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Prevalence and Risk Factors of Gastro Intestinal Parasitesof Small Ruminants in Sinana and Dinsho Districts of Bale Zone, South Eastern Ethiopia

Kemal Kedir Elemo and Minda Asfaw Geresu

College of Agriculture and Natural Resources,
Animal and Range Sciences Course Team, MaddaWalabu University, Bale-Robe, Ethiopia

Abstract: A cross-sectional study was conducted to determine prevalence and associated risk factors of gastrointestinal parasites of small ruminants in Sinana and Dinsho Districts of Bale Zone, South Eastern Ethiopia from October, 2014 to May, 2015. For this purpose, a total of 576 faecal samples (259 from Sinana and 317 from Dinsho) were coprologically examined for gastrointestinal parasites infections giving an overall prevalence of 52.78%. Coprological examinations revealed prevalence of *Strongyles* (52.64%), *Eimeria* Oocyst (13.66%), *Trichuris* (12.02%), *Fasciola* (7.10%), Strongyloides (4.74%), lung-worm larvae (4.01%), cestodes 3.64%) and *Paramphistomum* (2.19%). Risk factors analysis revealed that prevalence of gastrointestinal parasites was significantly (P< 0.001) associated with the origin, age, sex, body condition and deworming. Accordingly, origin, sex of animals, body condition and deworming significantly enhances the risk for gastrointestinal infection. Hence, female sheep/goat (OR= 2.546, 95% CI: 1.673, 3.876), poor body condition scores (OR= 7.588, 95%CI: 3.690, 14.539) and non-dewormed animals (OR= 4.470, 95%CI: 2.788, 7.166) were more likely to be infected with gastrointestinal parasites than corresponding animals. Greater proportions of the examined animals were lightly infested (80.38%), followed by moderate (11.11%) and massive infestation (8.68%). The study showed that GIT parasites of small ruminants are prevalent in the study area. Thus, further studies on economic losses and emphasis should be given to awareness creation about the strategic deworming and other management practices in the study area.

Key words: Dinsho · GIT Parasites · Prevalence · Risk Factors · Sinana · Small Ruminants

INTRODUCTION

Parasitic diseases represent a major problem for the health of small ruminants and hamper the poverty alleviation programs in livestock farming system in the developing countries [1]. Helminthiasis of domestic ruminants are of major importance in many agro-ecological zones in Africa, but their impact is greater in Sub-Saharan Africa in general and Ethiopia in particular due to availability of a wide range of agro-ecological factors suitable for diversified hosts and parasite species[2]. Parasitic infections in small ruminants are among serious problem in the developing countries, particularly where nutrition and sanitation standards are generally poor. Gastrointestinal parasites pose a serious health threat and limit the productivity due to the associated morbidity, mortality and cost of treatment and control measures [3]. They can also results in low productivity due to stunted growth, poor weight gain and poor feed utilization [4]. Helminthiasis adversely affects ruminants, causing hematological and biochemical disturbances [5], anorexia, weight loss, poor reproductive performance and even death of lambs [6]. Studies have shown that GIT parasites are by far the most serious causes of production losses in farmed ruminants and helminthes are indisputably the cause of serious production losses to ruminants in sub-Saharan Africa [7-9]. Hence, the disease deserves special attention as it diminishes the capacity of sheep and goats to achieve their inherent potential level of production for any given feeding and management regimen.

Review of the available literature in Ethiopia strongly suggests that helminthosis is nationwide distribution and is also considered as one of the major setbacks to livestock productivity incurring huge direct and indirect

Corresponding Author: Kemal Kedir Elemo, School of Agriculture and Natural Resources,
Animal and Range Sciences Course Team, Madda Walabu University, Bale-Robe, Ethiopia.
Cell: +251934771251, E-mail: kkedir8@gmail.com.

losses in the country [10-13]. However, there is lack of well established data on the magnitude, distribution and predisposing factors of sheep and goats GIT helminthes parasites in Bale zone in general and in Sinana and Dinsho district in particular. Therefore, this study was designed to determine prevalence of major GIT helminth and to investigate the associated risk factors.

