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Small Ruminants Gastrointestinal Nematodiasis with Species Composition Identification in Humbo District, Wolaita Zone, Ethiopia

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Abstract

A cross sectional study was conducted from November 2017 to April 2018 in Humbo district, Wolaita zone with the objective of estimating the prevalence and risk factors associated with small ruminants' gastrointestinal nematodes parasites. A total of 384 fecal samples were examined in simple floatation method in laboratory, 218 (56.8%) were found positive for at least one types of gastrointestinal nematode parasites. The study showed that 78/159 (49.1%) of goats and 140/225 (62.2%) sheep were found infected. Based on coprological method different types of nematode eggs were identified including *Strongyle* type 189 (49.2%), *Strongyloid Spp*. 39 (10.2%), *Trichuris Spp*. 12 (3.1%) and Ascaris *Spp* 2 (0.52%) as a general in both Sheep and Goat. In the same laboratory technique *Strongyle* 55.1%, *Strongyloide* 9.8% and *Trichuris* 3.6% were recorded in Sheep while, *Strongyle* 40.9%, *Strongyloide* 10.7%, *Trichuris* 2.5% and Ascaris 1.26% in Goats were recorded. *Strongyle* and *Strongyloid Spp*. (5.5%) were commonly encountered as mixed infection followed by *Strongyle* type, *Strongyloid Spp* and *Trichuris Spp*. (2.5%). There was significant association (P<0.05) between the gastrointestinal nematode infection in animals with different species, sex, body conditions and study site. However, there was no significant difference (P>0.05) in prevalence between age groups of the animals. Gastrointestinal nematodes are observed in our finding as a problem in small ruminants that could hinder the animal performance and production system in study area. Therefore, emphasis should be given for effective prevention, control and treatment as well as creating community-based education on the associated risk factors of gastrointestinal nematodes infection in the study area.

Keywords: Humbo district; GIT nematodes; Prevalence; Small ruminants

Introduction

Gastro-intestinal nematode infection is a major problem in the world; it affects the health of millions of animals in the developing world, particularly where management system, nutrition and sanitation are poor [1]. Gastrointestinal nematode infection in small ruminants is one of the serious health problems in sub-Saharan Africa and predominantly in Ethiopia, due to suitable ecological factors for hosts and parasites such as: humidity, temperature, rainfall, vegetation and management practices. It causes huge economic loss in a different way with losses through fertility, reduced work capacity, involuntary culling, lower weight gains, lower milk production treatment costs and mortality in heavily parasitized animals [1]. But in developed world, the greatest component of impact by these nematode parasites is probably found in the cost of control.

Nematode parasites of small ruminants are principally parasites of the gastrointestinal tract. The different types of nematode parasites are frequently present as mixed infections. Small ruminants under extensive and intensive production systems are extremely susceptible to a wide range of GIT nematode helminthes of sheep and goats. In tropical and subtropical areas of the world *strongyle*s are the most important groups of parasites. The most important Species common in small ruminants are Hemonchus contortus, Trichostrongylus colibbri formis and Oesphagostumum colubanium. Several species like *Strongyloid Spp*. and Trichuri *Spp*. are less common [2]. Nematode infection is one of the major problems of the disease that difficult to easily detected and prevented by smallholder farmers and pastoralists because of subclinical nature of the infection. Thus, subclinical nematode infections are responsible for serious economic losses due to reduce production, suppress immunity, morbidity and mortality [3]. The examination GIT nematode infections in the livestock need identification of nematodes eggs or larvae by microscopic examination using the method of simple floatation or larvae culture [4].

In Ethiopia strongly suggests that GIT nematode helminthosis has distribution and is also considered as one of the major hurdles to livestock productivity. Small ruminants' gastrointestinal parasites have been reported at in different parts of Ethiopia with 91.435% in and around Kombolcha [5]; 90.9%-94.9% in Gonder [6]; 87.5% at Guto Gida district [7], and 71.9% in Ziway Dugda district [8]. 57% at Haramaya district [9], 54.1% at Benchi-Maji district [10], 43.2% at Dembia district [11], 44.90% at Kuarit district [12], 42.2% at North West Ethiopia [13] in North East Ethiopia in descending order. Such variation in distribution was suggested due to different in agro climatic conditions that could suppress the prolonged existence and development of infective stage of larvae and management [14]. However, occurrence of small ruminate GIT nematode in Humbo district, Southern Nation Nationality People Regional State, Ethiopia was not yet assessed. Therefore, the objectives of this study were to estimate the occurrence of small ruminant's gastrointestinal nematode with species identification at Humbo district.

