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Prevalence of Gastrointestinal Parasites of Small Ruminants in and Around Jimma Town, Western Ethiopia

Nuraddis Ibrahim, Mulugeta Tefera, Mihreteab Bekele and Sisay Alemu

Jimma University, School of Veterinary Medicine, Jimma, Ethiopia

Abstract: A cross-sectional study was conducted from November 2011 to April 2012 with the objectives of determining the prevalence, identifying the species involved and assessing risk factors of gastrointestinal parasites in small ruminants in and around Jimma town. Faecal samples were collected from 214 sheep and 170 goats and examined coprologically. The study found that 191(89.3%) sheep and 148(87.1%) goats were found to harbor one or more gastrointestinal parasites. All species, sex, age groups were infected with identical parasite species, but with different levels of infection. The prevalence of various types of parasites in sheep and goats were respectively: *Fasciola* species 19.6%,7.6%; *Paramphistomum* species 22.4%,14.1%; Haemonchus species 37.4%, 42.9%; Trichostrongylus species 26.2%, 23.5; Strongloid 20.1%, 25.9%; Ostertagia species 16.8%, 24.1%; Oesophagastamum species 9.3%, 8.2 %; Trichuris species 7.9%, 5.3%; Chabertia species 4.2%, 8.2%; Bonustomum species 2.3%, 5.3%; Monezia 13.1%, 8.8 %; *Emeria* species 11.7%, 20.6%. h *Fasciola* species and *P*aramphistomum species prevalence were higher significantly in sheep whereas the reverse is true for *Emeria* species in goats. The prevalence of *Haemonchus* species*, Ostertagia* species*, Strongloid* species, *Chabertia* species and *Bonustomum* species were higher in goats but revealed statistically no significant difference (P>0.05), where as *Trichostrongloid* species, *Oesophagastamum* species*, Trichuris* and *Monezia* species were higher in sheep than goats with no significant difference as well (P>0.05). The prevalence of some gastrointestinal parasites (*Haemonchus* species*, S*trongloids species*, Emeria* species*, Trichuris and C*habertia) were higher in young than adult small ruminants shown significant difference (P<0.05), where as Paramphistosomum, Ostertagia, Trichostrongylus, Oesophagastamum and Bonustomum were also higher in younger than adult sheep and goats, but statistically not significant (P>0.05). In this study *Fasciola* was found significantly higher in adult than younger animals (P<0.05), while the reverse is true for *monezia*. The prevalence of *paramphistosomum* and *Haemonchus* was significantly higher in female sheep and goats than males (P <0.05). From studied animals 33.9% lightly, 26.0% moderately and 28.4% heavily infected. Therefore, awareness creation to the farmers should be instituted in the study area on the effect of gastrointestinal parasites of small ruminants and its control and strategic deworming of small ruminants should be practiced.

Key words: Jimma Goat · Sheep · Parasite · Prevalence

INTRODUCTION

Although Ethiopia possesses the highest number of livestock population in Africa, with an estimated 23.6 million sheep and 23.3 million goats, the productivity of this livestock is generally lower than the African average [1]. Sheep and goats, requiring little inputs, play vital role in rural economy through provision of meat, milk, blood, cash income, accumulating capital, fulfilling cultural obligations, manure and contribute to the national economy through the export of live animals, meat and skins [2].

The rich potential from the small ruminant sector is not efficiently exploited; however, due to several constraints, including malnutrition, inefficient management and diseases. In this regard, diseases due to

Corresponding Author: Nuraddis Ibrahim, Jimma University, School of Veterinary Medicine, P.O. Box 307, Jimma, Ethiopia. Tel: 251-0471116778, Cell: 251917808966, Fax: +251471110934.

parasites take the lion's share in limiting the productivity of these animals all over the World. This is especially true in many tropical and subtropical regions. Small ruminants under intensive and extensive production systems are extremely susceptible to the effects of wide range of helminthes [3].

