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Prevalence of Gastrointestinal Parasites of Small Ruminant in Sodo Zuria District, South Ethiopia

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Abstract

This study was aimed at investigating the prevalence of gastrointestinal parasites of small ruminants and identifying the most prevalent species of sheep and goats in Sodozuria district. A total of 395 fecal samples of sheep and goats consisting of 107 goats and 288 sheep were examined, 113 (28.60%) were harboring one or more different species of gastrointestinal parasites. The prevalence rate for goats was 24(22.42%) while for sheep was 89(30.90%). The gastrointestinal parasite species encountered for goats were Fasciola (21.49%), Coccidia (17.75%), Monezia (10.28%) and Paramphistomum (7.47%), Haemonchus (6.54%), Trichostrongylus (4.67%) and Trichuris (1.87%) while for sheep were Coccidia (30.90%), Fasciola (18.75%), Monezia (15.62%), Haemonchus (10.76%), Paramphistomum (9.72%), Trichostrongylus (9.37%), Bonustomum (5.55%) esophagastamum(4.86%) and Trichuris (4.16%). Female sheep (17.36%) and goats (17.76%) were found to have significantly higher rate of infection (p = 0.007) than the male sheep (13.54%) and goats 5 (4.67%). Highest prevalence of gastrointestinal parasites was observed in poor body conditioned small ruminants, out of 288 sheep examined 57(19.79%) and from 107 goats sampled 18(16.83%) followed by medium 26 (9.03%), 5(4.67%) sheep and goats respectively (P = 0.000). The older sheep and goats were more infected 86(21.77%); compared to the younger sheep and goats 27(6.83%) (P>0.05). The data obtained in this study suggest that the age, sex, and body condition were important factors which influence the prevalence of gastrointestinal parasites. Finally, based on the results obtained, effective and well planned control measures should be implicated by conducting extension programs of farmers regarding natural methods and proper use of anthelmintics.

Keywords: Goats; Gastrointestinal parasite; Sheep

Introduction

Small ruminants have an important role in sustainable agriculture in developing countries and support a variety of socioeconomic functions worldwide. Gastrointestinal parasites are highly prevalent in sheep and goats in humid subtropical and tropical areas of the world [1, 2]. The effect of infestation by gastrointestinal parasites varies according to the parasite concerned, the degree of infestation and other risk factors such as species, age, season and intensity of worm burden [3, 4]. Gastrointestinal parasites can result in economic losses through infertility, reduction in food intake, lower weight gains, treatment costs and mortality in heavily parasitized animals [5, 6, 7].

Sustainable food production is an increasingly important challenge for the world's expanding population. Population growth and increased consumer demand in developing countries has resulted in an increase in the consumption of animal products such as meat and dairy [8, 9]. Consequently, sustainable livestock production has an important role in food and environmental security [10, 11, 12, 13]. Sheep and goats are an important commodity for small holder farmers across east Africa and play an important role for home consumption, are a source of cash income for products such as meat, milk, wool, hides, and manure, and have a significance in their social value [14, 15, 16]. Additionally, small ruminants are of benefit to smallholder farmers because of their adaptation to harsh environments and their reproductive success with a short gestation period [17, 18]. In 2017, in Ethiopia, there were estimated to be approximately 30.7 million sheep and 30.2 million goats [18]. Indeed, the number of smallholder farmers that rely on livestock for their livelihood continues to grow [10, 11, 19].

However, many constraints remain to small ruminant production, including poor housing system, malnutrition, poor production system, management practices, burden of parasitic diseases [20, 21], limitations in access to animal health products and services [17, 22, 23], a lack of good quality grazing due to bush encroachment and urbanization [24, 25, 26], increasing episodes of drought, ineffective disease control [27, 28, 29], and limited access to markets [30]. Additionally, funding for the livestock sector is often under-represented and under-appreciated. Consequently, many poor livestock owners remain trapped in poverty, without the interventions that may enable their development [31, 32].

Livestock play a vital role in agriculture economy, but due to poor management practices chances for parasitic infections increase [33]. Grazing is the most common feeding method used for sheep and goat; so, there are chances of higher worm load. Pastures are considered the most suitable locale for transmission of parasites, as most parasites hibernate in pastures and complete their lifecycle by gaining entry in the animal body. Parasites can inversely affect livestock and cause damage by reducing wool and hair growth, as well as cause blood loss and reduced body growth. Among parasitic infections that cause huge economic losses to the livestock industry, are those due to endoparasites (roundworms, tapeworms, flukes and coccidia), which are the most severe [34]. Among endoparasites, Heamoncus (H.) contortus is the biggest threat to the livestock and sucks blood (approximately 0.05 ml blood per worm per day) from abomasum directly [35]. Different studies have shown that losses caused by these parasites are more severe as compared to other infections [36].

