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A study on prevalence of gastrointestinal helminthiasis of sheep and goats in and around Dire Dawa, Eastern Ethiopia

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A cross sectional study on gastrointestinal parasite of small ruminants was conducted from November, 2011 to April, 2012 in Dire Dawa with the objective to determine the prevalence of infestation, and to identify the gastrointestinal helminth parasite in sheep and goats. A total of 768 coprological examinations were performed on 384 fecal sample each from sheep and goats. Taking the overall parasitic infestation into consideration, 91.4% sheep and 86.2% were found to harbor egg of gastro intestinal helminth. The coprological findings were Strongyle (45.01%), *Nematodirus* (11.11%), *Trichuris* 12.8%, *Moniezia* 13.67%, *Fasciola* 6.84%, *Strongyloides* 10.54% in sheep while Strongyle (39.88%), *Nematodirus* (15.10%) *Trichuris* 16.31%, Monezia 12.08%, *Fasciola* 6.04%, *Strongyloides* 6.51% in goats. Upon coproculture, accurate differentiation of each genera of nematode were identified prevalent for those animal which were positive for strongyle egg type 138 (sheep), and 97 (goat) sample was cultured. Based on faecal culture, six genera of nematode were identified including *Bunostomum* 20.29%, *Oesophogostomum* 25.64%, *Chabertia* 23.19%, *Haemonchus* 28.99%, *Cooperia* 24.64%, *Trichostrongylus* 40.33% in sheep while in goats *Bunostomum* 20.62%; *Oesophogostomum* 24.74%; *Chabertia* 23.71%; Haemonchus 32.99%; *Cooperia* 25.77% and *Trichostrongylus* 40.1%. The majority of sheep and goats were having mixed infestation with more than one helminth. The study shows that gastrointestinal (GIT) parasite was a major problem of small ruminant in the study area. Therefore, comprehensive study on GIT parasite, cost effective strategic treatment and awareness creation to the smallholder should be instituted in the study area.

Key words: Dire Dawa, Eastern Ethiopa, GIT Helminth, Goat, Nematode, Sheep.

INTRODUCTION

Ethiopia possess the largest livestock population in Africa with an estimated population of 7.8 million equine, 1 million camel, 47.5 million cattle, 39.6 million chicken, 26 million sheep and 21.7 million goats (CSA, 2009).

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Livestock ownership currently contributes to the livelihoods of an estimated 80% of the rural population. But this extensive livestock resources is not adequately harnessed because of many constraints of which poor animal production and management, improper evaluation of public health importance due to various individual parasitic disease and inadequate knowledge of the epidemiology of parasite where the distribution of the disease determines the type and scope of control measures to be applied (Ento, 2005).

In Eastern Ethiopia, livestock production is mainly pastoral where communities are entirely dependent on communal pasture and animal exposure to infective larval stages of parasite continues throughout the year. The most important Strongyle nematode of sheep and goat in African countries are: *Haemonchus, Trichostrongylus*, *Nematodirus, Cooperia, Bunostomum, Oesophgotomum* and *Chabertia* (Hansen and Perry, 1994). Small ruminants under extensive and intensive production systems are extremely susceptible to a wide range of GIT helminthes of sheep and goats to the genera of *Haemonchus, Triostrongylus*, *Bunostomum, Oesophgostomum, Trichuris (Nematode*); *Fasciola Paraphistomum* (Trematode) and *Moneiza, Avitetlinala* and *Stellesia (Cestode*) (Tekley, 1991; Tembely and Hansen, 1996).

Sheep and goat are mainly found in arid and semiarid areas of sub-Sahara Africa. They play a vital economics role through provision of meat and milk. They contribute more to household income, manure and skin compared to cattle and camels. Small ruminants contribute a large proportion of readily available meat in the diet of pastoralist. They have been estimated to provide up to 30% of the meat, and 15% milk supply in sub-Sahara Africa where they thrived in wide range of ecological region better than cattle. small ruminants have survive better under drought conditions than cattle due to their low body mass and low metabolic requirement, and maintenance needed in arid and semi-arid areas (Wesongh et al., 2003).

Improper care, unhygienic environment, extreme climate and close contact with infected animals leads to a variety of parasitic infestations (Jones, 2001).Thus, the subclinical parasite infestations are responsible for significant economic losses in terms of animal productivity (Kaplan, 2006; Tibbo et al*.,* 2006). Helminth parasites of small ruminants are ubiquitous in all agro climatic zones of Ethiopia with prevailing weather condition that favors their survival and development; their presence doesn't mean that they cause overt disease (Sissay et al., 2007).

