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Prevalence of ovine gastrointestinal nematodes in and around Asella, South Eastern Ethiopia

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A cross-sectional study was carried out to determine the prevalence and risk factors associated with ovine gastrointestinal nematode infestation by faecal examination of 408 sheep from five different sites in and around Asella, South Eastern Ethiopia. The mean eggs per gram (EPG) count determined using modified McMaster technique showed that 73 (30.04%) of the sheep were lightly infested, 98 (40.34%) moderately infested and 72 (29.62%) heavily infested. Out of the total sampled sheep, 278 (68.1%) had a gastrointestinal nematode infection. Strongyles were the most frequently (64.0%) recovered nematode eggs followed by *Strongyloides* (7.4%) and *Trichuris* species (3.7%). The prevalence of gastrointestinal nematode infection showed a significant difference ($p < 0.05$) between young and adult age groups, and animals with poor body condition had a significantly higher worm egg count ($p < 0.05$) than those sheep in moderate or good body condition. There was significant association between the gastrointestinal nematode infection and animals with different age group, and body condition. In addition, there was a significant difference ($p < 0.05$) in prevalence among months of the study period. There was no significant difference ($p > 0.05$) in prevalence between sexes and different study sites of the subject area. 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.

Key words: Asella, eggs per gram (EPG), gastrointestinal nematode, ovine, prevalence, risk factor.

INTRODUCTION

Sheep and goats are the most numerous of man's domesticated livestock and are especially important in more extreme climates of the world. Over two-thirds of the total population of sheep and goats occur in the less developed countries where they often provide major contribution to farming enterprises (Tony, 2007). Ethiopia is the second in Africa, and the sixth in the world, in terms of sheep population. Its great variation in agro-climatic zones represents a good reservoir of small ruminant genotypes (Food and Agriculture Organization (FAO), 1983). With its great variation in climate and topography, the country possesses one of the largest livestock populations in the world, which is managed by smallholder farmers under extensive low input traditional management system and adjunct to crop production (International Lactation Consultant Association (ILCA), 1993). The latest estimate gives 23 million sheep and 18 million goats in Ethiopia (Anonymous, 2005).

In spite of huge population and importance of small ruminants, the country has benefited little from this enormous resource owning to a multitude of problems, disease being the most important. Disease alone accounts for mortality of 30% in lambs and 20% in adults (Demelash et al., 2006). It has well recognized that in resource poor regions of the world, helminth infections of sheep and goats are major factors responsible for economic losses through reduction in productivity and increased mortality (Urquhart et al., 1996; Tibbo et al., 2006). Smallholders and pastoralists may not easily detect the effect of helminths because of the subclinical

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nature of the infections (Soulsby, 1986; Urquhart et al., 1996). Thus, the sub-clinical helminth infections are responsible for significant economic losses. Once the clinical diseases are noticed, such economic losses in terms of animal productivity have already occurred (Kaplan, 2006; Tibbo et al., 2006). They are responsible for immunosuppresion, enhancing the susceptibility of the animals to other diseases. Productivity losses attributable to helminth parasites are often substantial. A loss of US $81.8 million is reported annually due to helminth parasites in Ethiopia (Demelash et al., 2006).

In developed world, the greatest component of impact by these nematode parasites is probably found in the cost of control. But their impact is greater in the sub-Saharan Africa in general and Ethiopia is particular due to ecological factors suitable for diversified hosts and parasite species (Ragassa et al., 2006). The epidemiology of gastro-intestinal (GIT) parasites in livestock varied depending on the local climatic condition, such as humidity, temperature, rainfall, vegetation and management practices (Takelye, 1991). These factors largely determine the incidence and severity of various parasitic diseases in a region. Therefore, it is important to assess the type and level of parasitism in ruminant livestock, in order to determine the significance of parasite infestations and to recommend the most beneficial and economically acceptable control.