Prevalence of parasites depends on a variety of factors as environment, volume and height of pasture, geographical location, grazing habits, nutritional status of host and immunological factors. Along with breed, age, and epidemiological data (of both husbandry practices and physiological factors), involvement of parasitic species are important factors affecting the prevalence of parasites [37]. In small ruminants, parasitic infections cause decrease in resistance against diseases, improper feed utilization and decrease in weight gain [38]. Gastrointestinal parasites directly affect the host by disturbing metabolism, feeding on blood and causing damage to the intestinal wall [39]. These parasites are also responsible for low food conversion ratio, low food absorption by intestinal wall and decreased appetite [40]. Parasitic infection may lead to production losses as decrease in growth rate and reproduction [41] as well as resulting in compromising the immune status of host and in turn increasing animal susceptibility for harmful pathogens [42]. Frequency of parasitic infections in sheep depends upon factors that include host breed, parasite species, epidemiological data, host age, humidity, parasite developmental stages, rainfall, temperature managemental practices and geography [1].

For the control of gastro intestinal parasites in small ruminants especially reared by resourcepoor farmers, it is better to identify the burden and

types of helminthes along with specific risk factors associated with helminthosis of specific area [43]. Breakdown of life cycle of gastro intestinal parasites is the main goal in attempting the control of parasitic infection. Use of anthelminthicsand proper management (of both animals and pastures) help to disturb the life cycle of gastro intestinal parasites. Specific combination of these factors usually gives the best results for control of GI parasites [44]. In developing countries, anti-parasitic drugs are used lavishly for the control of parasitic infections especially by smallholder farmers, leading to the development of resistance. Other factors responsible for development of resistance are: poor efficacy of anti-parasitic agents, inadequate dose level, low protein diet and environmental toxicity [45]. Development of resistance against anthelminthics and their residual effects stimulate scientists to investigate alternative sources to control parasitic infection and to improve public health [46].

Keeping in view the limitations of chemotherapy, alternative solutions like biological control of parasites, use of vaccines and development of resistant host genotypes are being considered. During the past decade, use of plants with anthelmintic properties (ethnoveterinary medicine) is also under consideration around the world [47, 48, 49, 50, 51]. A number of plant species with anti-parasitic properties were identified. Fundamental mechanisms involved in inducing these effects were not completely investigated but they may consist of direct, indirect, or combined effects [52]. In direct effects, components of plants disturb the regular physiological functions as reproduction, food absorption and mobility of gastro intestinal parasites by directly interacting with their surface proteins [53]. In indirect effects, condensed tannins released by plants build complexes with proteins and are passed to the abomasum without ruminal degradation. In the abomasum dissociation of these complexes releases proteins that are ready for absorption [54].

For better control of parasitic infections, environmental factors and proliferating velocity of parasites should be taken into consideration. Although drugs used against parasites are of great value, but the increasing resistance to these drugs (because of their broad spectrum and excessive use), cost of drugs and their remnants in blood and meat are the leading causes to find an alternative source to overcome these problems [55, 56]. Although considerable work has been done on endoparasites of sheep and goats in many parts of Ethiopia [57, 58, 59, 60, 61] and losses from clinical and sub-clinical level including losses due to inferior weight gains, lower milk yields, condemnation of organs and carcasses at slaughter and mortality in massively parasitized due to parasitic diseases were documented [59, 62]. However, very limited or no report so far has been published on the prevalence of small ruminant helminthosis and associated risk factors that influence their transmission which can in turn give us the basis for developing an efficient and effective strategic and tactical control measures of these diseases adopted by small landless marginal farmers in the SodoZuria district. Therefore the objectives of this study were:

- To determine the prevalence of small ruminant parasites in the study area
- To identify most prevalent species of small ruminant parasites

MATERIALS AND METHODS

Study Area

This study was conducted from November 2022 to June, 2023 at SodoZuria district. Sodozuria district is located in south Ethiopia region and is situated 390 km south of Addis Ababa. The altitude ranges from the lowest at the foot of Omo river valley 501 m.a.s.l to highest 2,950 m.a.s.l at peak of Mount Damota and geographically located between 6°36’N to 7°18’N latitude and 3712’E up to 38 24’E longitude. It experiences an average annual rain fall ranging from 450 to 1,446 mm. The rainfall over much of the areas is typically bimodal with the major rainy season extending from June to September and the short rainy season occurring from February to April.

