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Study on prevalence of gastrointestinal nematodes of small ruminant in Adami Tulu Jiddo Kombolcha District, East Shoa Zone of Oromia, Ethiopia

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Abstract

A cross-sectional study was conducted from November 2014 to April 2015 on 384 randomly selected small ruminants (192 sheep and 192 goats) in Adami Tulu Jiddo Kombolcha district, East Shoa zone of Oromia region, Ethiopia, with the objectives of determining the prevalence of gastrointestinal nematodes and assessing the potential risk factors.The overall prevalence of gastrointestinal nematodes was 52.34%. A total of 384 faecal samples were examined using floatation and modified McMaster methods. Out of the 201 sheep and goats that were positive for nematode eggs; 11.4%, 56.2% and 32.3% were massively, moderately and lightly infected respectively. The fecal samples examined revealed an overall prevalence of 201 (52.34%) in the small ruminants where as 117(60.9%) in sheep and 84 (43.8%) in goats harbor one or more gastrointestinal nematodes. Strongyles were the most frequently (36.2%) recovered nematode eggs followed by Strongyloides (6.8%) and Trichuris species (1.3%). There was a statistically significant difference in the prevalence of gastrointestinal nematodes between species of animals and different age groups ($p< 0.05$). However, there was no significant difference ($p > 0.05$) in prevalence between sexes. Due to its important health problem and impact on production in the study area, emphasis should be given for the control and prevention of gastrointestinal nematode infection with further studies on species identification and larval ecology.

Keywords: Gastrointestinal nematodes, small ruminants, Adami Tulu Jiddo Kombolcha, Prevalence, risk factor.

1. Introduction

Ethiopia lies within the tropical latitudes of Africa, and has an extremely diverse topography, a wide range of climatic features and a multitude of agro-ecological zones, which makes the country suitable for different agricultural production systems. This in turn has contributed to the existence of a large diversity of farm animal genetic resources in the country (Anon, 2004b). 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 (Central Statistical Agency, 2008).

There are large potential of small ruminants in the country but their productivity is low. The major problems that greatly affect the economy of sheep and goat production in Ethiopia were diseases. Disease

alone accounts for 30% mortality in young animals and 20% in adults. A loss of US$81.8 million is reported annually due to parasite infection. In a country confronted with such enormous losses caused by parasites, it is great loss to the country (Demelash *et al*., 1999).

Helminthosis occurs in a wide range of agro-climatic zones in sub-Saharan Africa and constitutes one of the most important constraints to small ruminant production (Ayalew *et al*., 2011). The production loss is a direct result of clinical and subclinical helminthes infections resulting in low productivity due to stunted growth, insufficient weight gain, poor feed utilization and mortality and indirect losses associated with treatment and control costs (Ayalew *et al*., 2011).

Gastro-intestinal nematode parasitic infection is one of the major health problems in the world. Gillian *et al*. (2004) reported that nematode infections affect the health of millions of people and animals, causing huge economic loss in livestock farming. Nematode infection is rampant in most developing countries where poor pastures and the quantities of nutritious food consumed do not cover the nutritional requirements of animals. In addition, there is insufficient veterinary care and the environment is conducive to nematode growth and transmission (Fikru *et al*.,2006). Nematode infection is a serious veterinary concern in South Africa aswell (Van Wyk *et al*.,1999). The problem is manifested especially in sheep and goats. The consequences of nematode infection include: reduced feed intake and weight gain, reduced immunity, lower fertility, a reduction in milk production and work capacity, treatment expenses and death in critical infections (Fikru *et al*.,2006; Hale, 2006). However, no report so far has been published on the prevalence of small ruminant gastrointestinal nematode infections in the present study areas, where sheep and goats are important assets to the local farmers. Knowledge of the nature and level of gastrointestinal nematode infections in a given agro-ecological zones is very important in order to recommend the most cost effective control measures. Therefore, the objectives of this study were to:

- Determine prevalence of gastrointestinal nematode infection in sheep and goats in the study area
- Assess potential risk factors influencing the epidemiology of the disease in the area.