MATERIALS AND METHODS

Description of Study Area: The study was conducted in two selected districts of Bale zone. The selected sites were: Sinana and Dinsho districts. Sinana district is located at 430 Km southeast of Addis Ababa. The area is situated at 7°7' N and 40°10' E and 2400 masl. The mean average rainfall of the area is 353 mm. For the same period, average annual maximum temperature is 21.2°C and minimum temperature is 9.4°C. The dominant soil type is pellicvertisol and slightly acidic (pH = 6). There are about 287,825 heads of cattle, 47,121 Sheep, 12,600 goats, 9,163 horses, 14,015 donkey, 2,800 mules, 60,000 poultry and 13,690 beehives in Sinanaworeda Agricultural Office [14]. Dinsho district is located at 400 Km south east of Addis Ababa. The area is situated at 2500-3300 masl. The average rainfall of the area is 1200 mm. Average annual maximum temperature is 26°C and minimum temperature is -2°C. Agricultural production system of the study area is mixed farming. There are about 69,515 heads of cattle, 63,355 Sheep, 9,616 goats, 18,461 horses, 6,949 donkey, 358 mules and 25,666 poultry in Dinshoworeda Agricultural Office [15]. Mixed crop/livestock production system is the main form of agriculture in both study areas. Most families are also involved in livestock farming, especially sheep andgoats.

Study Population and Animals: The study population was all local indigenous sheep and goats in two districts in selected kebeles and households. They are local indigenous breeds, which are managed under extensive system. The study animals were consisting of 576 small ruminants (479 sheep and 97 goats) selected by simple random sampling method from smallholders.

Study Design: A cross-sectional study design was conducted to determine the prevalence of gastrointestinal parasites of small ruminants and to investigate potential risk factors associated with the infection. The animals' body condition scores, estimated age, sex, origin, species and anthelmentics usage (deworming) were recorded as potential risk factors.

Sampling Method and Determination of Sample Size: Sampling was conducted using simple random sampling method to select individual sheep and goats. The sample size required for the study was calculated according to the formula given by Thrusfield [16] for simple random sampling.

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

Where:
n = required sample size,
Pexp = expected prevalence and
d = desired absolute precision

Since there is no reasonable research done in this area so far; the sample size is calculated using a method recommended by Thrusfield [16] with 95% confidence interval, at 5% desired absolute precision and expected prevalence of 50%. Accordingly; the total numbers of sample required for this study was 384 sheep and goats, butto increase precision of the study and representativeness of the sample, 576 sheep and goats were sampled. Since the prevalence of GIT parasites was not known previously in the area, seven kebeles (lowest administrative structure) were randomly selected using a lottery system out of the 14 kebeles with high concentration of sheep and goats in the district. Proportionality of incorporating sheep and goats in the sample was applied as per the population size of each district and kebeles.

Sample Collection and Coprological Examination

Faecal Sample Collection: Fresh faecal samples of approximately 10 g were collected directly from the rectum of sheep and goat using gloved finger. The faecal samples were placed in a clean, dry, leak-proof and transparent universal bottle and 10% formalin will be added to preserve parasite eggs. Each sample was clearly labeled with animal identification, date and place of collection. Those samples which are not examined within 24 hours of arrival at laboratory were stored at +4 °C until processed.

Coprological Examination: The collected faecal specimens were processed and examined by direct faecal smear, floatation and sedimentation techniques for qualitative investigation of GIT eggs and oocyst following the standard procedures. Eggs of the

different parasites were identified on the basis of their morphological appearance and size [17]. Those samples found positive for *Strongyle* by flotation were subjected to Mc master counting technique. The floatation solution used was saturated solution of sodium chloride. Based on quantitative examinations (egg per gram of faeces), the degree of infestation was categorized as light, moderate and massive. Egg counts from 50-799, 800- 1200 and over 1200 egg per gram of faeces were considered as light, moderate and massive infestation respectively [18-20].

Data Analysis: All data collected were entered into a Microsoft Excel spreadsheet and checked for accuracy. After validation, data were transferred to STATA version 11.0 for Windows (Stata Corp. College Station, TX, USA) for analysis. The response variable considered in the analysis of our data was parasite infection status and the potential risk factors considered were age, origin, sex, species and anthelmentics usage (deworming). Prevalence was calculated as a percentage value. The association between the independent factors and the prevalence of gastrointestinal parasites was evaluated using the Chi-square test (x^2). Multivariate logistic regression analyses were used to analyze the effects of different potential risk factors on the prevalence of GIT parasites. Odds ratio (OR) was utilized to measure the degree of association between potential risk factors with gastrointestinal infection prevalence. The 95% confidence interval and a P <0.05 was considered statistically significant.

