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Research Article

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Study on the Prevalence and Associated Risk Factors of Haemonchus Contortus Infection in Small Ruminants in Mitto District, Silte Zone, Ethiopia

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Abstract

A cross sectional study was carried out to determine the prevalence and associated risk factors of Haemonchus contortus in small ruminants from November 2021 to June 2022 in Mitto district Silte zone southern Ethiopia. The present study revealed that the overall prevalence of H. contortus in small ruminants was 46.1 %, which indicated a high prevalence of the parasite in the study area. Of the examined animals, 52.1% sheep and 33.1% goats were found positive showing a statistically significant difference in prevalence (P <0.05). Similarly the prevalence of H. contortus infection between sexes and age groups showed significant difference (P < 0.05) 51.4% in females and 36.3% in males, between age 60 % in young and 44.1% in adult and 35.5% in old respectively. Therefore, due to its important health problem and impact on production in the study area, emphasis should be given to the control and prevention of H. contortus infection with further studies on species identification and larval ecology.

Keywords: Floatation, Haemonchus, Mitto, Risk Factor, Sheep and Goat

1. Introduction

Small ruminants are an importance source of income and are considered one of economic importance in Ethiopian in different manners [1-3]. Sheep and goats are one part of the livestock sectors and they play a big role by providing various benefits particularly to smallholder farmers and the country as a whole [4-6]. The total number of small ruminant population in the country is estimated to be 40 million sheep and 51 million goats respectively [7].

In spite of the huge number of small ruminant populations in Ethiopia, the level of product obtained from them at present is suboptimal in all regions. In general, level of foreign currency obtained from sheep and goat is far below their total production performance [8]. This is due to disease prevalence like infectious diseases, lack of fed both in quality and quantity, poor management and low genetic endowment [9]. The impact of internal parasitic infection is larger in Sub-Sahara Africa especially in Ethiopia due to agro-ecological condition is appropriate for different hosts and intestinal parasitic species [10]. There are huge numbers of sheep and goat populations in Ethiopia though the quality and quantity of product obtained from them at present is suboptimal in all regions. Among the factors that hinder the optimum production there are different gastrointestinal parasites like H. *contortus*. H. *contortus* is an important cause of anemia, reduced fertility, economic losses through reduction in productivity and increased mortality in severely infected sheep and goats [11,12]. Previous research in Ethiopia reported that internal parasite have a wide distribution and is also regarded as one of the major economic losses associated with livestock production [13,14]. In general, there was not sufficient documented data with regard to the occurrence of H. *contortus* in small ruminants regardless of the high populations of sheep and goat in the study area so far, the present study therefore, aimed to investigate the prevalence, potential; risk factors of H. *contortus* in sheep and goat in Mitto district.

2. Material and Methods

2.1 Study Area

The study was conducted in Silte Zone, Mitto district, Southern nation nationalities and peoples region. Mitto is located about 223 km south east of Addis Ababa and 30 km from Werabe, capital town of Silte Zone. The area has two agro-ecological zones, locally called Kola 31.6% and Woynadega 68.4%, which means lowland and mid highland respectively. The annual average minimum and maximum temperature range from 21-26 °C, respectively and the average annual rainfall ranges from 700-900 mm [15].

2.2 Study Animal

The study animals were sheep and goats with different age, sex

and body condition. The origins of these animals were from four simple randomly selected kebeles in the district. A total of 384 indigenous small ruminants kept under traditional management system were taken as a sample, which 263 were sheep and 121 were goats (females 249 and males 135) selected by systematic random sampling technique. The age of the animal was estimated based on their dentition and categorized as young (< 2 yrs), adults 2-4 and old (> 4 yrs) and the body condition of animal was grouped as good, medium and poor as described by [16,17].

2.3 Study Design

A cross-sectional study design was used to estimate the prevalence of sheep and goat Haemonchus infection in Mitto district by coprological examination from November 2021 to June 2022.

2.4 Sampling Method and Coprological Examination

Mitto district was selected by the purposive sampling method due to its low land and mid highland climatic condition, which is a favorable condition for the multiplication and survival of internal parasites in general, and Heamonchus in specific and the presence of high number of small ruminant population. From the district, four kebeles (Aedenba, Seso, Girinizila gogilo and Girinizila shefode) were selected by a simple random sampling method. The samples were collected directly from the rectum of each systematic randomly selected animal using disposable glove. The collected samples were put in the universal bottle containing 10% formalin and properly labeled with the necessary information and transported to Alage ATVET College Parasitology laboratory by using an ice box and stored at (4°C) refrigeration until processing.The floatation technique was applied using sodium chloride floatation solution used to concentrate parasite eggs in the faeces and examined under microscope for presence of H. *contortus* eggs on the basis of their morphological characteristics [18].