In highland of Arsi, gastrointestinal nematodes infection still remains an important disease problem of sheep in the area. Hence, this study was devised to be conducted with the objective to determine the prevalence and identify the potential risk factors associated with occurrence of the parasite infection of ovine gastrointestinal nematode in and around Asella.

MATERIALS AND METHODS

Study area

The present study was conducted from November, 2008 to April, 2009 in Asella town and its surrounding, Tiyo woreda. The Town is a capital of Arsi Zone, Oromia regional state. It is located about 175 km south east of Addis Ababa at 6° 59' to 8° 49' N latitudes and 38° 41' to 40° 44' E longitudes. The altitude of the area ranges from 2500 to 3000 m.a.s.l. Asella and its surrounding is characterized by mid subtropical weather, with minimum and maxim temperature ranging from 8.4 to 22.6°C, and the relative humidity ranging from 43 to 60%. The average rainfall is 2000 mm. The area has a bimodal rainfall occurring from March to April (short rainy season) and July to October (long rainy season). According to Arsi Planning and Development Office (2007), the area is densely populated, with livestock population of 85,893 cattle, 57,118 sheep, 10,725 goats, 7841 horses, 15,642 donkeys, 517 mules and 35,489 poultry. The farmers in the area practice mixed crop-livestock farming system.

Study animals

The study subjects include all grazing sheep of different age groups and both sexes in Asella town and its surroundings that are kept under traditional extensive production management system. The sample size was determined by taking 50% expected prevalence with a total of 384 but increased to 408 (Thrusfield, 1995).

Study design

A cross-sectional type of study was used for prevalence determination of sheep GIT nematode by coproscopic examination.

Study protocol

Sampling method

Out of 18 peasant associations (PAs) of Tiyo Woreda, five were selected, including Asella town by simple random selection or lottery method. The selected sites were: Denkeka Koncha, Haro Bilalo, Dosha, Gora Silingo and Asella town. Equal proportions of samples were collected from each site by random selection of farmers and animals. The participating farmers were identified by name (codes) and their animals were identified by ear tags with code numbers. Faecal samples were collected every month throughout the study period. The animal breed type, body condition scores, estimated age group and sex were recorded. The body condition scores and age group were recorded. Body condition scoring of sampled animal was carried out according to the method described by Cooper and Thomas (1985) and categorized into three scores as poor, medium and good. The poor body condition was recorded when individual spinous process were sharp to touch and easily distinguished, in addition, the bony structure of the sheep were easily noticeable. The eye muscles are of moderate depth. Medium body condition was recorded when the spinous process examined with very firm pressure and they were round rather than sharp. The eye muscle areas are full with moderate fat cover. Good body condition was recorded when the top and side of the back bone in loin area immediately behind the last rib and above the kidney were covered with muscles. The eye muscles were full and had a thick fat cover. Age group was determined by dentition and categorized as lambs (less than 9 month old), and adult (greater than 9 month old) as indicated by Yohannes (1989).

Faecal sample collection

A fresh faecal sample of approximately 10 g was collected directly from the rectum of each animal. The faecal samples were placed in a separate screw capped bottles (universal bottles), labeled and kept in cool box before transportation to Asella regional veterinary laboratory for coprological investigation. Those samples which were not examined within 24 h of arrival at laboratory were stored at +40°C and examined the next day early in the morning.

Coprological examination

The collected faecal specimens were processed and examined by direct faecal floatation technique for qualitative investigation of the types of gastro-intestinal nematode eggs. Quantitative examinations of faecal samples were made using the modified McMaster technique following standard procedures (Soulsby, 1986).

Those samples found positive for gastro-intestinal nematode were subjected to EPG counting. In this study, the floatation solution used was NaCl (sodium chloride). Eggs were identified by ova identification keys.

Data management and analysis

Computer based primary analysis was done on data set entered in to Microsoft-Excel spread sheet. The prevalence was calculated for all data as the number of infected individual divided by the total number examined times hundred. Stat-view computer based statistical software package was used to carry out different statistical analysis of collected data, and the Pearson's chi- square (χ^2) was used to test the existence of differences in prevalence between age groups, sex, body condition scores, place of collection and months. For the purpose of this study, 95% probability ($P < 0.05$) was considered the significant level.