Materials and Methods

Description of the study area

This study was conducted from November 2017 to April 2018 to estimate the prevalence of major GIT nematode parasites in small ruminants in selected areas of Humbo district of Wolaita Zone. The Humbo district is located 1100 to 2300 meter above sea level, 6° 40'N latitude and 37° 50'E longitude in South Nation Nationalities and People Regional Government (SNNPR). The climatic condition of the study area was a mean annual temperature of 22°C and mean annual rainfall of 1123.15 mm. It is bordered on the South by West Abaya woreda, North by Sodo Zuria Woreda, East by Damote Woyde Woreda, and West by Ofa Woredas with estimated number of sheep and goats is 24,562 and 80,822 respectively [15].

Study population

During study time all breeds of small ruminants in the Humbo district are expected to include for gastrointestinal nematode examination but the study area was more rural and prominently populated in indigenous or local breeds kept under traditional management systems. Sample size calculation, the sample size for the study was calculated based on the formula developed by Thrusfield [16] for random sampling method. There was no previously studied documentation of GIT nematode of small ruminants in the selected area. Therefore an expected prevalence of GIT nematode parasite of small ruminants in Humbo district was assumed as 50%.

The parameters that were used are 95% confidence interval and 5% desired level of precision. By substituting these values in the formula, the sample size that was taken is n=384. n=1.962 × Pexp (1-Pexp)/d2 Where n=the total sample size Pexp=expected prevalence d=desired precision level. Therefore, the calculated sample size was 384.

Study design

A cross sectional study was conducted from November 2017 to April 2018, to estimate the prevalence of GIT nematode parasites and identification of the major gastrointestinal nematode genera that majorly affect small ruminants.

Study methodology

Out of the total of 27 peasant associations (PAs), 6 were selected randomly from the Humbo district. PAs are the smallest administrative units in Ethiopia. The selected sites were Abelazegire, Ampo, Elakabala, Fisho, Galcha and Gututo. Equal proportions of samples were collected from each site by using random selection of farmers and animals. The animals were identified by code numbers written at the back side and ear for goats and sheep respectively. The animal species, body condition scores, estimated age group and sex were recorded as risk factors.

The age of both species was estimated by based on dentition. According to ESGPIP [17], those animals with the age of less than one year were categorized as young while those greater than or equal to one year were considered as adults. Body condition scoring of sampled animals was categorized in to three as poor, medium, and good according to the scoring method described by Kripali et al. [18]. The poor body condition was recorded, when individual spinous process was sharp to touch and easily distinguished, in addition, the bony structure of the small ruminants was easily noticeable. The eye muscles are of moderate depth. Medium body condition was recorded when the spinous process examined with very firm pressure and they were round rather than sharp. The eye muscle areas are full of moderate fat cover. Good body condition was recorded when the top and side of the back bone in loin area immediately behind the last rib and above the kidney were covered with muscles. The eye muscles were full and had a thick fat cover.

Sample collection and laboratory examination

A fresh fecal sample of approximately 10 g was collected directly from rectum of 348 small ruminants by using gloved fingers. Collected fecal samples were put in sampling bottle containing 10% formalin and all necessary information such as site, dates, species, breed, sex, age, and body condition was labeled. The collected samples were transported to Wolita Sodo Regional Veterinary Parasitological Laboratory for processing. At the laboratory fecal samples werestored in a +4°C refrigerator until processing. Then fecal samples were examined for detection of gastrointestinal nematodes eggs using standard procedure of floatation according to Charles [19]. Thus, sodium chloride solution was used as saturated salt solution for flotation method.