RESULTS

Prevalence of Major GIT Parasites: Out of the 576 small ruminants examined, 304 were found positive with one or more gastro intestinal parasite eggs and oocysts, giving an overall prevalence of 52.78%. The prevalence was higher in goats 56/97 (57.73%) than sheep 248/479 (51.77%), however, with no statistical significant difference (P>0.05) in prevalence of gastrointestinal parasites between two species. The frequency of gastrointestinal parasites was significantly higher at Dinsho district, 59.62% (189/317) than in Sinana, 44.40% (115/259) (P<0.001). Prevalence of gastrointestinal parasites was significantly associated with the origin, age groups, sex, body condition and deworming (P < 0.001) as presented in Table 1.

Table 1: Overall prevalence of GIT parasites and their association with various risk factors

Factor	Total No. tested	Prevalence (%)	x^2 (*P* value)
Origin			
Dinsho	317	189 (59.62)	13.248 (<0.001)
Sinana	259	115 (44.40)	
Species			
Sheep	479	248 (51.77)	1.149 (0.284)
Goat	97	56 (57.73)	
Age			
Young	112	76 (67.86)	12.685 ((<0.001)
Adult	464	228 (49.14)	
Sex			
Female	390	238 (61.03)	32.965 ((<0.001)
Male	186	66 (35.48)	
Body condition			
Poor	86	68 (79.07)	71.034 ((<0.001)
Medium	296	178 (60.12)	
Good	194	58 (29.89)	
Deworming			
Present	136	33 (24.27)	58.076 ((<0.001)
Absent	440	271 (61.59)	
Overall	576	304 (52.78)	

Multivariable Logistic Regression Analysis of Risk Factors Associated with GIT Parasites: Logistic regression analysis of the effect of different risk factors on the prevalence of gastrointestinal parasites is depicted in Table 2. Accordingly, origin, sex of animals, body condition and deworming significantly enhances the risk for gastrointestinal infection. Hence, female sheep/goat (OR= 2.546, 95%CI: 1.673, 3.876), poor body condition scores (OR= 7.588, 95%CI: 3.690, 14.539) and non-dewormed animals (OR= 4.470, 95%CI: 2.788, 7.166) were more likely to be infected with gastrointestinal parasites than male, good body condition and dewormed animals.

Prevalence of Gastrointestinal Parasites Within Kebeles: The number of animals tested within each 7 study kebeles and proportions found to be positive for gastrointestinal parasites are depicted in Table 4. Gastrointestinal parasite prevalence with in selected kebeles was highest in Soba followed by Gofingira, Homa, Garamba Dima, Horaboka, KabiraShaya and Basaso.

Table 2: Multivariable logistic regression analysis of risk factors with prevalence of GIT parasites.

	GIT parasite Test result		Odds ratio		
Factor	Total No. tested	Prevalence (%)	COR (95%CI)	AOR (95% CI)	P value
Origin					
Dinsho	317	189 (59.62)	1.849 (1.326, 2.578)	1.860 (1.273, 2.719)	0.001
Sinana	259	115 (44.40)	1	1	
Age					
Young	112	76 (67.86)	2.185 (1.413, 3.381)	1.593 (0.957, 2.650)	0.073
Adult	464	228 (49.14)	1	1	
Sex					
Female	390	238 (61.03)	2.847 (1.981, 4.092)	2.546 (1.673, 3.876)	(<0.001
Male	186	66 (35.48)	1	1	
Body condition					
Poor	86	68 (79.07)	8.858 (4.844, 16.200)	7.588 (3.960, 14.539)	(<0.001
Medium	296	178 (60.12)	3.537 (2.406, 5.201)	2.902 (1.914, 4.400)	(<0.001
Good	194	58 (29.89)	1	1	
Deworming					
Absent	440	271 (61.59)	5.005 (3.234, 7.745)	4.470 (2.788, 7.166)	0.000
Present	136	33 (24.27)	1	1	

COR, Crude Odds Ratio; AOR, Adjusted Odds Ratio; CI, Confidence Interval; 1, Reference.

Table 3: Prevalence of gastrointestinal parasites in selected kebeles of the study districts.

