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RESEARCH ARTICLE

Prevalence of Gastrointestinal Parasites of Sheep and Goats in An-Lemo, Hadiya Zone Southern Ethiopia

Ephrem Sebro[1], Mulugeta Kebamo[1]*, Ashenafi Abebe[2]

1 Assistant Professor, School of Veterinary Medicine, Wachemo University, Hossana, Ethiopia
2 Lecturer, Department of statistics, Wachemo University, Hossana, Ethiopia

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* **Corresponding author**.

kebamoam@gmail.com

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Abstract

Background: Infestation with gastrointestinal parasites in extensively managed animals is common and cause significant economic losses. The objective of this study was to determine the prevalence of gastrointestinal parasites of small ruminants in the An-Lemo, Hadiya zone in Ethiopia. **Methods :** A cross-sectional study involving 383 animals(208 sheep and 175 goats). Standard parasitological techniques and copro-culture was used to identify parasite eggs, and determination of larvae some nematodes, respectively. **Findings:** The overall prevalence of gastrointestinal (GI) parasites was 74.41%, out of this 123(70.28%) were goats and 165 (79.32%) were sheep. Dis aggregating results by sex 161(75.23%) of female animals and 124(73.37%) male animals were infected by single or mixed infection. With regards to body condition a total of 73(19.06%), 140(36.55%) and170 (44.38%) animals with good, medium, and poor body condition respectively include for examination. Out of these 28(38.35%), 110(78.57%and147 (86.47%) of animals infected with good, medium, and poor body conditions respectively and body condition of small ruminants showed a significant association with the prevalence of the gastrointestinal parasite ($p<0.05$). The most prevalent infection identified were strongyles with 102 animals (26.63%), and strongyloides 14(3.65%) were found the second-highest prevalent in the woreda followed by coccidian infection in 48 animals (12.01%); monieza 12(3.13%) and fasciola10 (2.61%). Double infection cocccidia with monieza 14(3.65%) was found the highest mixed infection followed by strongyle with monieza 11(2.87%) and co-infection of Trichur is with coccidian10(2.61%). **Application:** The result revealed that there was high infestation rate, particular attention should be given to the management of small ruminants. A general means of reducing infestation might be systematic through providing awareness of the community and regular testing and deworming of small ruminants.

Keywords: Ethiopia; Extensive grazing system; Gastrointestinal parasites; Prevalence; Small ruminants

1 Introduction

In Ethiopia, agriculture is the dominant sector of the economy and accounts for 50% of the GDP, 30% of the export revenue, and provides a livelihood for over 80% of its inhabitants[1]. At present smallholder, farms are responsible for 95% of the total agricultural output. Ethiopia is one of the nations with the highest population of livestock more than 52.13 million cattle, 24.2 million sheep, 22.6 million goats, 8.36 million equines, and 44.89 million poultry[2]. The rapidly increasing human population implies increasing potentials for the demand for meat and milk. However various diseases, including parasitic diseases are a huge problem and considered as major constraints in the health and product performance of livestock in Ethiopia and elsewhere[3]. They reduce productivity, reduce reproductive potential and cause high economic losses affecting the income of smallholder farming communities[4–6] due to decreasing voluntary feed intake and/or feed conversion efficiency[7].

As a result, diseases caused by helminths remain a major impediment to small ruminant production in the tropics[8], and up to 95% of small ruminants are reported to show helminth infestation in these latitudes[9–11]. However, the majority of animals infested with helminths do not show clinical signs owing to the chronic nature of the disease. Gastrointestinal parasitism is one of the researchable items on sheep and goat health in the Southern Nations Nationalities Regional State, since gastrointestinal parasites incur significant economic losses in the region, due to insufficient information on the epidemiology.