Economic losses caused by GIT parasites vary from lowered fertility, reduced work capacity, involuntary culling, reduction in feed intake, lowered weight gain and milk production, treatment cost and mortality in heavily parasitized animals (Fikru et al., 2006). The direct losses caused by this parasites are attributed to acute disease and death, premature slaughter and rejection of some parts at meat inspection while indirect losses include the reduction in productive potential (Gonzalez and Gonzalez, 2004). Although, Ethiopia is endowed with large number of sheep and goats' population, little attempt has been made in the past, to study the health aspect of these animals. This study focus on the subsequent lack of a well-established data on the magnitude, and the distribution and predisposing factor of small ruminants GIT helminthes. Previously in Dire Dawa, no study was carried out on gastrointestinal helminthosis in small ruminants. However, information on the prevalence and type of helminth parasites infecting small ruminants is vital for their control. Therefore, the objectives of this study was to determine the prevalence of GIT helminth parasite in the study area

MATERIALS AND METHODS

Study area

The study was conducted at Dire Dawa administrative region which is located approximately between latitude 9°27 'and 9°49' North and longitude 41°38' and 42°19' East. It shares boundaries to the South, Southeast and Southwest with Eastern Haraghe zone of the Oromia regional state and to the North, Northeastern and West with Shinile zone of Somalia regional state. There are two farming system, namely, mixed and agro pastoral are noted in the rural area. Majority of agro -pastoral (a production system in which there they practiced growing crops and raising animals) and pastoral areas (rely only raising animals) located in the northeastern lowlands with rainfall that does not favor crop production. There are 16 peasant associations under this category. The mixed farming areas dominate the southeastern part of the region and are relatively better in crop farming. The rest 22 Keble (peasant association) are found in this agro ecological zone. In 2003, the livestock population of Dire Dawa Administration was estimated to have 37, 126 cattle, 64,370 sheep, 112,065 goats, 7,513camels, 10,779 equines, 1,225 Beehives and 25,301 chickens (RABDD, 2006).

Study population

Small ruminants in the study area are kept under traditional extensive system by households. Most householders maintain one to six sheep and goats. During this time, both sex and age group of sheep and goats were in selected 12 peasant associations and grazing in pasture fields. Those animals with the age of less than one year and above one year were grouped as young, and adult species of animals respectively was considered in the study according to the study of Tewdros (2007).

Study design, sampling technique and sample size determination

A cross-sectional study was carried out from November, 2011 to March, 2012 to determine the prevalence and to identify gastrointestinal tract helminthes from fecal samples collected from sheep and goats. Twelve peasant associations were selected purposively on easy of accessibility and simple random sampling method was employed to select 768 study units (25 samples from each PA for each specie was taken (total 600 samples), and the other 168 sample was taken from Dire Dawa veterinary clinic). The sample size required for the study was determined using the formula given by Thrusfield (2005), taking 50% expected prevalence, since

Table 1. Assessment of prevalence of parasitic infestation in relation to sheep and goats.

Species	No. of animals examined	No. of animals positive (%)	χ^2-Value	P-value
Sheep	384	351(91.41)		
Goat	384	331(86.2)	0.022	5.2377
Total	768	682 (88.67)		

there were no records to previous prevalence of gastrointestinal helminthes of sheep and goats in the study area, at 95% confidence level and 0.05 level of precision, therefore, a sample size of 768 (384 each for sheep and goat) was considered for the study.

Fecal sample collection

Fecal samples were obtained directly from the rectum of each animal. This was carried out by hands which were protected with glove. The samples were put into sampling bottles and labeled, and transported to laboratory for further coprological investigations.

Coproscopic examination

For coproscopic examination, a simple test tube flotation, sedimentation, fecal culture and Berman technique described by Hansen and Perry (1994) was employed, and the slides prepared were examined under microscope (x10). Eggs of different helminths were identified on the basis of morphological appearance and size of eggs (Foriet, 1999).

McMaster egg counting method was used to determine the number of eggs per gram of feces (EPG) in the positive fecal samples, and the degree of severity was categorized based on previously described methods (Soulsby, 1982; Urquhart et al., 1996). Furthermore, the EPG was classified as light, moderate and massive infestation for a count of 50 to 799, 800 to 1200 and over 1200, respectively.