Gastrointestinal parasite infections are a world-wide problem for both small- and large-scale farmers, but their impact is greater in sub-Saharan Africa in general and Ethiopia in particular due to the availability of a wide range of agro-ecological factors suitable for diversified hosts and parasite species. Economic losses are caused by gastrointestinal parasites in a variety of ways: they cause losses through lowered fertility, reduced work capacity, involuntary culling, a reduction in food intake and lower weight gains, lower milk production, treatment costs and mortality in heavily parasitized animals [4].

Endoparasites are responsible for the death of one third of calves, lambs and kids and considerable losses of parts of carcasses condemned during meat inspection [5]. It is well recognized that in resource-poor regions of the world, helminth infections of sheep and goats are major factors responsible for economic losses through reduction in productivity and increased mortality [6].

Helminth infections in the small ruminants are among serious problem in the developing countries, particularly where nutrition and sanitation standards are generally poor through reduction in production in infected animals and mortality. Most parasitic helminthes infect their host via oral route and live either at the mucosal surface of the gastro intestinal tract or cross the mucosal barrier on their way to predilection site. The problem is greater in tropical countries with good rain fall [7].

Although helminth parasites of ruminant livestock are ubiquitous in all of the agro-climatic zones of Ethiopia with prevailing weather conditions that provide favorable condition for their survival and development, their presence does not mean that they cause overt diseases. Among the diseases that constrain the survival and productivity of sheep and goats, gastrointestinal parasites infection ranks highest on a global index [6].

Review of the available literature in Ethiopia strongly suggests that helminthosis has nationwide distribution and is also considered as one of the major setbacks to livestock productivity incurring huge direct and indirect losses in the country. Therefore, this study was designed with the objectives of determining the prevalence, identifying the species involved and assessing possible risk factors of gastrointestinal parasites in small ruminants in the study area.

MATERIALS AND METHODS

Study Area: Jimma Zone, found in South Western Ethiopia, lies between 360 10´ E longitudes and 70 40´ N latitude at an elevation ranging from 880 m to 3360 meters above sea level [8]. Very currently Jimma Zone is divided in to 17 districts (hosting a total population of over 2.4 million; [1] an agro-ecological setting of highlands (15%), midlands (67%) and lowlands (18%) [8]. Farmers in the area practices mixed crop-livestock agriculture. The zone is one of the major coffee growing areas of southwest Ethiopia; cultivated and wild coffee is a main cash crop of the area. Jimma zone is well endowed with natural resources contributing significantly to the national economy of the country. In normal years, the rainy season extends from February to early October. The thirteen years mean annual minimum and maximum temperature of the area was 11.3°C and 26.2°C, respectively. The soil type of the study area is characterized with black to red soils. The total livestock population of Jimma zone is estimated to constitute, 2.02 million cattle, 288,411 goats, 942,908 sheep, 152434 equines, 1,139,735 poultry and 418,831 beehives [1].

Study Population: A sample size of 384 sheep and goats were randomly selected and subjected to qualitative and quantitative corpological examinations. Out of which, sheep and goats comprised 214 (55.7%) and 170 (44.3%), respectively.

The different variables such as species of the host, body condition score and age groups of local origin were analyzed as risk factors.

Age categorization into young and adult was performed as described by Gatenby [9] for sheep and Steele [10] for goats. Accordingly those sheep and goats under 1 year were categorized as young and adults are above one year.

Sample Size and Sampling Method: Determine the sample size an expected prevalence of 50% was taken into consideration since there was no previous study conducted in the Jimma zone. The desired sample size for the study was calculated using the formula given by Thrusfield [11] with 95% confidential interval and 5 % absolute precision. Therefore based on the above formula a total of 384 sheep and goats were examined.

Study Methodology: Fecal samples were collected directly from the rectum of each animal and placed in air and water tight vials and then taken to the laboratory.

In the laboratory the samples were subjected to sedimentation, floatation, Modified McMaster coproculture techniques and identification of the third larvae (12).