2.5 Sample Size Determination

To calculate the total sample size, the following parameters were used: 95% of confidence level (CL), 5% precision level with the assumption of 50% expected prevalence of sheep and goats Haemonchosis in the study area, the sample size was determined using the formula given by Thrustfield [19].

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

2.6 Data Analysis

Microsoft Excel software was used to store the data and analysis of simple descriptive statistics. The computation of descriptive statistics was conducted using SPSS Version 20 software program. The confidence level was held at 95% and statistical analysis for the difference in prevalence of H. *contortus* among risk factors was considered significant when the P-value is <0.05. Analytical statistics using Chi-square (x^2) was employed for the purpose of getting a significance level and estimation of the risk factors associated with the disease of interest. For Chi-square (x^2), the interpretation was based on the p-value.

3. Results

In this study, out of the total 384 small ruminants (263 sheep and 121 goats) studied using coprological examination, 177 animals were found to be positive for the *Haemoncus contortus*. Thus, the overall prevalence of sheep and goat Haemonchosis in the study area was 46.1% (Table-1). The prevalence of Haemonchosis was found to be high in sheep 52.1% than goats 33.1% and the analysis of the data showed that there was statistically significant difference on the occurrence of Haemonchosis between species (P<0.05) (Table-2). In the present study, statistically significant variation was observed between sexes where higher prevalence of Haemonchosis infection was observed in female 51.4% as compared to male 36.3% (table-2). The highest prevalence was observed in small ruminants that were originated from Seso 57.3%, Adeneba 52.1% followed by Grinizila gogilo 40.6% and Grinizila shefode 34.4% showing a statically significant variation among the different origins of the animals (Table-2). Concerning the body condition, a statistically significant variation was observed with the highest percent of Haemonchosis encountered in animal with poor body condition score 81.6% followed by medium 33.3% and good body condition 16.3% (table 2). In addition, prevalence of H. *contortus* among different age groups, young 60%, adult 44.1% and old 35.5% also showed a statically significant difference (P<0.05) between age.

Factors	Animal examined	Test positive	prevalence
Haemonchus	384	177	46.1%

Table 1: The Overall Prevalence of H. Contortus in the Study Area

Factors	Number of examined	Number of positive	Prevalence	Chi-square	P-value
Species					
Sheep	263	137	52.1%	12.083	0.001
Goat	121	40	33.1 %		
Sex					
Female	249	128	51.4%	8.043	0.003
Male	135	49	36.3%		

Kebele					
Seso	96	55	57.3%	12.69	0.005
Adeneba	96	50	52.1%		
G/gogilo	96	39	40.6%		
G/shefode	96	33	34.4%		
BC					
Poor	136	111	81.6%	1.14	0.000
Medium	150	50	33.3%		
Good	98	16	16.3%		
Age					
Young	130	78	60%	17.10	0.000
Adult	152	54	44.1%		
Old	102	45	35.5%		
Over all	384	177	46.1%		

Table 2: The Prevalence of H. Controtus In Related With Different Risk Factors

The probability of infection of sheep and goat by H. *contortus* in Seso kebele was 2.418 times higher than Girinizila shefode kebele and the risk of infection between the two kebeles had statistically differences (P<0.05). Sheep had probability to be infected with H. *controtus* by 2.202 times higher than goats in the study areas and the observed difference was statically significant (P<0.05). Prevalence in female was higher than male in which female was 1.952 times more likely to be positive for H. *contortus* than male (Table-3). In case of age group, the risk of young sheep and goat infection by H. *contortus* was 2.629 times higher than that of old groups with significant. Small ruminants with poor body conditioned were 2.964 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 1.907 times more likely than good body conditioned.