Ovoculture and identification of larvae

Fecal samples were collected in slightly capped plastic bottles, and incubated at room temperature under suitable moisture contents for 14 to 21 days with continuous moistening at an interval of 3 days. The recovered larvae (L_3) were studied and identified. The presence of larvae was assessed by using stereomicroscope, when present; two drops of larval suspension were mixed with drop of lugols iodine on glass slide, and examined at low magnification power for identification. Identification keys used were: shape of larval head, number and shape of gut cells, presence or absence of retractile bodies, larval sheath coverage and length of sheath tail. The L_3 harvested using Berman apparatus after 14th day of incubation were differentiated to the generic level using the method as described by Annon, (1997).

Data analysis

The data collected was entered into a Microsoft Excel spreadsheet, edited and analyzed using Stata 11 intercooled statistical software (StataCorp, 2009). Descriptive statistics was employed to compute the prevalence of each parasite type. Pearson's chi square was utilized to assess the presence of association between prevalence of parasite, sex, age and species of animals. A statistically significant association was said to exist when the calculated P-Value is less than 0.05 (P<0.05) at 95% confidence level.

RESULTS

Overall prevalence

A total of 768 fecal samples from small ruminants (384 sheep and 384 goats) were examined. The overall prevalence of gastrointestinal helminth parasites infestation in sheep and goats was 88.67% (682/768). The prevalence of gastrointestinal helminth was 91.41% and 86.2% in sheep and goats respectively under 95% confidence interval (Table 1).

Interaction between host characteristics and prevalence

Species and prevalence

Species-wise analysis of prevalence has showed that sheep were more commonly affected than goats (Table 1). This variation in prevalence of gastrointestinal helminthes between sheep and goats was found to be statistically significant (P<0.05).

Sex and prevalence

During the study, sex-wise analysis of the prevalence of the gastrointestinal helminths of sheep and goats have indicated that female sheep (ewes) were slightly more infected than the male (rams) counter parts (Table 2). Opposing to this in goats, male animals were highly infected than females. However, this variation in susceptibility was statistically not significant (P>0.05).

Age and prevalence

Comparison of the frequency of infestation between young and adult age groups of animals showed that in sheep, young animals are more frequently affected than the adults (Table 3). This difference in the frequency of infestation between the two age groups of sheep is statistically significant (P<0.05). But in goats, both young and adult animals were equally susceptible to

Table 2. Assessment of prevalence of gastrointestinal helminths in sheep and goats by sex.

Species	Number of positive animals		χ^2-Value	P-Value
	Female (%)	Male (%)		
Sheep (n=384)	231(92.03)	120 (90.23)	0.3611	0.548
Goat (n=384)	217(84.11)	114 (90.48)	2.8852	0.089

Table 3. Analysis prevalence of gastrointestinal helminths in sheep and goat by age group.

Species	Number of positive animals		χ^2-Value	P-Value
	Young (%)	Adult (%)		
Sheep (n=384)	77(98.72)	274(95.06)	6.6617	0.010
Goat (n=384)	37(86.05)	294(86.22)	0.009	0.976

Table 4. The result of coproscopic examination of sheep and goats in Dire Dawa.

Helminth parasite		Sheep (n = 384)		Goat (n = 384)	
Class	Group or Genus	Number positive	Percentage (%)	Number positive	Percentage (%)
Nematoda	Strongyle	158	45.01	132	39.88
	Nematodirus	39	11.11	50	15.10
	Trichuris	45	12.80	54	16.31
	Strongyloides	48	13.67	40	12.08
Trematoda	*Fasciola*	24	6.84	20	6.04
Cestoda	*Moniezia*	37	10.54	35	10.57

gastrointestinal helminth infestation, but this is statistically not significant (*P*>0.05).

Parasite Identification

Coproscopyic examination

Based on eggs and larval studies, it was observed that nine genera of nematode parasites, one genus of cestode as well as one genus of trematode infected sheep and goats . Strongyle type eggs were encountered more frequently in the feces of sheep (45.01%) and goats (39.88%) than others. *Fasciola* was the least prevalent helminth parasite identified from 24 (6.84%) sheep and 20(6.04%) goats. The frequency of occurrence of the identified helminthes eggs in the feces of small ruminants examined is presented in Table 4.