Statistical analysis

Microsoft excel work sheet was used to store all the collected and examined data by entering with appropriate code of variables before analysis. The coded data in the excel work sheet were analyzed by using STATA software, version 11. The nematode egg identification, average nematode infections, total nematode parasite infection, and the nematode infections of six PAs, in Humbo district were compared by STATA software package. Associations among explanatory variables (sex, age and body condition) and prevalence were done by chi-square (X2) test. In all analysis, 95% confidence intervals and $P<0.05$ were set to indicate significance.

Results

Occurrences of nematode parasites

Out of 384 small ruminants, an overall prevalence of 56.8% (218/384) gastrointestinal nematodes infection with 49.1% (78/159) with various GIT nematode infections was recorded in Caprine and 62.2% (140/225) in Ovine were recorded. In this study, the site, sex, age, species and body conditions of the animals were considered as the risk factors and all risk factors have significance difference except the age of the animals ($P<0.05$) (Table 1). Of all the sheep and goat examined in the six PAs, samples from Fisho 42/64 (65.6%), Galcha 41/64 (64.1%), and Gututo 41/64 (64.1%) showed the higher GIT nematodes infection prevalence and the samples from Elakabala 27/64(42.2%) showed low infection prevalence record. There was statistically significant difference ($P=0.032$) in prevalence of gastrointestinal nematode infection of small ruminants between the six sites (Table 2). The prevalence of GIT nematode parasite infection in Ovine was higher than in Caprine with 140(62.2%) and 78(49.1%) respectively and there was significant difference between species ($P=0.010$). Of both species of small ruminants, different age groups were equally infected by GIT nematode and no statistical significance between young and adult ($P=0.7$). Both in sex and body conditions of the small ruminants have statistical significant difference ($P<0.05$). The females 149(65.1%) were highly prone to GIT nematode infection than

male 69(44.5%) and animals with poor body condition were more vulnerable to parasite infection than both animals with medium and good body conditions.

Risk factors		No examined	No. (%) Positive	χ2	P value	OR	95% ORCI*
Site	Abelazegire	64	31(48.4)			1.3	0.64-2.6
	Ampo	64	36(56.3)			1.7	0.87-3.5
	Elakabala	64	27(42.2)	12.2	0.032	1	0.49-2.0
	Fisho	64	42(65.6)			2.6	1.3-5.4
	Galcha	64	41(64.1)			2.4	1.2-4.9
	Gututo	64	41(64.1)			2.4	1.2-4.9
Species	*Caprine*	159	78(49.1)			1	0.6-1.6
	Ovine	225	140(62.2)	6.6	0.010	1.7	1.1-2.6
Age	Adult	179	100(55.9)				
	Young	205	118(57.6)	0.1	0.7	-	-
Sex	Female	229	149(65.1)			2.3	1.5-3.5
	Male	155	69(44.5)	15.9	0.000	1	0.6-1.6
Body condition scores	Good	105	34(32.4)			1	0.6-1.8
	Medium	172	93(54.1)			2.4	1.5-4.1
	Poor	107	91(85)	60.8	0.000	11.9	6.1-23.2
	Total	384	218(56.8)				
Note: *CI was not calculated due to p>0.05.							

Table 1: Overall prevalence of small ruminant gastrointestinal nematodes in the study area. Out of total prevalence of Ovine with 140 (62.2%) and Caprine with 78 (49.1%), the age, sex and body condition scores of the animals were considered as the risk factors. Among those, the age of the animals was no statistical significance difference (P>0.05) in sheep and goat while the sex and body conditions are statistically significant (p<0.05).

Species	Risk factors		No. Examined	No of positive		χ2	P value	OR	95% CI*
Sheep	Sex	Female	146	98(67.1%)		4.2	0.04	1.7	1.0-3.2
		Male	79	42(53.1%)				1	0.5-1.8
	Age	Young	97	61(62.9)		0.032	0.9	-	-
		Adult	120	79(61.7)					
	BCS	Good	59	23(39)		27.4	0.000	1	0.5-2.11
		Medium	101	62(61.4)				2.5	1.3-4.8
		Poor	69	55(84.6)				6.1	2.8-13.5
Goat	Sex	Female	83	51(61.4)		10.66	0.01	2.9	1.5-5.5
		Male	76	27(35.5)				1	0.5-1.9
	Age	Young	82	39(47.6)		0.15	0.7	-	-
		Adult	77	39(50.6)					
	BCS	Good	46	11(23.9)		35	0.000	1	0.4-2.6

		Medium	71	31(43.7)				2.5	1.1-5.6
		Poor	42	36(85.7)				19	6.4-57.2
Note: *CI was not calculated due to p>0.05.									