Among ruminant gastrointestinal parasites (GIP) in Ethiopia, the trochostrongyloids, including Dictyocaulus, are responsible for considerable mortality and widespread morbidity. The most important genera are Oestertagia, Heamonchus, Bunostomum, oesphagostomum, Trychostrongylus, Chabertia, Cooperia, Nematodirus, Hyostrongylus, Marshallagia and Meistocirrus. The prevalence of GIP, the genera and species of helminths involved, and the level of infection vary considerably depending on local environmental conditions and management practices. Hence, the foundation for any program on parasite control should be based on a sound knowledge of parasitic infection in a particular area[12].

Several control methods against ruminant GIP infection are available. These methods involved reduction in the number of intermediate hosts by chemical or biological means, reduction in the number of snails by drainage, fencing, and other managemental practices, and reduction in the risk of infection by planned grazing management[12]. In the Hadiya zone, no report on the epidemiological prevalence of shoats GIT parasite infection was available. Therefore, this study aimed to determine the prevalence of gastrointestinal parasites of small ruminants and to provide baseline data for planning of control strategy. This study might assist veterinarians and technicians in the woreda, who are engaged in the diagnosis and control of diseases of ruminants caused by helminth parasites.

2 Materials and Methods

2.1 Study Area

The study was conducted in An-Lemo woreda of Hadiya zone, Southern Nations Nationalities, and People's Regional State (SNNPRS). The area has an altitude of 1600–2240masl with a bimodal rainfall system (long and short rainy seasons). The long rainy season extends from June to September, whereas the short rainy season ranges from March to April. The annual rainfall is 950–1200mm while the maximum and minimum annual temperature are 23°C and 13°C respectively. The livestock in the woreda is indigenous and crossbreeds.

2.2 Study Design

The sample size was calculated using the formula given by[13] for simple random sampling.

$$N = \frac{(1\text{-}pexp)\ 1.96^2 \times pexp}{D^2}$$

Where,

N= number of study population

Pexp= expected prevalence

D^2= desired absolute precision

The sample size was determined by considering 50% expected prevalence, 5% the level of precision, and 95% confidence level. Accordingly, the total number of animals needed and sampled was 384. The target population comprises small ruminants of different ages, sex categories, and body conditions found under extensive grazing in private and communal pastures

2.3 Sample Collection

During faecal sample collection, sex, age, and body condition of the sample animal were registered. The age and body condition were determined using personal and farmer's observation. The sample was collected directly from the rectum of each selected animal using disposable plastic gloves and put into a clean screw-capped universal bottle and each sample was clearly labeled with an animal identification number and preserved in 10% formalin except the sample collected for larvae culture. The faecal sample collected for larvae recovery was collected into wide-mouth containers, closed tight, and kept in the cold chain until dispatched to the laboratory. The universal bottle containing the fecal sample for coprology examination was labeled with a specific number, sex, and age of the animals used waterproof marker on adhesive tape attached to the sample container.

2.4 Coprology examination

For corposcopic examination of the fecal samples, a simple test tube flotation and sedimentation technique described by[12] was employed and the slides prepared were examined under the microscope (x10). Eggs of the different helminths were identified based on morphological appearance and size of eggs[14].

2.5 Data Analysis

Data were entered and managed in Microsoft Excel and Statistical analysis was done with Statistical Package for Social Science (SPSS) version 20 software. Descriptive statics such as percentages and frequency distribution was used to describe the nature and the characteristics of the data. The association of different risk factors with the prevalence of gastrointestinal was computed by Chi-square ($\chi 2$) test. The effects of different epidemiological risk factors on the prevalence of the gastrointestinal parasite in sheep and goats were analyzed by logistic regression entering all variables at once. In all the analyses, P-values less than 0.05 (P<0.05) were considered statistically significant.

3 Result

Of the 383 animals tested (208 sheep, 175 goats), 285(74.41 %) tested positive for at least one parasite. 123(70.28%) of goats and 162 (77.88%) of sheep were infected by single or mixed infection, with no significant difference between the two species (p>0.05)[Table 1]. Similarly, no significant difference between male and female animals was observed.