Selected kebeles	Positive samples (N)	Negative samples (N)	Total	Prevalence (%)
Sinana				
Horaboka	52	58	110	47.27
Basaso	27	39	66	40.91
KabiraShaya	36	47	83	43.37
Dinsho				
Homa	50	34	84	59.52
Soba	46	28	74	62.16
GarambaDima	54	39	93	58.06
Gofingira	41	25	66	62.12

Table 4: Prevalence of the different type of parasites identified at coproscopic examination

	Type of Parasite (%)						
Species	*Strongyle*	*Eimeria*	*Trichuris*	*Fasciola*	*Strongyloides* Lungworm larvea	*Cestodes*	*Paramphistomum*
Sheep	233(52.48)	59(13.29)	53(11.94)	32 (7.21)	21 (4.73) 19 (4.28)	17(3.83)	10(2.25)
Goat	56(53.33)	16(15.24)	13 (12.38)	7 (6.67)	5 (4.62) 3 (2.86)	3 (2.86)	2(1.90)
overall	289(52.64)	75(13.66)	66 (12.02)	39(7.10)	26 (4.74) 22 (4.01)	20(3.64)	12(2.19)

Table 5: Prevalence of gastrointestinal parasite and degree of egg per gram of faeces.

		EPG Category (%)			
Species	Prevalence (%)	Low	Moderate	Severe	Total
Sheep	248(51.77)	396 (82.67)	51 (10.65)	33 (6.89)	479
Goat	56 (57.73)	67 (69.07)	13 (13.40)	17 (17.53)	97
Total	304 (52.78)	463 (80.38)	64 (11.11)	50 (8.68)	576

Prevalence of the Different Type of Parasites Identified at Coproscopic Examination: From the feces of 576 sheep and goats subjected for coproscopy, 304 (52.78%) were found to have eggs of different parasites in the following proportions: *Strongyles*, 52.64%; *Eimeria* oocyst, 13.66%; *Trichuris*, 12.02%; *Fasciola*, 7.10%; *Strongyloides*, 4.74%; lung-worm larvae, 4.01%; cestodes, 3.64% and *paramphistomum*, 2.19% (Table 4).

Prevalence of Gastrointestinal Parasite and Degree of EPG: The results of quantitative examination of eggs using modified McMaster method are presented in Table 5. An attempt was made to classify the severity of infection based on the level of EPG. It was found that 80.38% of the animals were lightly infected, 11.11% were moderately infected and the rest, 8.68% were severely infected.

DISCUSSIONS

The present study unveiled an overall prevalence of gastrointestinal parasites of small ruminants in Sinana and Dinsho districts were 52.78%. The current finding is lower than the report of Achenef [21] from Debre Berhan, Moti [22] from Welinchity, Ntonifor *et al*. [23] from Cameroon,Gizachew *et al*. [24] from Bako town, who indicated prevalence rate of 79.09%,76.3%, 66.9% and77.4%, respectively. However, it is higher than the report of Negasi *et al.* [11] who disclosed prevalence rate of 48.21% from Northern Ethiopia. The difference in prevalence reports of gastrointestinal parasites in the present study and other reports could be attributable to differences in farm management practices, level of production, individual animal factors, origin and differences in study methods and materials employed by the investigators. The relatively higher prevalence rates in the study area and other parts of the country might be due to poor management systems, over stocking, existence of unfavorable climatic or environmental factors that could support prolonged survival and development of infective larval stage of most helminthes and animals are mostly managed under extensive management system in which large numbers of the animals are kept together. This could increase the degree of pasture contamination leading to high prevalence rates.

The current study has shown the presence of mixed infection characterized by the presence of two or more gastrointestinal parasites both in sheep and goats which agrees with the findings of other researchers in the country [24-27]. These Mixed infections have been suggested to be an important cause of morbidity and loss of production in sheep and goats [26]. Moreover, the presence of interaction and compromization of the immune system of the host by mixed infections described increase in their susceptibility to other diseases or parasites [28].

The most prevalent GIT parasites were the *Strongyles*, *Eimeria* oocyst and *Trichuris*. This finding is in accordance with a number of findings obtained in different parts of the country in which strongyle eggs were dominant. Abebe and Eseyas [25] and Regassa *et al*. [29] reported a high prevalence rate of Strongyle infection followed by *Eimera* oocyst and *Trichuris* in eastern and western parts of Ethiopia. The contributing factors towards high prevalence rate in different parts of the country might be attributed to favorable agro ecology which is suitable for survival and transmission of the parasites. Furthermore, poor farm management practices leads to higher prevalence rates.

The prevalence of gastrointestinal parasites was significantly associated with origin of animals ($P<0.001$). Thus, prevalence was relatively higher in Dinsho (OR = 1.860) than Sinana district. Significant association of origin with gastrointestinal parasites was reported by other authors [23, 29]. The difference in prevalence reports of gastrointestinal parasites in the present study could bedue todifferences in husbandry practices within the extensive management systems and agro ecological factors in the two study areas.