RESULTS

Prevalence of gastrointestinal nematodes of sheep encountered in the study area

Of the total 408 sheep examined, 278 (68.1%) were found infected with different types of gastro-intestinal nematodes. Of the total positive cases, 261 (64.0%) were infected with strongyles, 30 (7.4%) were infected with Strongyloides spp. and 15(3.7%), were infected with Trichuris species (Table 1).

Variation between sex and age categories

Of the total 408 of sheep examined coprologically for gastrointestinal nematode eggs, 68.1% were found positive. The prevalence was 79.6% in lambs and significantly higher ($P < 0.05$) than 62.4% in adults (Table 2). There was no significant difference ($P > 0.05$) in prevalence of gastrointestinal nematode between the two sexes (Table 2).

Variation with body condition scores

Of the total 408 sheep examined, 65, 98 and 115 were categorized as having poor, medium and good body condition scores. Infection prevalence was significantly higher in animal with poor body condition when compared to that of medium and good body condition scores ($P < 0.05$). The overall infection prevalence according to body condition grades, 81.3, 69.5 and 61.5% with poor, medium and good, respectively (Table 3).

Variation on monthly basis

Analysis of prevalence of gastrointestinal nematode infections of sheep by months showed that there was statistically significant variation between months ($P < 0.05$). The higher infection prevalence was recorded in months during wet seasons, March and April whereas the lower was in months during dry seasons, January and February (Table 4).

Variation between study sites

Of all the sheep examined in the five sites, samples from Asella (71.1%) and Denkeka Koncha (70.0%) showed the higher GIT nematode infection prevalence and samples from Haro Bilallo (54.8%) showed lower infection prevalence recorded. The chi-square ($\chi 2$) test value indicated that there was no statistically significant difference ($P > 0.05$) in prevalence of gastro-intestinal nematode infection of sheep between these sites (Table 5).

Quantitative faecal examination

The results of quantitative faecal examination using the modified McMaster technique for GIT nematodes of 243 infected sheep were 30.04, 40.32 and 29.62% for light, moderate and heavy infection, respectively. Most of the infected sheep had a faecal egg count in a range of 801 to 1200 epg and more (Table 6).

DISCUSSION

The gastrointestinal nematodes of sheep are one of the important parasitic disease that obviously result in reduced productivity of sheep raised by smallholders using traditional husbandry management system in and around Asella, Arsi zone of Oromiya region. The coprological examination done for this study using direct faecal floatation method revealed an overall gastro-intestinal infection prevalence of 68.1% of sheep originating from this area which were being parasitized at least by one type of gastrointestinal nematodes. However, apparent difference were also noted, this finding agrees with previous studies by coprological examination in some areas of Ethiopia 76.3% (Moti, 2008) and 79.09% (Achenef, 1997).

Accordingly, similar prevalence of gastrointestinal nematodes results agrees with reports of previous studies conducted in Ethiopia as 56.6% strongyles, 8.2% strongyloides and 5% trichuris in Debre Zeit (Tigist, 2008); 66.6% strongyles type and 3.3% Trichuris species in Bedele (Temesgen, 2008); 70.2% strongyles type and 4.5% Trichuris species in Western Oromia (Ragassa et al., 2006) and 42.25% strongyles type in Kelela (Tesfaye, 1998). Other comparatively very large coproscopic examination report was 97.03% strongyles type, 45.22% strongyloides and 30.25% Trichuris species in eastern part of Ethiopia (Abebe and Eseyas, 2001).

Many surveys were carried out in different regions of the country using both coproscopic and post mortem examination. The gastrointestinal nematodes are the predominant parasites prevalent in the country reported by Hailuleul (2002) in Wolayta Soddo and Yosef (1993) in Asella, and showed very high prevalence of infested sheep over 85% in their study areas. The variation is

Table 1. Prevalence of gastrointestinal nematodes of sheep encountered in the study area.