2. Materials and Methods

2.1. Study Area

The present study was conducted from November 2014 to April 2015 in Adami Tulu Jiddo K ombolcha district. Adami Tulu Jiddo Kombolcha district is located in middle rift valley of Ethiopia, at 160km centering the capital of the district (Ziway), in south eastern part of Oromia. It has latitude and longitude of 38°20 and 38°55'E and 7°35' and 8°05'N respectively. The total land area of the district is 1403.3km2 (140,330 hectare) which is inhabited by 177,492 people, of which more than 79 percent are living in the rural area. It lies at altitudinal range from 1500 to 2000 m.a.s.l. The area receives the mean annual rainfall 760mmhg. The rainfall is bimodal with short rainy season from March to May and along rainy season from June to September followed by the dry season from October to February. The area has maximum and minimum temperature of 27.2 and 12.7° respectively, and relative humidity of 60%. According to Adami Tulu Jiddo Kombolcha district Livestock Development and Health bureau (2008), the area is densely populated, with livestock population of 211559 cattle, 116585 goats, 25114 sheep, 23720 donkeys, 1441 horses, 423 mules and 13059 poultry. The farmers in the area practice mixed crop- livestock production farming system.

2.2. Study population

The study animals were indigenous breeds of small ruminants with different age, sex and species owned by farmers in the area where mixed crop-livestock production system was practiced.

2.3. Study Design and Study Methodology

A cross-sectional study was conducted and fecal samples were collected directly from the rectum of a total of 384 small ruminants (192 sheep and 192 goats) by using a gloved finger and each collected sample in the universal bottle was labeled and 10% formalin was added to preserve parasite eggs. In generally, a minimum 5-10 gram of fecal samples were collected, then transported to laboratory and stored in a the refrigerator (4 0 C) until they were processed for processed qualitative and quantitative parasitological examination, so that samples can be kept without

significant changes in the egg counts and the morphology of eggs. The samples were collected from both sexes and all age groups. Age groups were determined for both species based on farmers' response and estimated by looking at erupted permanent incisor (Annex 3). Parasitological examination was done by floatation (Annex 1) following the standard procedures. Positive faecal samples for floatation were subjected to McMaster egg counting technique (Annex 3) and the degree of infection was 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 (Urquhart *et al*., 1996).

2.4. Sampling

2.4.1. Sample size determination

The study animals were selected from the study population by applying simple random sampling technique and the required sample size was determined following the formula described by Thrusfield (2005). The sample size was determined by taking expected prevalence 50% and using desired 95% confidence interval, 5% precision, since there is no previous study conducted in the area as follows;

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

Where,
n=no of animals were sampled
Pexp= expected prevalence
d=desired absolute precision
Therefore, 384 animals were selected for the study

2.6. 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 faeces 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 was the statistical tools applied. In all the analyses, confidence level will be held at 95% and P<0.05 was set for significance.

3. Results and Discussion

3.1. Prevalence of GIT Nematodes in the Study Area

Of the total 384 small ruminants (192 sheep and 192 goats) examined, 201(52.34%) were harboring one or more gastro-intestinal nematodes. In this study three types of GI nematodes were identified including their mixed infections as presented in Table 1.

Table 1: Prevalence of GIT nematodes infections in the Study Area

Species of animals	No of animals examined	Types of parasite and prevalence(%)			
		Strongyles	Strongyloides	Trichuris	Mixed Infections
Sheep	192	72(37.5%)	19(9.9%)	4(2.1%)	22(11.5%)
Goats	192	67(34.9%)	7(3.6%)	1(0.5%)	9(4.7%)
Total	384	139(36.2%)	26(6.8%)	5(1.3%)	31(8.1%)

3.2. Prevalence of GIT Nematodes in different species of animals studied

Of the total 384 of small ruminants examined coprologically for gastrointestinal nematode egg output, 52.3% were found positive. The prevalence was 60.9% in sheep and significantly higher (P < 0.05) than 43.8% in goats (Table 2).