Table 2: Gastrointestinal nematodes in studied spices by risk factors. Out of the 218(56.8%) positive sample for GIT nematodes, 189(49.2%) were positive for Strongyle type, 22(10.2%) positive for Strongyloid, 12 (3.1%) for Trichuris and 2(0.52%) positive for Ascaris species. Based on the floatation technique which performed in the study time for nematode egg identification four genera of gastrointestinal nematode were examined including Strongyle type 55.1% and 40.9%; Strongyloide 9.8% and 10.7%; Trichuris 3.6% and 2.5% and Ascaris 0% and 1.26% in Sheep and Goat out of (62.2%) and (49.1%) respectively.

The most prevalent nematode was *Strongyle* type followed *Strongyloid* and *Trichuris* (Table 3).

Genera of the elminth	**Sheep (n=225)**	**Goat (n=159)**	**Total (n=384)**
	No. (%) positive	**No. (%) positive**	**No. (%) positive**
Strongyle	124 (55.1)	65 (40.9)	189 (49.2)
Strongyloide	22 (9.8)	17 (10.7)	39 (10.2)
Trichuris	8 (3.6)	4 (2.5)	12 (3.1)
Ascaris	0	2 (1.3)	2 (0.52)

Table 3: Gastrointestinal nematode genera identified in infected sheep and goat.

Distribution of gastrointestinal nematode species in studied sheep and goat

In sheep with poor body condition had higher prevalence of *Strongyle*, and other less prominent helminth species (*Strongyloide* and *Trichuris*) than those with medium and good body condition and the differences were statistically significant (p<0.05). Female sheep had higher prevalence of *strongyles* than male sheep. Young sheep had higher prevalence of *Strongyle* species than adult goats. But there were no significant associations (P>0.05) between age and sex (Table 4).

Risk factors	**No. of animal Examined**	*Strongyle*		*Strongyloide*		*Trichuris*	
		No. positive (%)	**χ2 (p value)**	**No. positive (%)**	**χ2 (p value)**	**No. positive (%)**	**χ2 (p value)**
Age							
Adult	128	67 (52.3)	0.9(0.34)	15(11.7)	1.3 (0.3)	7(5.5)	3.2(0.08)
Young	97	57 (58.8)		7 (7.2)		1(1.0)	
Sex							
Female	146	86 (58.9)	2.42 (0.12)	15 (10.3)	0.12 (0.7)	7(4.8)	1.8(0.2)
Male	79	38 (48.1)		7 (8.9)		1(1.3)	
BCS							
Good	59	23 (39.0)		0		0	
Medium	101	53 (52.5)	15.7(0.00)	18(17.8)	*	2 (2.0)	*
Poor	65	48 (73.8)		4(6.1)		6 (9.2)	
Total	225	124 (55.1)		22(9.8)		8 (3.6)	

Note: *Chi-square was not calculated due to zero (0) cell.

Table 4: Distribution of gastrointestinal nematode species in studied sheep based on risk factors.

In goats, with poor body condition had higher prevalence of *Strongyle*, *Strongyloide Spp*., and *Trichuris* than those with medium and good body condition and the differences were statistically significant (p<0.05). Female goats had higher prevalence of *strongyle*s and other nematodes than male goats. Similarly, adult goats had higher prevalence of nematode species than young goats. But there were no significant associations (P>0.05) between age and sex (Table 5).