Variable category	No. examined	No. positive	Prevalence	OR	95% CI Lower-upper	P-value
Kebele						
Seso	96	55	57.3%	2.418	1.162 - 5.031	0.018
Adeneba	96	50	52.1%	1.524	.736 - 3.158	0.257
G/gogilo	96	39	40.6%	1.159	.551 - 2.438	0.697
G/shefode	96	33	34.4%	Ref [a].		
Species						
Sheep	263	137	52.1%	2.202	1.405 – 3.451	0.001
Goat	121	40	33.1%	Ref [a].		
Sex						
Female	249	128	51.4%	1.952	1.129 - 3.375	0.017
Male	135	49	36.3%	Ref. [a]		
Age						
Young	130	78	60%	2.629	1.341 - 5.156	0.005
Adult	152	54	44.1%	.819	.427 - 1.570	0.547
Old	102	45	35.5%	Ref. [a]		
Body condition						
Poor	136	111	81.6%	2.964	1.562 - 5.675	0.000
Medium	150	50	33.3%	1.907	.974 - 3.732	0.060
Good	98	16	16.3%	Ref. [a]		

Table 3: Comparison of Risk Infection by H. Contortus in Sheep and Goats from Mitto District Using Multivariate Analysis A=Reference; OR= Odd Ratio; CI= Confidence Interval

4. Discussion

H. *contortus* is the very common gastrointestinal parasite and the most pathogenic nematode of sheep and goat. This parasite is responsible for anemia, submandibular oedema, reduction of blood protein, loss of PCV and hemoglobin [20]. The infection, called Haemonchosis, may cause large economic impact, especially for those animals were found in tropical and subtropical regions [21].

The present study revealed that the overall prevalence of H. *contortus* in small ruminants 46.1%, which indicated high prevalence of the parasite in the study area. This outcome is lower than the result of in Gonder with prevalence of 80.21%, who reported 77.38% in Helmex-Export Abattoir, with the rate of 71.3% in and around Finoteselam, in sheep and goats slaughtered at Haramaya municipal abattoir who recorded prevalence rate 90.1%, and who reported 67.2% in Asella municipal abattoir [22-26].

On the other hand, the current result is higher than the previous work of who reported 26.8% prevalence of Haemonchosis in sheep and goat slaughtered at Abergelle export abattoir in Mekelle, who reported the overall prevalence 33.1% in Jimma municipal abattoir and who reported 31.5% prevalence in and around Nekemte town. This variation of prevalence of Haemonchosis in small ruminants may be due to difference in agro-ecological situation, husbandry practices, environmental variation, sample size variation, study methods, coverage and quality of veterinary service [27-33].

A statistical significant difference in prevalence of H. *contortus* infection in sheep than goats recoreded was recorded as 52.1% and 33.1% respectively in present study is similar with previously reported by in and around Bedelle who reported that 69.5% and 65% in sheep and goats respectively, in Hawassa who reported that 92.9% and 90.2% sheep and goat respectively, in Bishoftu ELFORA export abattoir reported 69.7% and 57.1% in sheep and goats respectively, in and around Gonder 65.6% in sheep and 8% in goats respectively and [37] in Mojo Luna export abattoir who was reported that sheep 63.68% and goats 50.74% . In this study the prevalence of H. contortus was higher in sheep than goat this is might be due to different factors like, feeding behavior of sheep are differs from that of goats, sheep have ground grazing habit and usually graze very close to the soil which might be helpful in the gaining of more infective larvae (L3) of H. *contortus* from the contaminated grazing land. This variation of H. contortus in goat than sheep might be due to the fact that goats browse on bushes and small trees. This goats feeding habit may also reduce the amount larvae that enter the mouth with grass from the pasture land.in this study, female small ruminants were 1.952 times more likely to be infected with H. contortus was compared to male which was show statically significant difference ($P<0.05$) [34-37].
This observation agrees with the previous work of in Genchi district reported that 90.2% in female and 82.9% in males respectively, in Hawassa Ethiopia who reported that female 81.9% and in males 79.6%, in and around Ejere town who reported that 71.6 % in Female 58.4% in males respectively, reported that female 61.60% and male 48.98% respectively in and around Gonder towen, in and around Ambo town reported that female 69.4% and males 57.2%, in Wayu Tuke and Diga district Oromia reported that female 68.2% and males 31.8% respectively [38-43].

The higher prevalence of H. *contortus* in females than males this is due to that females are more exposed to stress than males in different condition such as during lactation; lactating small ruminant are often in a negative energy balance, and therefore females are weaker and less able to resist the effects of parasites on their body, and ewes and does in late gestation, and for a short period after parturition lose much of their resistance to parasites due to hormonal and photoperiod effects. During this period, the ewe or doe is no longer able to resist worm development or egg production (Per-parturient period) due to stress and decline immune status, as well as male small ruminants are kept indoor for purpose of fatting [44-46]. The present result, However, vary with previous findings which were reported in Ethiopia by who reported 73.22% in males and 64.71% in females respectively in and around Finoteselam in Amhara, who reported 90% in males 87% in females respectively in and around Haramaya University and as 57.6% and 16 % in males and females respectively in and around Gonder North West Ethiopia [47-49].