Positive fecal samples were subjected to McMaster egg counting technique and the degree of infection was categorized based on Soulsby [12] and Urquhart *et al.* [13].

The animals were then categorized as lightly, moderately and severely (massively) infected according to their egg per gram of faeces (EPG) counts.

Egg counts from 50-799, 800-1200 and over 1200 eggs per gram of feces were considered as light, moderate and massive infection, respectively.

Data Analysis: The prevalence was calculated by dividing the number of animals harboring a givenparasite by the total number of animals examined. In addition to this, the number ofworm EPG of feces was categorized and the result thus obtained was analyzed to determine prevalence using SPSS version 16. Percentages (%) to measure prevalence and chi-square ($x2$) to measure association between prevalence of the parasite and species of the animals, sex, age, body condition score was the statistical tools applied. In all the analyses, confidence level will be held at 95% and $P<0.05$ was set for significance.

RESULTS AND DISCUSSION

From 384 small ruminants (214 sheep and 170 goats) examined, 339 (87.2%) were harboring one or more GIT parasites. In this study twelve types of GIT helminth parasites were identified during the study period based on their morphology described by Urquhart *et al.* and Hansen and Perry [13, 14].

With respect to the species prevalence of GIT parasites, 191(89.3%) sheep and 148(87.1%) goats were found to harbor one or more parasites. This result coincides with the results of Esayas [15], Hailelul [16], Getachew [17], Genene [18], Gebreyesus [19], Tesfalem [20], Melkamu [21], Bayou [2], Yoseph [22] and Tefera *et al.* [23]. They have reported a prevalence of 96.4% in goats of Ogaden range lands, 90.41% and 82.13% in sheep and goats in and around Wolayita Soddo, 88.1% and 84.32% in sheep and goats in and around Mekele, 91.4% in sheep in and around Kombolcha, 90.9% and 94.9% in sheep and goats of Gonder, 92.2% and 94.1% in sheep and goats of Mendayo district of Bale, 93.2% and 92.2% in sheep and goats of four Awrajas of Eastern Showa, 90.2% and 88.3% in sheep and goats of Buno province, 85.8% in sheep in and around Asella and 91.32% and 93.29% in sheep and goats in and around Bedelle, respectively.

Prevalence by Species of Parasite: The types of parasites found in this study included gastrointestinal nematodes, cestodes, trematodes and protozoa. The parasite found in the sheep and goats of the study area were *Fasciola s*pecies*, paramphistosomum* species, *Haemonchus* species*, Trichostrongylus* species*, Strongloids* species*, Ostertagia* species*, Trichuris* species*, Oesophagastamum* species*, chabertia* species*, bonustomum* species*, Moniezia* species and *Emeria* species (Table 1). In this study from one host more than one type of genera of helminthes were identified in both sheep and goats. This finding agreed with reports of previous studies conducted in Ethiopia [4, 16 and 23]. *Haemonchus spp*., *Trichostrongylus spp., Strongyloids spp.,* Ostertagia spp*, Oesophagastamum spp., Trichuris, Chabertia and Bonustomum spp* were the main nematode species found in sampled sheep and goats. The prevalence of trematodes was *Fasciola* and *paramphistosomum* species. *Monezia spp.* and *Emeria spp.* were the only cestode and protozoa types found in this study, respectively, which is also similar with Sissay [24] and Kanyari *et al.* [25].

Prevalence by Species of Host: Sheep and goats harbor a variety of gastrointestinal tract (GIT) parasites, many of which are shared by both species. Both *Fasciola spp.* and *Paramphistomum spp.* were higher significantly in sheep than in goats where the reverse is true for *Emeria* species.