Table 1. The prevalence of gastrointestinal parasites between species

Species	No of examined animals	No of positive animals	Prevalence%	X^2	P-Value
Goat	175	123	70.28%		
Sheep	208	162	77.88%	79.181	P=059
Total	383	285	74.41%		

Concerning body condition a total of 73(19.06%), 140(36.55%) and170 (44.38%) animals had good, medium, and poor body condition respectively. Out of these 28(38.35%) with good 110(78.57%) with medium, and147 (86.47%) with poor body condition tested positive for at least one parasite. The current study indicated that the body condition of small ruminants showed a significant association with the prevalence of the gastrointestinal parasite (p<0.05)[Table 2].

Table 2. The prevalence of gastrointestinal parasite based body condition

Body condition	No of examined animals	No of positive animals	Prevalence%	X^2	P-Value
Good	73	28	38.35%		
Medium poor	140 170	110 147	78.57% 86.47%	166.174	0.005
Total	383	285	74.41%		

Of the tested animals 228(59.53%) were aged less than 3 years and 155(40.46%) above3 years. The current study showed that the age of small ruminants was not significantly associated with being infected with the prevalence of the gastrointestinal parasites (p>0.05). The sheep and goats were found to possess different types of gastrointestinal helminths including nematodes, cestode, trematodes, and protozoa. Of these, nematodes account for the highest prevalence followed by protozoa, cestodes, and trematodes in both sheep and goats. About the prevalence of detected gastrointestinal parasites the most prevalent infection identified wasNematods191 (49.86%), Protozoa 95(24.80%), Cestodes 51(13.31%), and Trematodes 38(9.92%) [Table 3].

Table 3. The overall prevalence of GIT helminths in sheep and goats by types of helminths

Type of helmenths	Sheep(n=208)		Goat (n=175)		Total (n=383)	
	positive	prevalence	positive	prevalence	Total positive	Overall prevalence
Nematods	106	50.96%	85	48.57%	191	49.86%
Cestodes	28	13.46%	23	13.14%	51	13.31%
Trematodes	28	13.46%	10	5.71%	38	9.92%
Protoza	61	29.32%	34	19.42%	95	24.80%

The results of the coprological examination in both sheep and goats have also shown the presence of several genera of GIT helminths in each of the different types of helminths. Accordingly, both sheep and goats 9 genera of GIT helminths were detected namely, Strongyle type eggs, Strognyloidessp., Ascarisovis sp., Ascarisvitulorum sp., Trichurissp., Fasciola sp., Paraphistomumsp., Moneziasp.,and Coccidia sp. The most identified prevalent infection was strongyle 133(34.72%), Coccidia 95(24.80%), Moneizia51(13.31%), cestode51(13.31%), and the least identified infection wasFasciola32(8.35%), Strongyloides (5.48%), Ascarisvitulorum 14 (3.68%),Trichuris12(3.13%), Ascarisovis 11(2.87%) and Paraphistomum6(1.56%) [Table 4].

Table 4. The prevalence of particular gastrointestinal helminths infection

Helminth eggs	Sheep(n=208)		Goat (n=175)		Total(n=383)	
	positive	prevalence	positive	prevalence	Total positive	Overall prevalence
Nematode	**106**	**50.96%**	**85**	**48.57%**	**191**	**49.86%**
Strongyle	66	31.73	67	38.28	133	34.72
Strongyloides	13	8.25	8	4.57	21	5.48
Ascarisovis	9	4.32	2	1.14	11	2.87
Ascarisvitulorum	9	4.32	5	2.87	14	3.65
Trichuris	9	4.32	3	1.71	12	3.13
Trematodes	**28**	**13.46%**	**10**	**5.71%**	**38**	**9.92%**
Fasciola	23	11.05	9	5.14	32	8.35
Paraphistomum	5	2.4	1	0.57	6	1.56
Cestode	**28**	**13.46%**	**23**	**13.14%**	**51**	**13.31%**
Moneizia	28	13.46%	23	13.14%	51	13.31%
Protoza	**61**	**29.32%**	**34**	**19.42%**	**95**	**24.80%**
Coccidia	61	29.32%	34	19.42%	95	24.80%

Mixed helminths eggs were noticed in some of the slides examined beside the single type of helminth eggs, with an overall prevalence of 78(20.28%) in both host species. Among these, Coccidia species with Moneiza species 14(3.65%) and Strongyle species with Moneizia species coexist most of the time [Table 5].