Risk factors	No. of animal Examined	*Strongyle*		*Strongyloide*		*Trichuris*	
		No. (%) positive	No. (%) positive	No. (%) positive	χ2 (p value)	No. (%) positive	χ2 (p value)
Age							
Adult	77	33.(42.9)	0.24(0.62)	9(11.7)	0.15(0.69)	2(2.6)	0.004(0.95)
Young	82	32(39.0)		8(9.8)		2(2.4)	
Sex							
Female	83	43(51.8)	8.6(0.03)	12(14.5)	2.6(0.11)	2(2.4)	0.008(0.9)
Male	76	22(28.9)		5(6.6)		2(2.6)	
BCS							
Good	46	11(23.9)	20.2(0.00)	0	*	0	*
Medium	71	25(35.2)		9(12.7)		0	
Poor	42	29(69.0)		8(19.0)		4(9.5)	
Total	159	65(40.9)		7(10.7)		4(2.5)	

Note: Ascaris ovis was observed in one each in young and adult goat of poor; *Chi-square was not calculated due to zero (0) cell.

Table 5: Distribution of gastrointestinal nematode species in studied based on risk factors.

In the coproscopic examination among the positive samples: the proportion of 77.9% *strongyle* type, 10.1% *Strongyloide*, 2.3% *Trichuris*, 0.9% Ascaris *Spp*, 5.5% *Strongyle* and *Strongyloide*, 0.9% *Strongyle* and *Trichuris* and 2.5% *Strongyle*, *Strongyloide* and *Trichuris* were encountered. The proportion of *Strongyle* type was predominantly recorded followed by *Strongyloide Spp* and *Strongyle* and *Strongyloide*. The Proportion of *Trichuris* and Ascaris *Spp* were lowest in our study (Table 6).

Infection pattern	Proportion (%) of animals infected
Strongyle only	170 (77.9)
Strongyloid only	22(10.1)
Trichuris only	5(2.3)
Ascaris*Spp*. Only	2(0.9)
Strongyle and *Strongyloid*	12(5.5)
Strongyle and Trchuris	2(0.9)
Strongyle, *Strongyloid* and Trichris	5(2.5)
Total	218 (100)

Table 6: Single to mixed parasitic infection encountered during study period.

Discussion

The present study revealed an overall prevalence of GIT nematode parasites in the small ruminants to be 56.8%, with 62.2% and 49.1% in sheep and goats, respectively. These results are in line with the findings of Ahmed et al. [9] in Haramaya district, Eastern Hararege (57%) and Tigist et al. [10] in Benchi Maji district, South west Ethiopia (54.1%) who reported the prevalence of gastrointestinal nematode in small ruminants. This study is significantly higher than the previous study of Muluneh et al. [11], at Dembia district, North West, Ethiopia (43.2%); Petros et al. [12], in Kuarit district, North West Ethiopia (44.90%) and Andualem et al. [13] in North East Ethiopia (42.2%), who reported the prevalence of gastrointestinal parasites of small ruminants. The decrease in the GIT nematode prevalence in the present study compared with the other studies in Wondimu, et al. [7] (87.5%) at Guto Gida district, Eastern Wolleaga [5] (91.435%) in and around kombolcha [6], (90.94 and 94.85%) in Gonder and in Ziway Dugda district, Eastern Ethiopia (71.88%) Jiregna, et al. [8] who reported the prevalence and identification of the gastrointestinal nematode parasites of small ruminants. This could be due to the extensive use of anthelminthic by farmers, different in agro climatic conditions that could suppress the prolonged existence and development of infective stage of larvae and management [14]. From selected PAs of the district in the current study, the highest prevalence of gastrointestinal nematode was observed in Fisho (65.6%) and the lowest prevalence was recorded in the Elakabala (42.2%), while the association between the PAs of the selected district showed statistically significant difference ($p<0.05$). This study lined with the Ahmed, et al. [9], reported the gastro intestinal nematode parasites in small ruminants and anthelmnitic efficacy in sheep of Haramaya district. This difference could be related with variation in management (that is, overstocking density of animals, poor drained and poor sanitized environment). While according to Tesfalem [20] site is not statistically significant because of animals reared in similar geographical area have equal exposure chance to infection [21].