Parasite egg types	Number of animals examined	Positive samples nematode eggs	Prevalence (%)
Strongyles spp	408	261	64.0
Strongyloides spp	408	30	7.4
Trichuris spp	408	15	3.7
Total	408	278	68.1

Table 2. Prevalence of gastrointestinal nematode infection based on sex and age of animals using coprological examination.

Risk factors	Total no. of animals examined	No. of positive samples (%)	χ^2	P- value
Age				
Lamb	271	109 (79.6)	12.4005	0.00
Adult		169 (62.4)		
Total	408	278 (68.1)		
Sex				
Male	179	119 (66.5)	0.4032	0.525
Female	229	159 (69.4)		
Total	408	278(68.1)		

Table 3. Results of chi- square (χ^2) analysis of association of body condition of the sheep as risk factor of GIT nematode infection.

Body condition	No. of animals examined	No. of positive samples (%)	χ^2	P-value
Good	187	115 (61.5)		
Medium	141	98 (69.5)	10.2547	0.006
Poor	80	65 (81.3)		
Total	408	278 (68.1)		

Table 4. Prevalence of gastrointestinal nematode of sheep during the period November, 2008 to April, 2009 using coprological examination.

Months	Faecal samples examined	No.of positive samples	Prevalence (%)
November	68	45	66.2
December	68	47	69.1
January	68	35	51.5
February	68	39	57.4
March	68	60	88.2
April	68	52	76.5
Total	408	278	68.1

χ^2 =27.3204, P = 0.00

reported in prevalence rate among different works. This difference could be due to the sample size considered, climatic condition of the study area, long dry season between November and January and short of rain season between February and April in the study area and types of techniques utilized.

This study showed that strongyles having direct life cycle were the most prominent among those that were positive for gastrointestinal nematode parasites of animals. Therefore, strongyles are gastrointestinal nematodes of greatest importance in sheep, and causes serious direct and indirect losses in most parts of the

Table 5. Prevalence of gastrointestinal nematodes of sheep at different sites of the study area using coprological examination.

Study sites	No. of faecal samples examined	No.of positive sample	Prevalence (%)	χ^2	P-value
Denkeka Koncha	120	84	70.0		
Haro Bilallo	42	23	54.8		
Gora Silingo	36	23	63.9	4.7151	0.318
Dosha	30	20	66.7		
Asella	180	128	71.1		
Total	408	278	68.1		

Table 6. Level of infection based on egg per gram (e.p.g) count of examined positive animals for nematode according to Hansen and Perry (1994).

Intensity of infection	Examined no. of samples (%)	e.p.g
Light	73 (30.04)	50-800
Moderate	98 (40.32)	801-1200
Heavy	72 (29.62)	More than 1200
Total	243 (100)	-

country by Hailuleul (2002) in Wolayta Soddo and Yosef (1993) in Asella. Strongyloides and Trichuris species were poorly represented. This agrees with the idea of Urquhart et al. (1996) which indicates only youngs are more susceptible to these parasites while adults usually develop certain immunity. Soulsby (1986) also indicated the presence of resistance for Trichuris in sheep over eight months and not usually severe enough to cause clinical disease. Clinical signs are seen mainly in the young and appear only in case of severe infection.

When infection rate on age was subjected to analysis, lambs were found more frequently infected than adult sheep. Even though their prevalance was not shown in a dramatic difference, the statically significant difference ($P < 0.05$) was recorded between the two age groups. The reason is that as new born and younger sheep, they lack strong immunity as in the adults. The possible explanation is that in adult sheep, after primary infection, rapid solid immunity is acquired. In fact, sheep continually exposed to infection are at low risk provided the rate of acquisition of infective larvae is sufficient to stimulate satisfactory response, and no cause of clinical illness was reported by Soulsby (1986). There are also special conditions encountered during peri-perturient rise in nematode eggs excretion, as early as two weeks before lambing, and persisted up to eight weeks post-partum when lambing, and took place during the wet seasons is the idea of Ng'ang'a et al. (2006). Thus, pregnant or lactating ewes became the major source of infections for the newborn lambs. In the same manner, other studies in Africa have shown that the age and immune status of the host animal have significant influences on nematode egg output (Magona and Musisi, 2005).