Table 1: Prevalence of GIT parasites examined in sheep and goats

Spp of parasite	Prevalence
Bonustomum	14(3.6%)
Chabertia	23(6.0%)
Emeria	60(15.6%)
Fasciola	55(14.3%)
Haemonchus	153(39.8%)
Monezia	43(11.2%)
Oesophagastamum	34(8.9%)
Ostertagia	77(20.1%)
Paramphistomum	72(18.8%)
Strongloid	87(22.7%)
Trichostrongloid	96(25%)
Trichuris	26(6.8%)

Table 2: The identified spp. of parasites in different spp. of small ruminants and their respective prevalence

Spp. of parasite	Spp. of small ruminant			
	Ovine(n=214)	Caprine(n=170)	x^2	P-value
Bonustomum	5(2.3%)	9(5.3%)	2.359a	0.125
Chabertia	9(4.2%)	14(8.2%)	2.732a	0.098
Emeria	25(11.7%)	35(20.6%)	5.700a	0.017
Fasciola	42(19.6%)	13(7.6%)	11.079a	0.001
Haemonchus	80(37.4%)	73(42.9%)	1.221a	0.269
Monezia	28(13.1%)	15(8.8%)	1.729a	0.188
Oesophagastamum	20(9.3%)	14(8.2%)	0.145a	0.704
Ostertagia	36(16.8%)	41(24.1%)	3.145a	0.076
Paramphistomum	48(22.4%)	24(14.1%)	4.297a	0.038
Strongloid	43(20.1%)	44(25.9%)	1.812a	0.178
Trichostrongloid	56(26.2%)	40(23.5%)	0.352a	0.553
Trichuris	17(7.9%)	9(5.3%)	1.054a	0.305

n = number of observations

The prevalence of *Haemonchus spp., Ostertagia spp., Strongloid spp. Chabertia spp*. and *Bonustomum spp*. were higher in goats and revealed statistically no significant difference (p>0.05) where *Trichostrongloid spp., Oesophagastamum spp., Trichuris* and *Monezia spp*. were higher in sheep than goats but statistically no significant difference (p>0.05) observed (Table 2).

The prevalence of *Haemonchus* spp. was 37.4% and 42.9% in sheep and goats, respectively. Our result was lower than findings of Hailelul [16] who reported 61.63% and 54.76% in sheep and goats, in and around Wollaita Soddo and Tefera *et al*. [23] who *reported* 69.5% and 65% prevalence in sheep and goats, respectively. Our findings were also lower than the results reported from arid and semiarid zones of eastern Ethiopia by Abebe and Esayas [3] that identified 90.8% *Haemonchus spp*.

In the current study the prevalence of *Trichostrongylus spp* during the qualitative fecal examination *was* 26.2% and 23.5%, in sheep and goats, respectively. This result was in agreement with Hailelul [16] who reported prevalence of 22.09% in sheep in and around Wolaita Sodo and Esayas [15] who reported prevalence of 16.59 in goats of Ogaden. Our result was lower than report of Tefera *et al*. [23] with prevalence of 43.5% and 55% in sheep and goats, respectively and Yoseph [22] who reported prevalence of 54.76% in sheep of Asella. The differences of the prevalence may be due to management and the current study area was ever green that animals are grazing elsewhere rather than around water source which is most favorable for development and survival of free-living stages of the parasites.

The prevalence of *Paramphistomum* spp. and *Fasciola* spp. was 22.4% and 19.6% in sheep, respectively while 14.1% and 7.6% in case of goats, respectively. In sheep both trematodes spp. had higher prevalence than in goats, which is correlated with the report from Kenya by Kanyari *et al.* [25], who reported in sheep the prevalence of *Fasciola* spp. and *Paramphistomum* spp. was 37% and 30% and in goats 36% and 12 %, respectively.

The prevalence of *Strongloid* species in the present study was 20.1% and 25.9% in sheep and goats, respectively, which is agreed with the reports from Bedelle by Tefera *et al*. [23], who reported the prevalence of *Strongloid* species 13.04% and 20% in sheep and goats, respectively.

The prevalence of *Ostertagia* species in the present study was 16.8 % and 24.1% in sheep and goats, respectively, which is agreed with the reports from Bedelle by Tefera *et al*. [23], who reported 26.1 % and 25% in sheep and goats, respectively. The higher prevalence of *Ostertagia* species in goats might be due to low immunity to the parasitic infections in goats and they were forced to graze grasses.