Coproculture

Upon coproculture of those faecal samples found positive for strongyle type, six genera of parasites were recognized. Trichostrongylus was the most common type of strongyle encountered 40.33% of sheep and 40.1% goats, while *Bunostomum* was the least recovered from 20.29% sheep and 20.62% goats (Table 5). From 351 sheep and 331 goats infected with helminthes, 132 (37.60%) sheep and 183 (55.28%) goats harbored single infestations whereas only 219 (62.39%) sheep and 148 (44.71%) goats contained mixed infestations (Table 6). Based on mean egg per gram by any gastrointestinal helminthes in the study period, in both sheep and goat, the infestation of parasitic infestation was light (Table 7).

DISSCUSION

The coprological examination revealed that the overall prevalence of gastrointestinal parasite was 88.67% of which sheep and goat showed 91.41 and 86.20%, respectively. This result agrees with the result of Getchew (1998) who reported 88.1 and 84.32% in sheep and goat in and around Mekele; Mulugeta et al. (2011) reported 91.32 and 93.29% in and around Bedelle (south western), Bayou (1992) reported 90.23 and 88.13% in Buno province (illubabor), Tesfalem (1989) reported 92.33 and 93.33% in Bale, Gebreyesus (1986) reported 90.41 and 82.13% in Gonder and Genene (1994).

Table 5. Result of coproculture from sheep and goat in the study area**.**

Strongyle	Sheep (n=138)		Goat (n=97)	
	Number positive	Percentage (%)	Number positive	Percentage (%)
Trichostrongylus	55	40.33	38	40.1
Haemoncus	40	28.99	32	32.99
Oesophagostomum	35	25.64	24	24.99
Chabertia	32	23.19	23	23.71
Bunostomum	28	20.29	20	20.62
Cooperia	34	24.64	25	25.77

Table 6. Prevalence of GI helminthes of sheep and goat.

Species	Positive animals		Single Infestation		Mixed Infestation	
	Number	Percentage	Number	Percentage	Number	Percentage
Sheep (n=384)	351	91.41	132	37.60	219	62.39
Goats (n=384)	331	86.20	183	55.28	148	44.71
Total	682	88.67	315	46.44	367	53.55

Table 7. Intensity of different helminthes in sheep and goat.

Helminth parasite	Sheep		Goat	
	Number of animals	Mean EPG	Number of animals	Mean EPG
Strongyle	50	738	50	742
Trichuris	4	133.33	6	375
Moniezia	5	140	6	455
Nematodirus	4	300	16	400
Strongyloides	10	400	13	375
Fasciola	6	408.33	6	408

However, this finding is comparatively lower than Amenu (2005) who reported a prevalence of 97% in sheep in three different agro ecological areas of southern Ethiopia. Mulugeta et al. (2011) reported a prevalence of 93.8% in goat. This difference in prevalence could be related with variation like season of study, age and stage of infestation and treatment of animals (Donald and Waller, 1982). This difference in prevalence in different ecological region could be explained by the existence of favorable climatic conditions (Rossanigo and Grunder, 1995) that support prolonged survival of infective larvae stage. Additional factors like sample size, management system (that is, overstocking of the animals, grazing of young and adult animals together with poorly drained land) could also contribute to the different prevalence. The overall prevalence of this finding is greater than the overall prevalence. Tesfaheywet (2012) reported 61.4% in sheep and in goats in and around Haramaya. The difference may be due to climate and environmental variation which could determine the prevalence.

This study showed statistically significant difference ($p<0.05$) between species. This findings are contrary to the report of Tony (2007) who described that goats appeared to be more susceptible to helminthes than sheep as they appear to develop less immunity but sheep picked more parasites because they predominantly grazed on grass which harbor infective larvae while goat mostly consume browse which is uncontaminated with parasite larvae. A significant differences ($p<0.05$) in infestation level among age groups (adult and young) showed only in sheep. According to Asnaji and Williams (1987), young animals are highly susceptible due to immunological immaturity and unresponsiveness.