When the body condition is considered, the prevalence rate was higher in poor body condition small ruminants as compared to the good and medium body conditions with the prevalence of 81.6% in poor body conditioned, 33.3% in medium body condition and 16.3% in good body condition showing a statistically significant ($P < 0.05$) variation among the body condition. The prevalence of H. contortus infection was high in poor body condition sheep and goats small; this means poor body condition animals are highly susceptible to parasitic diseases and they cannot resist due to lowered immunity; this agree in and around Mekelle town who reported 97.7% in poor body condition 60.7% in medium body condition and 35.63% in good body conditions, in Bahir Dar municipal abattoir who reported 64.68% in poor body condition 46.34% in medium body condition and 39.13% in good body conditions, in Jimma Horro district who reported 30.2% in poor body condition, 14.5% in medium body condition and 12.6% in good body conditions and in Borena lowland who reported 81.8% in poor body condition, 63.8% in medium and 55.2% in good body condition [50-53].

Good body condition animals have ability to resist gastrointestinal parasites than poor and medium body condition animals; this is due to good immunity that inhibits the fecundity of the parasites [54]. However it disagrees with the research reported by, who report prevalence of Haemonchosis was found to be higher in good body condition than medium and poor body condition. This might be due to different factors like seasonal change of feed and difference in management system [55,56].

The overall prevalence of H. *contortus* infection according to age

revealed higher prevalence 60% was recorded in young followed by adult 44.1% and old 35.5% showing statically significant difference among the age group (P<0.05). The present study indicates that the prevalence of H. *contortus* was higher in young animals than adult and old animals. The current findings are similar to the previous finding of in Janamora wereda who reported that young 62%, adult 58% and old 41%, in and around Haramya university who reported that 97.1% in young, 87% in adult and 85.7% in old, in municipal abattoir of Jimma town who reported that 75.4% in young, 35.3% in adult and 19.1% in old. Different reports show that Adult and older animals are get well from internal parasitic infection more quickly as the immunity of the host increase with age because animals may hence become immune, especially as they undergo repeated exposure [57-63]. Young small ruminant are more at risk to parasite infection due to their low resistance or greater susceptibility. Lamb and kids in the earliest time of their life they fed, graze and browse on bushes, thus the first stage of their exposure to infection with parasites occurs [64]. The current finding disagrees with the previous work of in South Omo zone who reported that young 41.37%, adult 78.66% and old animals 84.40% [65].

The present study revealed that the prevalence of H. contortus was different among animals originated from different Kebeles of the study areas; with higher prevalence in sheep and goats originated from Seso with the rate of 57.3%, Adeneba 52.1%, Girinizila gogilo 40.6% and Girinizila shefode 34.4% with statically significant difference between kebeles (P < 0.05). This study agrees with the work of in and around Finotselam, in bale zone, in and around Tullo District in Western Harerghe zone. This difference might be due to environmental factors such as temperature, humidity and altitude which can predisposing with flood especially during the rainy season necessary for the prolonged survival and development of infective larval stage of most helminthes [66-70].

5. Conclusion

Hamonchus contortus is the most important gastrointestinal parasite of small ruminant. It is blood feeding and the most pathogenic parasite that found in ruminant abomasum and may cause of severe anemia, weight loss, growth retardation, decrease production and submandibular edema are the most common clinical signs. H. *contortus* is the most pathogenic and economic importance in small ruminants. Mitto district was selected by the purposively sampling method and from the district, Seso, Aedenba, Girinizila gogilo and Girinizila shefode kebees were selected by a simple random sampling method. A cross-sectional study design was used to estimate the prevalence of sheep and goat Haemonchosis in Mitto district by coprological examination. The present study revealed that the overall prevalence of H. *contortus* in small ruminants 46.1%, which indicated high prevalence of the parasite in the study area. The prevalence even though this finding is lower than the results of previous works in sheep and goats from different parts of Ethiopia but which indicated high prevalence of the parasite in the study area. The higher prevalence of H. *contortus* in this study area is significantly associated with the different risk factors such as body condition, age, species, sex and origin of small ruminants. And those higher finding related may be, the risk factors like temperature and humidity, poor animal management, and shortage of feed in the study area this could lead them graze close to the ground leading them to uptake a higher number of infective larvae in contaminated pasture that favors the occurrence of disease.

Data Availability

Documents used to support the review of this article are available from the corresponding author upon reasonable request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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