The prevalence of *Oesophagastamum* species and *Trichuris* spp. was 9.3%and 7.9% in the sheep and 8.2% and 5.3% in the goats of the study area, respectively, which is in line with work of Barsissa *et al*. [26].

The prevalence of *Bonustomum* species was 2.3% and 5.3% in sheep and goats, respectively, which is lower than reports of Esayas [15] with prevalence of 59.38% in goats of Ogaden, Hailelul [16] with prevalence of 41.86% in sheep in and around Wolaita Sodo and Yoseph [22] with prevalence of 40.48% in sheep of Asella and Tefera *et al*. [23] with prevalence of 26.1% and 35% in sheep and goats of Bedelle, respectively.

The prevalence of coccidian parasites in sheep and goats was 11.7% and 20.6%, respectively, which is lower than report from Kenya by Kanyari *et al.* [25], with prevalence of 35% and 48% in sheep and goats, respectively.

The only cestode observed in the ruminants was *Moniezia* spp, with prevalence of 13.1% in sheep and 8.8% in goats, which is lower than report from eastern part of Ethiopia by Sissay *et al.* [24], with prevalence of 61% and 53% in sheep and goats, respectively. The difference of the prevalence may be due to that the previous area was occupied by pastoralist and animals were very congested, which increase the transmission of the parasite.

The prevalence of *Chabertia spp*. was 4.2% and 8.2% in sheep and goats, respectively which is agreed with Yoseph [22], who reported a prevalence of 2.88% in sheep in and around Asella and lower than report of Tefera *et al*. [23], with prevalence of 17.4% and 25% in sheep and goats, respectively.

Prevalence by Body Condition of Host: Small ruminants with poor body conditions had higher prevalence of helminth parasites like *Haemonchus* spp., *Trichostrongylus spp., Ostertagia spp., Fasciola spp. and Paramphistomum spp.* which support the report from Kenya by Kanyari *et al.* [25] who reported animals with good body condition had lower prevalence and intensity of trematodes than those with poor body condition but the differences were not significant (P>0.05) (Table 3).

Prevalence by Sex of Host: The prevalence of *Paramphistomum* species and *Haemonchus* species was significantly higher in female sheep and goats than males (p<0.05), but for the other parasite it were not significant. Female and males were infected by *Ostertagia, strongloids* and *chabertia* by the same fashion (Table 4).

Prevalence by Age of Host: The prevalence of some GIT parasites (*Haemonchus* spp., *Strongloids* spp., coccidian spp., *Trichuris* and *chabertia* spp) were significantly higher in younger than adult small ruminants (P<0.05) where *Paramphistomum* spp, *Ostertagia* spp, *Trichostrongylus* spp, *Oesophagastamum* and *Bonustomum* spp were also higher in younger than adult sheep and goats, but statistically not significant (P>0.05). The prevalence of *Fasciola* spp. was significantly higher (p<0.05) in adults small ruminants than young small ruminants is agreed with Shrestha *et al*. [27] and Maqbool *et al*. [28], who reported significantly higher prevalence of *Fasciola* in adults animals as compared to young animals (Table 5). In general, the prevalence of many GIT parasite were higher in younger than older small ruminants, which is in agreement with Kanyari [29] and Kanyari *et al.* [25].

The Degree (Severity) of Parasitic Infection: The severity of parasitic infection in studied animals were categorized as 45(11.7%) without egg, 130(33.9%) light, 100(26.0%) moderate and 109(28.4%) heavy, which is close to the previous study by Tefera *et al*. [23] in and Around Bedelle, who was reported 137 (40.53%) were lightly, 164 (48.52%) moderately and 37 (10.95%) were massively affected.