Table 2: Prevalence of GIT nematodes in different species of small ruminants

Animals	Animals examined	No of animals infected and prevalence P-	(%) 95% CI	χ2	df	value
Sheep	192	117(60.9%)	54.0-68.0			
Goats	192	84(43.8%)	37.0-51.0	11.4	1	0.001
Total	384	201(52.34%)				

CI = Confidence Interval

3.3. Prevalence of GIT Nematodes in different sex group of Sheep and Goats

The results of gastrointestinal nematode infections within the species studied are summarized in Table 3. The nematode infection rate is not significantly different between female and male animals for both sheep and goats ($p>0.05$).

Table 3: Prevalence of GIT nematodes in different sex group of sheep and goats

Species of animals	Sex group	No of animals infected and prevalence (%)	95% CI	χ2	df	P-value
Sheep	Female	66(34.4)	27.0-41.0			
	Male	51(26.6)	20.0-32.0	0.056	1	0.812
Goats	Female	49(25.5)	20.0-32.0			
	Male	35(18.2)	12.0-24.0	0.263	1	0.608

3.4. Prevalence of GIT nematodes infection in different age group of animals

The result of GIT nematodes within the species studied revealed that 32.8% and 28.1% prevalence of young and adult sheep respectively while 26% and 17.7% prevalence belongs to young and adult goats respectively. There was statistically significant difference within the species ($P < 0.05$) in prevalence of gastrointestinal nematode between the age of two species (sheep and goats) (Table 4).

Table 4: Prevalence of GIT nematodes infection in different age group of sheep and goats

Species of animals	Sex group	No of animals infected and prevalence (%)	95% CI	χ2	df	P-value
Sheep	Young	63(32.8)	26.0-40.0			
	Adult	54(28.1)	22.0-34.0	19.95	1	0.000
Goats	Young	50(26.0)	20.0-32.0			
	Adult	34(17.7)	12.0-24.0	18.4	1	0.000

3.5. Quantitative Faecal Examination

The results of quantitative faecal examination using the modified McMaster technique for gastrointestinal nematodes of 117 infected sheep were 18.2, 36.5 and 6.3% for light, moderate and massive infection, respectively and 84 infected goats were 15.6, 22.4 and 5.7% for light, moderate and massive infection respectively. Most of the infected sheep and goats had a faecal egg count in a range of 800 to 1200 epg (Table 5).

Table 5: Intensity of GIT nematodes infection based on faecal egg count in sheep and goats in the study area.

Species of animals	Intensity of faecal egg Count	No of animals infected and prevalence (%)	95% CI
Sheep	Light	35(18.2)	12.0-24.0
	Moderate	70(36.5)	30.0-44.0
	Heavy	12(6.3)	3.0-9.0
Goats	Light	30(15.6)	11.0-21.0
	Moderate	43(22.4)	16.0-28.0
	Heavy	11(5.7)	3.0-9.0

4. Discussion

The coprological examination performed for this study using direct faecal floatation method revealed the occurrence of gastrointestinal nematodes with an overall prevalence rate of 52.34% in the small ruminants examined. This finding almost similar with the previous studies carried out using coprological examination in some areas of Ethiopia in which a prevalence of 54.1% (Bikila *et al*., 2013) and 59.89% (Tesfaheywet, 2012) were reported.

The current prevalence was lower when compared to various research outputs in Ethiopia by Achenef (1997) from Debre Berhan and Moti (2008) in and around Welinchity who reported 79.09% and 76.3% respectively. The higher prevalence observed in different parts of Ethiopia could be due to over stocking, poor nutrition (starvation), difference in agro ecology and management practice of the study area and frequent exposure to the communal grazing lands that have been contaminated.