The present study revealed that sheep was more susceptible to gastrointestinal nematode parasites than goat and statistically significant difference was recorded in species of small ruminants ($p<0.05$). This study agreed with the reports from Wondimu [7] at Guto Gida district, Eastern Wolloega. In this regard, this may be due to different habits of grazing by these two species of animals. Infact, sheep have exposure to communal grazing lands that have been contaminated by feces of infected animals [22]. Unlike this finding the reports in the eastern Ethiopia [1] informed that goats are more infected than sheep this might be due to difference in study area, which are thought to be suitable for survival of the larval stage of parasites. The present study revealed that there was no statistical difference of age of the animals in gastrointestinal parasite infections. This study agrees with the reports from Kuarit district, North West Ethiopia by Petros et al. [12], from Gambiya and semi-arid areas of Kenya by Bikila et al. [23] and from Yemisrach et al. [24], reports the prevalence and associated risk factors of sheep and goats' gastrointestinal parasites in different parts of Ethiopia. This might be as a result of equal chance of exposure for both age groups to the infective stage of the parasite as all can graze under extensive management system. But it contrary to the study conducted on the epidemiology of gastrointestinal nematode in Sheep and Goats in Ghana [25] as young animals are more vulnerable to the infection. This might be due to having weak immunity to resist infection [26]. The present study also showed female animals 65% had higher infection rates than males 44.5% and the difference was statistically significant ($p<0.05$). This related with Andualem [13], who reported the females were more susceptible to gastrointestinal nematode infection compared to males. This could be due to females are in pregnancy and parturient period loss acquired immunity and became stressed [3,27]. It disagreed with study of Regassa, et al. [1] in Ethiopia, who conducted study on epidemiology of gastrointestinal parasites of ruminants in Western Oromia and Tesfalem [20] who studied the prevalence of ovine gastro intestinal parasites at Meskan district. The report of Tesfalem [20] revealed that males are more prone to GIT nematode infection due to the difference in behavior, morphology or physiological status of sex. The female is more resistant to infection of nematode, this might be due to the stimulatory effect of estrogen hormone on immune response, while males are more susceptible to the infection because of androgen hormone suppress immunity [28].

Difference in body condition score is statistically significant ($P<0.05$) with gastrointestinal nematode infection such that shedding of nematodes eggs increased with poor body condition (81.3%) than in good body condition (61.5%). This finding lined with report from Asela South Eastern Ethiopia by Deriba [29] and report in and around Wolaita Southern Ethiopia, by Yemisrach et al. [24] suggested that well-fed animals develop good immunity that suppresses the fecundity of the parasites and animals with good body condition had lower prevalence of gastrointestinal parasites than those with poor body condition [30]. But animals with poor body condition have weak immunity compared to others and might be resulted from malnutrition or other concurrent disease that suppress the immunity [31]. Both sheep and goat with poor body condition tend to harbor a significantly higher *Strongyle* infection rate than those of sheep and goats with medium and good body conditions. The difference was statistically significant ($p<0.05$), which is lined with the previous study [10]. The reason might be due to the *Strongyle* infection itself or other concurrent diseases or nutritional constraints. The prevalence of *Strongyle* infection was higher in young and female sheep and goat than adult and male sheep and goat respectively. But there was no statistical significance ($p>0.05$). Moreover, it is widely expected that *Strongyle* are the most common nematode helminthes reported in small ruminants followed by *Strongyloide* and *Trichuris*. Thus, our findings were 77% *Strongyle* type, 10.1% Strongyliode, 2.3% *Trichuris* and 8.9% mixed nematode infections in both sheep and goat. The predominant mixed infections were *Strongyle* and *Strongyloide*. The present investigation was well agreed with the previous work performed in different parts of Ethiopia including 70.2% *Strongyle*s type in Western Oromia [1] and 8.33% *Strongyloide* and 3.13% *Trichuris* in Ziway Dugda district [8]. The collective predominance of *Strongyle* type might be due to high biotic potential to acquire faster resistant than other nematodes [32].

Conclusions and Recommendations

The gastrointestinal nematode parasites are found livestock health problems including for small ruminants and are responsible for economic losses due to reduced production, morbidity and mortality. In present carpological prevalence of small ruminate GIT nematode species which are predominated by *Strongyle* type and *Trichuris* shows the significant effects in the studied area. Moreover, mixed infection of small ruminants with more than one nematode infection indicated the possible challenges to small ruminant production sectors from economic points of view. Thus, strategic deworming of both sheep and goat with broad spectrum anthelminthic could reduce and effective to treat the mixed infection, too.

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