4 Discussion

This study revealed that the prevalence of gastrointestinal (GI) parasites small ruminates were 77.88%, and 70.28% in sheep and goats, respectively. These results were markedly lower than with the results of [11,15–23]. They have reported a prevalence of 96.38% in goats of Ogaden rangelands, 90.41% and 82.13% in sheep and goats in and around Wolayita Sodo, 88.1% and 84.32% in sheep and goats in and around Mekele, 91.43% in sheep in and around Kombolcha, 90.94% and 94.85% in sheep and goats of Gonder, 100% in Boer goats at Adami Tulu agricultural research center 92.23% and 94.1% in sheep and goats of Mendayo district of Bale, 93.22% and 92.24% in sheep and goats of four Awrajas of Eastern Shoa, 90.23% and 88.33% in sheep and goats of Buno province and 85.79% in sheep in and around Asella respectively. In the present study, 77.88% prevalence was observed in sheep slightly higher than 75.3% prevalence observed in sheep Western Oromia [24]. This difference might be due to the difference between the management system of examined animals, sample size, and geographical and environmental location of the area and also might be due to sheep and goats are managed under an extensive managements system with the high stocking density, where large numbers of animals graze together throughout the year in communal grazing land and inadequate nutritional status.

The prevalence of GI parasites concerning sex comparison, a total of 214(55.87%) female and 169(44.87%) small ruminants were included for the investigation. Out of this 161(75.23%) female animals and 124(73.37%), male animals were infected by

Table 5. Mixed types of helminth eggs in sheep and goats in the study area

Helminth eggs	Sheep (n=208)		Goat (n=175)		Total (n=383)	
	positive	prevalence	positive	prevalence	Total positive	Over all prevalence
Strongyle +Moneizia	4	1.92%	7	4%	11	2.87%
Moneiza+Ascaris.vitulorum	5	2.40%	3	1.71%	8	2.08%
Trichuris+ Coccidia	7	3.36%	3	1.71%	10	2.61%
Coccidia + Moneiza	11	5.28%	3	1.71%	14	3.65%
Fasciola+ Moneizia	5	2.40%	2	1.16%	7	1.82%
Strongyle+ Coccidia	2	0.96%	2	1.16%	4	1.04%
Fasciola+ Paramphistomum	5	2.40%	1	0.57%	6	1.56%
Coccidia + Fasciola	1	0.48%	0	0%	1	0.25%
Strongyle,+Fasciola	2	0.96%	0	0%	2	0.52%
Strongyle+Moneizia+Fasciola	2	0.96	3	1.71%	5	1.30%
Strongyle+Stringyloides+Coccidia	4	1.92%	2	1.16%	6	1.56%
Coccidia+Strongyle+Trichuris	1	0.48%	0	0%	1	0.25%
Fasciola+Strongyle+Trichuris	1	0.48%	0	0%	1	0.25%
Strongyle+ Ascarisovis,+Coccidia	2	0.96%	0	0%	2	0.52%
Total	**52**	**24.96%**	**26**	**14.89%**	**78**	**20.28%**

single or mixed infection. The prevalence of GI parasite was 147(86.47%), 110 (78.57%), and 28 (38.35%) concerning poor, medium, and good body, respectively. The present study revealed that 178 (78.07%) young animals and 107(69.03%) adult animals were susceptible to the parasites. The analysis result also showed that there was no statistically significant difference (P> 0.05) between the age of the animals. This observation agrees with work [25] who reported similar findings in Gechi districts, South West Ethiopia. But [26] reported significant relation with age in sheep of Bako agricultural research center community-based breeding program project small holder farms at Horro District. However, the body condition of the animals showed significant variations (p<0.05).