No statistical difference ($p>0.05$) was observed between sex groups on the basis of breed and origin. The study findings are similar with the report of Assefa and Sissay (1998), gastrointestinal parasite affects both sexes equally. In similar agro ecological area, there is equal exposure of both sex to parasite (Armour, 1980)

In addition to direct coproscopic examination carried out, the level of each genera of nematodes was prevalent for those animals positive for strongyle egg type 138 (sheep) and 97 (goat) sample cultured. Based on facal culture, six genera of nematode were identified including

Bunostomum 20.29 and 20.62%; *Oesophogostomum* 25.64 and 24.74%; *Chabertia* 23.19 and 23.71%; *Haemonchus* 28.99 and 32.99%*; Cooperia* 24.64 and25.77% and *Trichostrongylus* 40.33 and 40.1% in sheep and goat, respectively. The most prevalent nematode was *Trichostrongylus* and *Haemonchus* followed by *Oesophagostomum* and others.

This finding was similar to the report of Bayou (1992) and Gebrekirose (1990), who identified *Trichostrongylus* to be the most predominant parasite isolated from larvae cultured. The abundance of these parasites was associated with difference in the study method or technique used. However, this study finding is contrary with the report of Sisay (2007), and Haileleul (2002) were *Haemonchus* dominates. *Haemonchus* was observed to be the most prevalent internal parasitic pathogen of GIT in this study. This could be related partly to breed susceptibility, biological and high environmental adaptability (Baiser and Dunsmore, 1993).

The current study has shown the existence of poly parasitism as observed in coproscopic and coproculture examination. Most of the animals had more than one type of parasite eggs. The prevailing poly-parasitism agrees with the result of Haileleul (2002), Gennene (1994) and Gebreyesus (1986). This prevalence of poly parasitism observed in current studies showed that gastro intestinal helminthosis is an important cause of morbidity and loss of production in sheep and goat in the study area. This can be supported by the fact that most of animal included in this study were in some selected PA, and the ones brought to the veterinary clinic of Dire Dawa town for various health problem. The presence of interactions and compromization of the immune system of the host by polyparasitism to increase their susceptibility of other disease or parasite has been a documented phenomenon (Wang et al., 2006).

Larvae of *Haemonchus* were the second abundant in sheep and goat. However, it's pathogenecity *Haemonchus* is known to be more important parasite than other nematode. The importance of this genus has also been reported in other region of the countries as by Tesfalem (1989), Bayou (1992), Yoseph (1992) and Haileleul (2002).

Oesophagostomum and *Bunostomum* were helminthes genera encountered in this study. The occurrence of these genera has been variably reported in different parts of Ethiopia. For instance the study of Bergeon (1968) and Grabber (1973) have showed that they are widely distributed throughout the countries at relatively high prevalence. Similarly, Gebreysus (1986), Tesfalem (1989), Genene (1994) and Haileleul (2002) have reported high prevalence of this genera of parasite in sheep and goat reared in different agro ecological of Ethiopia those may be due to the difference in study methodology. Most of the previous studies were based on postmortem examination that allows the recovery of arrested parasite which cannot release eggs. But during ova culture, we can obviously miss this arrested parasite as they do not release egg.

During the study period, the prevalence based on mean EPG of each genus of the gastrointestinal helminth by species of animal was conducted, and the result showed light infestation by all the genera of helminth that were encountered in sheep and goats. But there was no moderate and heavy infestation observed based on mean EPG by any gastrointestinal helminth in the study period. The classification of intensity of parasitic infestation was made based on fecal egg counts as light (50 to 800), moderate (801 to 1200) and heavy (>1200) as described for mixed infestation in grazing small ruminants (Jorgan and Brain, 1994).

CONCLUSION AND RECOMMENDATIONS

In general, the overall prevalence of gastrointestinal helminth parasites in the study area indicates gastrointestinal helminthosis to be an important heath problem due to its high prevalence and occurrence of polyparasitism. The result also shown that sheep carries more parasitic type than goat. This is because, they predominantly graze in grass which harbors infective larvae while goats mostly consume browse which is uncontaminated with parasite larvae. The majority of sheep and goats were infected by two and more parasite types with some animals showing pure infestation. Strategic deworming of animals, when conditions are most favorable for larval development on the pasture, using broad spectrum anti-helminthics since poly-parasitism is a common problem. Moreover, proper pasture and animal management is required since this is a key component in managing gastrointestinal helminths in sheep and goat operations. In addition, rotation grazing is used in interval, and this avoids communal grazing with other animals to avoid cross parasite contamination. The professional input of veterinarians is needed especially in the preventive and control measures against gastro-intestinal helminths.

Conflict of Interests

The authors have not declared any conflict of interests.

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