The present study shows no statistically significant differences ($P > 0.05$) between different sex groups. This finding agrees with report by Assefa and Sissay (1998), with gastrointestinal helminthes affecting both sex groups equally. This is due to equal exposure of both sexes, and they are from similar agro-ecology. The variation may occur in the intensity of infection due to post-parturient parasite rise in lambed sheep. Similarly, there is no statistical significant difference observed between the study sites since they have the same agro ecology. This also agrees with report by Armour (1980) significant difference was reported in animals reared in different geographical areas.

Difference in body condition score is statistically significant ($P < 0.05$) with gastrointestinal nematode infection such that shedding of nematodes eggs increased with poor body condition (81.3%) than in good body condition (61.5%). This finding agrees with Bisset et al. (1986) who suggest that well-fed animals develop good immunity that suppresses the fecundity of the parasites. The highly statistical significant difference ($P < 0.05$) result obtained on monthly study revealed that the highest percentage of infection of the study subjects was 88.2% on March during the short rainy season and the lowest was 51.5%, recorded in January during the dry season. In the rest of the months, almost a close similarity records were obtained. This could be due to the development, survival and transmission of free living stage of nematode parasites which is influenced by micro-climatic factors within the faecal pellets and herbage which is in agreement with Urquhart et al. (1996). These include sunlight, temperature, rainfall, humidity and soil.

The seasonal fluctuations in numbers and availability of the infective larval stages are influenced by the level of

contamination of pasture. Larvae of important gastro-intestinal nematodes are able to undergo a period of arrested development (hypobiosis) in host following infection; larvae may become metabolically inactive for several months. The greatest proportion of larvae usually becomes arrested at times when conditions in the external environment are least favorable for development and survival of eggs and larva (Michael et al., 1975). This suspension of development helps some nematode to survive the dry seasons. Resumption of rainy season is the most favorable period for larval development and transmission on pasture (Agyei et al., 1991).

CONCLUSION AND RECOMMENDATIONS

The present study was based solely on coproscopic examination for detection of gastrointestinal nematode eggs; it has provided an insight to the current prevalence and associated risk factors. It suggested that ovine gastrointestinal nematodes are of the major helminthosis in and around Asella. Age, body condition and seasonal dynamics are the most prominent risk factors associated with gastrointestinal nematode infection. In addition, weak status of animal health services and lack of proper management, especially in the study area, crop-livestock mixed farming is highly practiced, and most land is cultivated so that many species of animals are kept together on marginal and a piece of land. However, they give low priority to sheep in respect to the value they obtained from them. They give the first line to draught animals and forced sheep to graze behind on overstocked areas which lead them to graze close to the ground and on faecal materials, resulting in the uptake of higher numbers of infective larvae.

On the basis of the above conclusion and the present findings, the following recommendations are forwarded:

1. Detailed study should be conducted to clearly identify parasitic fauna using faecal culture and postmortem examination in the study area.
2. Strategic anthelminthic treatments: Treat sheep with broad spectrum anthelminthic at the beginning of rain season and at the end of dry season to reduce the worm burden and minimize pasture contamination with larvae, and treat flock with special consideration to those sheep in poor condition rather than individual animal separately. To prevent anthelmintic resistance, regular study should be carried out on the efficacy and resistance of the anthelminthic drugs directed to the subject area.
3. Using pasture management: Applying rotational grazing system for different seasons would reduce pasture contamination, separating the most susceptible young animals from adults, which is a possible source of contamination. Maintaining the stocking rate to reason-able level avoids consequent pasture contamination.
4. 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.
5. Support role of veterinarians and animal healthy extensions in giving professional advices regarding preventive and control measures against gastrointestinal helminthes parasites and prevention of drug abuses.

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