The prevalence of this GI parasite in the study area may be because sheep and goats are managed under an extensive system with high stocking density, where large numbers of animals graze together throughout the year, inadequate nutritional status, poor veterinary services and lack of awareness of farmers to proper handling of their animals. The present study revealed that the most prevalent identified single infection were strongyle133(34.72%), coccidian 48(12.01%), strongyloides14(3.65%),monieza 12(3.13%), and fasciola 10(2.61%). The most identified mixed infection were Cocccidia with monieza 14(3.65%), strongyle with moneizia 11(2.87%), trichuris with coccidian 10(2.61%), and moneiza, ascaris and vitulorum 8(2.08%).

The prevalence of nematode parasites, strongyle species in this study was 31.73% and 38.28% in sheep and goats, respectively. This result was in line with [5] who reported 32.56% and 39.84% in sheep and goats around Haramaya in southeastern Ethiopia. The prevalence of Strongyloid species in this study was 8.25%in sheep and 4.57% in sheep and goats respectively. This result is lower than 13.04% in sheep and 20% in sheep and goats around Bedele in south-western Ethiopia reported by [27]. The present findings are also higher than the work of [28] who reported a prevalence of 1.1% in sheep and goats of three different agro-ecological zones of southern Ethiopia. The prevalence of Trichuris species in this study was 4.32% and 1.71% in sheep and goats respectively. This result is lower than7.87% and 6.77% in sheep and goats around Haramaya in southeastern Ethiopia that reported [5]and 4 % in sheep and 7.2 % in goat flocks in the cholistan desert of Pakistan that reported [29]. This difference might be due to the different the age of examined animals and the geographical and environmental location of the area.

The prevalence of fasciola in this study was 11.05% in sheep and 5.14% in goats respectively. This result is much higher than [5] who reported 1.82% in sheep and 0.00% in goats around Haramaya in southeastern Ethiopia and 3 % in sheep and 3.8 % in goats flocks in the cholistan desert of Pakistan that reported [29]. This difference might be due to the different ages of examined animals and the geographical and environmental location of the area

The prevalence of cestode parasites, monezia species in this study was 13.46% and 13.14% in sheep and goats respectively. This result is not in line with [27] who reported 30.4% and 40% in sheep and goats around Bedele in south-western Ethiopia [22] who reported 26.04% in sheep and 23.81% in goats in and around Wolaita Sodo, [16] who reported 16.13% prevalence of monezia species in goats of Ogaden and [30] reported 52.6% in sheep and47.% in goats slaughtered at Bishoftu Elfora Export Abattoir. The results by the above authors are relatively much higher than the present finding. This difference might be due to the different ages of examined animals and the geographical and environmental location of the area.

The present study revealed that nematode infections were highly prevalent, followed by protozoa, cestodes, and trematodes. Similar results have been reported for central Oromia, Ethiopia [8] and Haramaya, southeastern Ethiopia [5]. Many nematode species do not require an intermediate host for the completion of their life cycle [31], and for egg hatching and larval development, they find suitable conditions around the natural water reservoirs. The higher prevalence could be related to the fact that this nematode has a relatively short generation interval and lays up to 10,000 eggs per day for several months. Additionally, this parasite can develop resistance against anthelmintics faster than other helminth species [32].

The current study has shown the presence of mixed infection characterized by the presence of two or more helminth genera both in sheep and goats. Similarly, the occurrence of simple and multiple poly-parasitism in small ruminants agrees with findings from several locations in Ethiopia [5,8,11]. Polyparasitism is an important cause of morbidity and loss of production in sheep and goats [8]. The impairment of the host's immune system by polyparasitism increases the animal's susceptibility to other diseases or parasites [33].

5 Conclusion

The most important gastrointestinal (GI) parasites identified were strongyle followed by coccidian infection. Double infection of Cocccidia with Monieza and Strongyloides were found the second-highest prevalent in the woreda. Thus, Awareness creation for the community thorough training is very crucial to develop disease control stragies in order to minimize GIT Parasite infestation.

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