The mean annual maximum and minimum temperature of the area is 34.1 and 11.4°C, respectively. The main economic source in the area is mixed farming system and the area has moderately drained acidic red soils. The livestock population of Sodozuria is estimated to be 241,456 bovines, 25,940 ovine, 5,567 caprine, 1,801 equines and 134,428 poultry [63, 64].

Study Population

The study animals included in present study were sheep and goats in the house holds of Sodozuria district. Animals of different breeds, age, sex and body condition were included. The age of the animal was estimated on the basis of the dentitions. Age categorization into young and adult was performed as described by Gatenby (1991) [65], for sheep and Steele Steele (1996) [66], for goats. Accordingly those sheep and goats under 1 year were categorized as young and adults are above one year. The body condition score was given by according to the rule of (Nicholson and Butterworth, 1986) [67]. Based on this animals was categorized as good, medium and poor body conditioned. Animals which score (2, 3 was categorized as poor/lean); (4, 5, 6, was medium) and (7 was classified as good/fat).

Sampling method and Sample Size Determination

The sample size was determined by using 50% expected prevalence since there was no previous study conducted in the SodoZuria district. The desired sample size for the study was calculated using the formula given by Thrusfield (2005) [68] at 95% confidence level and 5 % absolute precision. Therefore based on the formula a total of 384 sheep and goats were examined.

n = 1.96 2 *Pexp (1-Pexp) d 2 Where; n = required sample size Pexp = expected prevalence d = required precision (usually 0.05)

Laboratory Examination

Fecal samples was collected directly from the rectum of each sheep and goats, using disposable plastic gloves and placed in clean universal bottle and each sample was labelled with identification number, age, sex, body condition, date and origin. Then samples were taken to WolaitaSodo University laboratory and in the laboratory the samples were subjected to sedimentation, floatation, Modified McMaster and coproculture techniques and identification of the third larvae by the method described by [69, 70, 71, 72, 73, 74, 75].

Data management and analysis

The prevalence was calculated by dividing the number of animals harboring a given parasite by the total number of animals examined. In addition to this, the number of worm EPG of feces was categorized and the result thus obtained was analyzed to determine prevalence using SPSS version 20. 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 was held at 95% and $P<0.05$ was set for significance.

RESULTS

The overall prevalence of gastrointestinal parasites found in sheep and goats in SodoZuria district is as shown in table 1. From 395 small ruminants (288 sheep and 107 goats) examined, 113 (28.60%) were harboring one or more gastrointestinal parasites. A total of 107 goats were sampled in the SodoZuria district, 24 (22.42%) goats were infected with various species of gastrointestinal parasites while 83 goats were not found to be infected. A total of 288 sheep were sampled in the area, 89 (30.90%) sheep were infected with various species of gastrointestinal parasites. The study reveals 108(27.34), 77(19.49%), 57(14.43%), 38(9.62%), 36(9.11%) and 32(8.10) overall prevalence with Coccidia, Fasciola, Monezia, Haemonchus, Paramphistomum and Trichostrongylus species respectively having the lowest prevalence of Oesophagastamum 15(3.79%)and Trichuris 14(3.54%) species.

Identified parasite species	Male		Female		Total N=395
	Ovine	Caprine	Ovine	Caprine	
Monezia species	17(5.90)	3(3.74)	28(9.72)	8(7.47)	56(14.17)
Trichostrongylus species	12(4.16)	1(0.93)	15(5.20)	4(3.73)	32(8.10)
Haemonchus species	10(3.47)	3(2.80)	21(7.29)	4(3.73)	38(9.62)
Fasciola species	25(8.68)	4(3.74)	29(10.07)	19(17.75)	77(19.49)
Trichuris species	4(1.38)	1(0.93)	8(2.77)	1(0.93)	14(3.54)
Bonustomum species	6(2.43)	0	10(3.82)	0	16(4.05)
Oesophagastamum species	8(2.77)	0	6(2.08)	1(0.93)	15(3.79)
Paramphistomum species	10(3.47)	0	18(6.25)	8(7.47)	36(9.11)
Coccidia species	39(13.54)	4(3.74)	50(17.36)	15(14.02)	108(27.34)