In this study three types of gastrointestinal nematode parasites with their mixed infection were identified during the study period based on the morphology of egg described by (Urquhart *et al*., 1996*;* Hansen and Perry, 1994). Of the total positive cases, 139(36.2%) were positive for Strongyles eggs, 26(6.8%) were positive for *Strongyloides* species, 5(1.3%) were positive for *Trichuris* species and 31(8.1%) were infected with mixed infection of parasite. This finding was harmonous with reports of previous studies conducted in Ethiopia by (Fikru *et al*., 2006), (Hailelul, 2002) and (Tefera *et al*., 2011). Among the different gastrointestinal nematodes identified from the faeces of sheep and goats, the prevalence of Strongyles eggs accounted for 36.2 % followed by mixed infection (8.1%), *Strongyloides* species (6.8%) and *Trichuris* species (1.3%). In this study, the Strongyle eggs were identified in general terms, since their eggs were not differentiated easily to genus level Van (Wyk, *et al.* 2004).

The current prevalence of gastrointestinal Strongyle eggs agree with reports of previous studies conducted in different parts of Ethiopia (Tesfaheywet, 2012) and (Shimelis *et al*., 2011) who reported prevalence of 36.2 and 37.63% respectively. Abebe and Eseyas (2001) reported prevalence of 97.03%, which is higher than the current finding. This difference could be due to the sample size considered, climatic condition of the study area, long dry season between November and April in the study area and types of techniques utilized.

The prevalence of *Strongloides* species in the present study was 6.8 % which agree with the report from Bedelle by (Ayele *et al*., 2014) and from Debre Zeit by Tigist (2008) who reported the prevalence of *Strongloides* species as 6.1%and 8.2%, respectively. This finding was lower as compared to 45.22% from Eastern part of Ethiopia by Abebe and Eseyas (2001).This variation in prevalence might be attributed to difference in agro ecology and management practice of the study area.

The prevalence of *Trichuris* species was 1.3% and this finding was in lined with the work of Temesgen (2008) who reported *Trichuris* species with the prevalence of 3.3%. The present finding however was lower as compared to 30.25% from Eastern part of Ethiopia Abebe and Eseyas (2001). This variation in prevalence might be attributed to difference in agro ecology and management practice of the study area.
The prevalence of mixed infection parasites were 8.1% and this finding was similar with the work of Tesfaheywet (2012) who reported mixed infections of parasite with the prevalence of 11.2%.

The study showed that 60.9 and 43.8% of sheep and goats respectively were infested with one or more type of gastrointestinal nematodes. This observation was in lined with the earlier works reported by (Bikila *et al*., 2013) and (Tesfaheywet, 2012) with the prevalence of 62.4%, 40.6 and 65.1%, 54.46% respectively. However, the prevalence result of the present study was lower than the prevalence reports in sheep by (Diriba, L. and Birhanu, A., 2013) with the prevalence of 68.1%. The decreased in the gastrointestinal nematodes in the present study compared with the other studies in the country could be due to the existence of unfavorable climatic or environmental factors that could support prolonged survival and development of infective larval stage of most helminths (Rossanigo and Grunder, 1995; Andrews, 1999). Because most of these studies are conducted in the part of the country where there is a very favorable humidity and temperature which generally supports parasitic growth and development (Regassa *et al*., 2006; Dagnachew *et al*., 2011). There existed direct relationship between moisture and prevalence of parasitosis (Regassa *et al*., 2006) while desiccation suppress the development and growth of parasite (Dagnachew *et al*., 2011) thereby reducing the infection rate. Furthermore, management system (Regassa *et al*., 2006) could also contribute in the difference in the prevalence.