Table 3: Respective prevalence of the observed Spp. of parasites between body condition scores of small ruminants

	Body condition				
Spp of parasite	Good (n=174)	Medium (n=182)	Emaciated (n=28)	x^2	P-value
Fasciola	13(7.5%)	23(12.6%)	9(32.1%)	7.840a	0.02
Paramphistomum	28(16.1%)	35(19.2%)	9(32.1%)	4.835a	0.188
Emeria	35(20.1%)	22(12.1%)	3(10.7%)	4.900a	0.086
Haemonchus	62(35.6%)	75(41.2%)	15(53.6%)	4.925a	0.085
Trichostrongloid	33(19.0%)	53(29.1%)	10(35.7%)	6.742a	0.059
Strongloid	38(21.8%	44(24.2%)	5(17.9%)	0.674a	0.714
Ostertagia	24(13.8%)	45(24.2%)	8 (28.6%)	7.999a	0.018
Oesophagastamum	15(8.6%)	13(7.1%)	8(28.6%)	6.158a	0.046
Bonustomum	5(2.9%)	9(4.9%)	0%	2.229a	0.328
Chabertia	1(0.6%)	21(11.5%)	1(3.6%)	19.327a	0.001
Trichuris	16(9.2%)	9(4.9%)	1 (3.6%)	3.036a	0.219
Monezia	21(12.1%	21(11.5%)	1(3.6%)	1.792a	0.408

n = number of observations

Table 4: The identified spp. of parasite in the sex groups and their respective prevalence

	Sex of s. ruminant			
Spp of parasite	Male(n=189)	Female(n=195)	x^2	P-value
Fasciola	29(15.3%)	26(47.3%)	0.316a	0.574
Paramphistomum	25(13.2%)	47(24.1%)	9.144a	0.002
Emeria	34(18.0%)	26(13.3%)	1.578a	0.209
Haemonchus	54(28.6%)	99(50.8%)	19.731a	0.001
Trichostrongloid	46(24.3%)	50(25.6%)	0.087a	0.768
Strongloid	43(22.8%)	44(22.6%)	0.002a	0.965
Oesophagastamum	16(8.5%)	18(9.2%)	0.070a	0.792
Bonustomum	8(4.2%)	6(3.1%)	0.365a	0.546
Chabertia	13(6.9%)	13(6.7%)	0.007a	0.934
Trichuris	8(4.2%)	15(7.7%)	2.040a	0.153
Monezia	25(13.2%)	18(9.2%)	1.542a	0.214
Ostertagia	37(19.6%)	40(20.5%)	0.052a	0.819

n = number of observations

Table 5: The identified spp. of parasite in the age groups and their respective prevalence

	Age group			
Spp of parasite	Adult (n=83)	Young (n=301)	x^2	P-value
Fasciola	14(16.9%)	41(13.6%)	0.559a	0.455
Paramphistomum	12(14.5%)	60(19.9%)	1.280a	0.258
Emeria	8(9.6%)	52(17.3%)	2.878a	0.09
Haemonchus	22(26.5%)	131(43.5%)	7.859a	0.005
Trichostrongloid	20(24.1%)	76(25.2%)	0.046a	0.830
Strongloid	11(13.3%)	76(25.2%)	5.343a	0.021
Ostertagia	12(14.5%)	65(21.6%)	2.067a	0.151
Oesophagastamum	6(7.2%)	28(9.3%)	0.347a	0.556
Monezia	7(8.4%)	64(21.3%)	14.561a	0.001
Chabertia	0%	23(7.6%)	6.746a	0.009
Trichuris	1(1.2%)	23(6.0%)	5.197a	0.023
Bonustomum	1(1.2%)	13(4.3%)	1.796a	0.180

n = number of observations

CONCLUSION

GIT parasites of the small ruminants in the study area has been found to be very important problem due to not only to its high prevalence, but also to its pathogenic role as well as loss of production, reducing growth rate and death of small ruminants it causes. Jimma town and its surrounding is conductive for the successive perpetuation of helminth parasites and favorable for subsequent transmission to susceptible hosts. We recommend awareness creation to the farmers in the study area on the effect of GIT parasite of small ruminants and its control.

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