Table 1: The prevalence of different parasites species identified in sheep and goats

The prevalence of gastro-intestinal parasites of sheep and goats in SodoZuria district based on different categories (age, breed, sex, body condition) is shown in table 2. The prevalence of gastrointestinal parasites in sheep and goats based on sex is as shown in table 1. Female sheep and goats were found to have higher rate of infection 50 (17.36%) and 19(17.76%) respectively than the male sheep 39(13.54%) and goats 5 (4.67%) as shown in table 1. There was statistically significant association ($P<0.05$) between occurrence of infection based on sex of sheep and goats sampled as described in different categories in table 2.

Categories N=395	Ovine	Caprine	Total	X2	P-value
Age					
Adult	67(23.26)	19(17.75)	86(21.77)	3.954	0.140
Young	22(7.63)	5(4.67)	27(6.83)		
Sex					
Male	39(13.54)	5(4.67)	44(11.13)	7.376	0.007
Female	50(17.36)	19(17.76)	69(17.47)		
Breed					
Local	89(30.90)	24(22.43)	113(28.60)		
Cross bred	0	0	0		
Body condition					
Good	6(2.08)	1(0.93)	7(1.77)	73.358	0.000
Medium	26(9.02)	5(4.67)	31(7.84)		
Emaciated	57(19.79)	18(16.82)	75(18.98)		

Table 2: The prevalence of gastrointestinal parasites in different categories

The prevalence of gastro-intestinal parasite in SodoZuria district based on age is as shown in Table 3. Out of 395 sheep and goats sampled, 236 were adult sheep and 86 were adult goats with age ranging from one year and above, while 52 were young sheep and 21 were young goats less than one year old. Out of 236 adult sheep sampled, 67 (23.26%) were infected with different species of gastrointestinal parasites and from 86 adult goats 19(17.76%) were infected with different species of gastrointestinal parasites. While 22 (7.63%) of the young sheep and 5(4.67%) goats were infected with gastrointestinal parasites. There was statistically significant association ($P<0.05$) between age of sheep and gastrointestinal parasites infection as shown in table 3.

N =395	Age	Infected	Non infected	Total	Prevalence	X^2	P-value
Ovine	Adult	67	169	236	23.26	3.866	0.038
	Young	22	30	52	7.63		
	Total	89	199	288	30.90		
Caprine	Adult	19	67	86	17.76	0.029	0.535
	Young	5	16	21	4.67		
	Total	24	83	107	22.43		

Table 3: The prevalence gastrointestinal parasites based on age of sheep and goats

In this study, body condition showed significant difference (P<0.05) on the prevalence of gastrointestinal parasites of sheep and goats sampled as described in table 4. Highest prevalence of gastrointestinal parasites was observed in poor body conditioned small ruminants, out of 288 sheep examined 57(19.79%) and from 107 goats sampled 18(16.83%) followed by medium 26 (9.03%), 5(4.67%) sheep and goats respectively.

Categories N =395	Body condition	Infected	Non infected	Total	X^2	P-value
Ovine	Good	6(2.08%)	81	87	37.426	0.000
	Medium	26(9.03%)	52	78		
	Emaciated	57(19.79%)	66	123		
	Total	89(30.90%)	199	288		
Caprine	Good	1(0.93%)	9	10	9.272	0.003
	Medium	5(4.67%)	41	46		
	Emaciated	18(16.83%)	33	51		
	Total	24(22.43)	83	107		

Table 4: The prevalence based on body condition of sheep and goats

DISCUSSION

This study revealed that a total of 113 (28.60%) samples out of the total of 395 sheep and goats were infected with gastrointestinal parasites, while 89 (30.90%) out of 288 sheep examined were infected with gastrointestinal parasites and 24(22.43%) out of 107 goats examined were harbouring one or more different species of gastrointestinal parasites. This prevalence of different species of gastrointestinal parasites in sodozuria district may be attributed to the fact that most of the animals examined were kept in grazing on pastures and managed on extensive system management. They were having open access to outer infection sources and were not dewormed regularly as suggested by the veterinarian. Higher prevalence of GIT parasitic infections in sheep as compared to goats was probably due to their grazing behavior. Sheep grazes very close to the ground so risk of ingestion of parasitic ova is comparatively more than the goats, as they are browsers [76].

