34	20	14	8			
Total	250	184	66	73.6			

The present study also revealed infection difference in small ruminant haemonchosis between sexes indicating higher prevalence in male animals (57.6%). However, the difference was not statistically significant (Table 2).

Table 2. Prevalence of haemonchosis between sexes of small ruminant

Sex	Total examined	Number of positive	Number of negative	Overall prevalence (%)	df	X^2	*P-Value*
Male	193	144	49	57.6			
Female	57	40	17	16			
Total	250	184	66	73.6	1	0.446	0.504

Prevalence of haemonchosis in different body condition score indicated that medium body condition animals had higher disease prevalence (46%) than good body condition animals (27.6%) and the difference was statistically significant (Table 3).

Table 3.Prevalence of haemonchosis between body condition scores

Body Condition	Total examined	Number of positive	Number of negative	Overall prevalence (%)	df	X^2	P-Value
Good	106	69	37	27.6			
Medium	144	115	29	46	1	5.41	0.02
Total	250	184	66	73.6			

Prevalence of haemonchosis in age groups indicated that adults (age great or equal to one year) had higher prevalence (52.8%) than young animals (20.8%) and the difference was statistically significant (Table 4).

Table 4. Prevalence of haemonchosis based on age groups

Age	Total examined	Number of positive	Number of negative	Overall prevalence (%)	df	X^2	P-Value
<1 year	69	52	17	20.8			
≥1year	181	132	49	52.8	1	6.152	0.016
Total	250	184	66	73.6			

IV. Discussion

The present study revealed high overall prevalence of haemonchosis (73.6%) in small ruminant in and around Gondar town with species specific prevalence of 65.6% in sheep and 8% in goats. However, this finding was lower when compared to the report from different researchers from different regions of the country. For example, Abebe and Esayas [14] reported 96.5% prevalence in sheep and 100% in goats in the arid and semi-arid zone of eastern Ethiopia; Kumsa and Wossene [15] reported overall prevalence of 91.2% in sheep and 82.9% in goats slaughtered at Debrezeit ELFORA abattoir; and Tewodros and Girja [16] reported 81.2% overall prevalence in Gonder town. This variation in disease prevalence might be due to differences in diversity of factors as environmental factors, host, age and breeding status of the animals, grazing habits, and education level of the community, economic capacity, and anthelmentics usage which influences the development, distribution and survival of the infecting parasites [17].

In the present study, prevalence of haemonchosis between species showed significant difference ($P < 0.05$) indicating sheep to be more infected by the disease than goats. These findings were in agreement with the reports by Hailelul [18]; and Tewodros and Girja [9]. However, our findings disagree with previous research conducted in and around Finoteselam in Amhara region by Mengist *et al*. [17] that indicated sheep as less susceptible species to *Haemonchus contortus* infection than goats. The probable reason for the occurrence of higher prevalence of heamonchosis in sheep than 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 the parasite 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.

The present study also revealed difference in small ruminant haemonchosis infection between sexes. It was

found that prevalence of haemonchosis in male animals was higher (57.6%) when compared to female animals (16%). Our findings concur with previous reports by Tewodros and Girja [9] and Mengist *et al.* [17]. The assumptions were that sex is a determinant factor more susceptible to parasitism during pregnancy and Per-parturient period due to stress and decreased immune status. 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 [19].

There was significance difference in small ruminant haemonchosis beteen different body conditions ($P < 0.05$). Those medium body condition animals were highly infected by haemonchosis than good body conditioned animals. Our findings concur with previous reports by Tasawar *et al* (2010) but, disagree with the study reported by Ragassa *et al* (2006). The high infection rate of haemonchosis in medium body condition animals might be due to the 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 [19].

The current finding also indicated significant difference in small ruminant haemonchosis between age groups ($p< 0.05$). Young animals of less than 1 (one) year age have developed low infection rates of haemonchosis than adults (greater or equal to 1 year). The low infection rate of haemonchosis in young animals might be due to the fact that animals under one year ages in endemic area could have obtained a certain protective passive immunity from colostrums that enables them to conquer effect of the disease. However, further study would be necessary to determine the underpinning reasons.

V. Conclusion

This study revealed haemonchosis as a very important parasitic disease in small ruminants in and around Gondar town. The distribution of the parasites is more common in sheep than goats, male animals than females, medium body conditioned than good body conditioned and in adult animal than young. This needs great attention when designing the control programs of the parasite. Overall, it would be wise to include in the control of this parasite, targeted therapies using herd management with emphasis on the seasons and the life cycle of Haemonchus spp.

Conflict of Interests

The authors declare that they have no competing interest

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