In the present study, there was statistically significant difference between two species of animals (sheep and goats) which show that a higher prevalence of gastrointestinal nematodes was observed in sheep than in the goats. This observation was agree with the earlier works in other parts of Ethiopia (Teklye, 1991) and Kenya (Waruiru *et al*., 2005) that shows higher gastrointestinal nematodes prevalence is more common in sheep than in goats. The finding also agrees with the work of (Yoseph, 2009) in and around Nekemte and (Berry, 2011) in and around Yabello District, who reported the prevalence of gastrointestinal nematode to be more in sheep than in goats. The higher prevalence of nematode parasites in sheep than in goats as indicated by the result of this study could be due to the fact that sheep have frequent exposure to communal grazing land that have been contaminated by feaces of infected animals. Goats are browsers in behavior but sheep are grazers from the ground where the gastrointestinal nematodes egg hatches and reaches the infective stage (Teklye, 1991) and (Waruiru *et al*., 2005). However, it is in contrary to reports from Western (Regassa *et al*., 2006) and Eastern (Abebe and Esayasu, 2001) parts of Ethiopia. In this regard, beside the grazing habit of the sheep, the communal grazing area of sheep and goats practiced in the study area could put the goats in a risk of acquiring the infection from the sheep (Dagnachew *et al*., 2011); furthermore, it is assumed that sheep do have a considerably higher immunological response to gastrointestinal parasites compared with that of goats (Urquhart *et al*., 1996).

The current study shows no statistically significant differences in the prevalence of gastrointestinal nematode parasites between sex groups. This finding agree with report by (Regassa *et al*.,2006; Assefa and Sissay, 1998; Fikru *et al*.,2006; Getachew,1998 and Ghanem *et al*., 2009) which showed that sex of the animals did not show significant association with the prevalence of gastrointestinal nematode parasites. This is due to equal exposure of both sexes, and they were from similar agro-ecology. This finding disagree with the work of (Dagnachew *et al*. 2011), Yoseph (2009), (Bashir *et al*. 2012), Desta (2013) and Lone (2011) who reported higher prevalence of gastrointestinal nematode parasites in females than in males. These authors stated that female animals are exposed to stress than male animals in different time such as during pregnancy and lactation which favors the egg output of helminthes.

In the present study, there was statistically significant difference within the species ($P < 0.05$) in prevalence of gastrointestinal nematode between the age of two species (sheep and goats), which was the higher susceptibility of younger animals than adult animals. Thesereport was in line with reports in Ethiopia (Regassa *et al*., 2006; Dagnachew *et al*., 2011), and elsewhere (Fritsche *et al*., 1993; Keyyu *et al*., 2003; Melkamu, 1991; Ng'ang'a *et al*., 2004; Githigia *et al*., 2005). The reason was that as new born and younger small ruminants, they lack strong immunity as in the adults. Several authors have documented that adult and old animals develop acquired immunity (Urquhart *et al*., 1996; Taswar *et al*., 2010) against helimenth infections as they get mature due to repeated exposure (Dagnachew *et al*., 2011) and this will help expel the parasite before it establish itself in the GIT (Shah-Fischer and Say, 1989).

The results of quantitative faecal examination using the modified McMaster technique for gastrointestinal nematodes of 117 infected sheep were 18.2, 36.5 and 6.3% for light, moderate and massive infection, respectively and 84 infected goats were 15.6, 22.4 and 5.7% for light, moderate and massive infection

respectively. Most of the infected sheep and goats had a faecal egg count in a range of 800 to 1200 epg.

5. Conclusion

Gastrointestinal nematode parasites are the major animal health constraints in sheep and goats production constituting a major loss to the economy. The present study revealed that the gastrointestinal nematode of small ruminants is prevalent disease in the study area to affecting the wellbeing of the animals and thus the economies of the smallholder farmers. During the present study an overall prevalence of 60.9% and 43.8% in sheep and goats respectively were harboring by nematode parasites. The role of species and age in the occurrence of gastrointestinal nematodes found to be significant. Sex of the animals was shown to have association with prevalence but significant difference was not found. In line with the above conclusion and the present findings, the following recommendations are forwarded:

- Detailed study should be conducted to clearly identify parasitic fauna using faecal culture and postmortem examination in the study area.
- Strategic control programs with anthelmintic should be practiced in the study area to minimize the impact of gastrointestinal nematodes on the health of animals.
- Education of farmers on the importance of the parasitic diseases, its economic losses and the correct ways to improve animal husbandry system need to be applied.

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