This study revealed Coccidia, Fasciola and monezia species as the most common parasites of small ruminants in the study area. The most prevalent species of the parasites in goat in this study were Fasciola (21.49%), Coccidia (17.75%), Monezia (10.28%) and Paramphistomum (7.47%), Haemonchus (6.54%), Trichostrongylus (4.67%) and Trichuris (1.87%). The most prevalent species of the parasites in sheep in this study were Coccidia (30.90%), Fasciola (18.75%), Monezia (15.62%), Haemonchus (10.76%), Paramphistomum (9.72%), Trichostrongylus(9.37%), Bonustomum (5.55%) esophagastamum(4.86%) and

Trichuris(4.16%). The various species of gastrointestinal parasites recovered during present investigation have been reported by various researchers in different parts of the world [77, 78, 79, 80, 81, 82, 83, 84, 85, 86].

During the present study, it was found that overall prevalence of parasitic infection was significantly (p= 0.007) higher in females than males. Among sheep, a significantly higher prevalence was recorded in females (17.36%) as compared to their male (13.54%). Similarly to sheep, the infection in goats was found higher in females (17.76%) than males (4.67%). The influence of sex on the susceptibility of animals to infections could be attributed to genetic predisposition and differential susceptibility owing to hormonal control. The physiological peculiarities of the female animals, which usually constitute stress factors thus reducing their immunity to infections, and for being lactating mothers, females happen to be weak and malnourished, as a result of which they are more susceptible to the infections besides some other reasons [87, 88].

The current study revealed that the adult sheep (21.77%) were significantly more prone to parasitic infection with the than the young (6.83%) ones. It could be explained that higher nematode prevalence in adults might be due to grazing on larger area of pastures being contaminated with various flocks and different stress conditions such as climate, long daily traveling, and gestation [89]. This increased prevalence in sheep may be due to physiological to nutrition and foraging patterns (sheep are grazers, preferring to feed on grass and forbs, rambling slowly eating plants near the ground, whilst goats are browsers, consuming leaves, vines and shrubs even if other nutritional forage is available) or to factors related to a long standing process of natural selection developed consequently to the foraging behavior of goats, which leads to reduced exposure to parasites [90, 91]. The young animals are less susceptible to parasitic infections due to less exposure for grazing as they mainly depend upon milk feeding and these findings were in concordance with Belem et al. (2005) [92],Yadav et al. (2006) [93] and Emiru et al. (2013) [94]. Similarly there was higher infection of adult goats in this study. In this study, body condition showed significant difference (P<0.05) on the prevalence of gastrointestinal parasites. Highest prevalence of gastrointestinal parasites was observed in poor body conditioned small ruminants (18.99%) followed by moderate (7.85%) and good body conditioned (1.77%) small ruminants table 4. This result was corresponded to Biswas et al. (2014) [95] and Admasu and Nurlign (2014) [96], who found higher parasitic infection in poor body conditioned host over moderate and good condition. On the other hand, Dabasa et al. (2017) [97] found more prevalence with good body conditioned animal likely than poor and medium body conditioned animals. Indeed, malnutrition and other concomitant parasitic infection will lead to poor immunological response in host to infective stage of the parasites [98]. Meanwhile, Etter et al. (1999) [99] found increased fecundity of parasites in case of immuno-compromised animals.

CONCLUSION AND RECOMMENDATIONS

Gastrointestinal tract parasitism in sheep and goats is of paramount importance because small ruminants' rearing has been a major source of income especially to the marginal farmers of the country. The infestation of coccidia and fasciola are widespread amongst smallholder sheep and goats examined in Sodozuria district. There was an increased risk of coccidia, fasciola, Monezia and haemonchus infection in sheeps and goats kept under traditional smallholder management system in study area. The practice of routine deworming, provision of adequate nutrition, and strict environmental hygiene will help in minimizing production losses due to coccidian, fasciola, monezia and haemonchus infections in the smallholder farms. The prevalence rate of gastrointestinal parasitism needs to be monitored periodically among the small ruminants in Sodozuria district and surroundings as well. Further, effective and wellplanned control measures to check the parasitic population should be implicated by conducting extension programs to educate the farmers regarding the proper use of anthelmintics.

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