Higher prevalence rate was recorded in goats (57.73%) compared to sheep (51.77%), but with no significance association between the two species. The higher prevalence rate in goats compared with sheep is in agreement with report from eastern Ethiopia and Western Ethiopia [25, 29]. This might be attributed to differences in feeding habit of these two species of animals and poor veterinary infrastructure and medication to goats. More importantly, the condition could be due to less or slow development of immunity in goats to gastrointestinal parasites compared with the situation in sheep. The latter faced prolonged challenge over generations, but in goats, the declining of sufficient browsing area and expansion of crop agriculture forced them to graze with sheep that had good resistance.

Higher prevalence rate was recorded in younger animals (67.86%) than adults (49.14%) with significant association differences ($P < 0.001$) with the prevalence of the parasites. This finding is in agreement with most literatures, Keyyu *et al*. [30] and Githigia *et al*. [31] from different corner of the world. This could be due to the fact that younger animals are more susceptible than adult

counter parts. Adult animals may acquire immunity to the parasites through frequent challenge and expel the ingested parasite before they establish infection [20]. But the findings of this study are inconsistent with reports from Gambia where adults and older animals bear high worm burden [32].

The prevalence of gastrointestinal parasites varied significantly (P<0.001) among sex of animals, where higher prevalence was recorded in female (61.03%) than male (35.48%). Female animals had shown to have a significant effect (P<0.001, OR=2.546, 95% CI = 1.673, 3.876) on the prevalence of gastrointestinal parasites. It is assumed that sex is a determinant factor influencing prevalence of parasitism [33] and females are more prone to parasitism during pregnancy and per-parturient period due to stress and decreased immune status [20]. Dagnachew *et al.* [34] reported a higher prevalence of helminth infection in females.

There was a significant difference (P < 0.001) in prevalence of gastrointestinal parasites in relation to body condition of the animal. The highest prevalence rate was recorded in poor body condition. Odds ratio indicated that animals with poor body condition were 7.588 times more likely to be exposed to gastrointestinal parasites than those with good body condition. This result was in agreement with Keyyu *et al.* [30]. Poor body condition might be due to malnutrition, other concurrent disease or the current parasitic infection which lead to poor immunological response to infective stage of the parasites.

Sheep and goats that were not dewormed had higher infection rates(61.59%) compared to dewormed (24.27%).The multiple logistic regression analysis also revealed significant association of non dewormed animals (OR=4.470, 95%CI= 2.788, 7.166, p<0.001) with prevalence of gastrointestinal parasites.The current result is in agreement with the finding of Rahmeto *et al*. [3] and Gonfa *et al.*[12]. Anthelmentics usage is crucial elements influencing the development, distribution and survival of parasites[3]. Analysis of the degree of infectionby gastrointestinal parasites as determined by EPG of faeces showed that greater proportion of study animals (80.38%) were with low EPG whilefewer with moderate (11.11%) to severe EPG (8.68%).The results for relative severity of *Strongyle* parasitic infestation in studied animals were in accordance with a previous study by Tefera *et al*.[27] in and around Bedelle, Western Ethiopia and Bikila *et al.* [35] from Gechidistinict of south west Ethiopia. These differences might be due to the influence of host variations and differences in husbandry practices within the extensive management systems. The quantity of eggs determined by the level of EPG irrespective of the species of animals involved in creating continuous contamination of the pasture and availability of infective larval stages to animals in the study districts.

CONCLUSION

In the present study, gastrointestinal parasites were prevalent in small ruminants in the study districts. Our investigation here provided basic data on the prevalence of GIT parasites and associated risk factors in study areas. The prevalence of GIT parasites were the major biological constraints contributing to the low productivity of small ruminants and hampered the economic benefit obtained from the sector. The observation of poly parasitism with relatively higher prevalence and overall egg per gram of faeces and suggests the presence of favorable environmental conditions for survival, infection and perpetuation of helminths of small ruminants in Ethiopia. Origin, sex, age, body condition score and antihelmintic usage were found to be risk factors significantly related to GIT parasite prevalence. Determination of prevalence and associated risk factors has significant importance both for the choice of treatment of the affected animals as well as for devising effective measures against risk factors. Hence, a detailed study on the species composition, epidemiology, pathogenecity, treatment and control strategies to the most economically important species of helminths in small ruminants is highly recommended.

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