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Gastrointestinal Nematode Infestation; Prevalence and Associated Risk Factors in Small Ruminant at Wolayta Soddo District, Southern Ethiopia

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Abstract

A cross-sectional study was conducted to estimate the prevalence and risk factors associated with small ruminant nematodes in the Wollayta-Soddo district, southern Ethiopia. In the study conducted from october 2017 to June 2018, a total of 270 small ruminants (175 sheep and 95 goats) were examined. The study revealed that the overall prevalence of nematode was 74.07%. The species level prevalence of nematode was75.43 % and 71.6% in sheep and goats respectively. In animals with poor body condition, the nematode egg detection level was higher than the corresponding categories that showed significant association withp< 0.05. The statistically significant difference was not observed between sex, species, season and age of the animals. Hence, the need for strategic deworming and other related measures was suggested to reduce the production loss associated with the Gastro-Intestinal Tract (GIT) nematodes in small ruminants at the current study area.

Keywords: Gastrointestinal Nematodes, Risk factors, Prevalence, Small Ruminants

1. Introduction

The small ruminant population of Ethiopia is one of the largest in Africa (IBC, 2007). There are about 25 million heads of sheep and 22 million heads of goats in the country, playing an important role in the livelihood of resource-poor farmers. In Ethiopia, sheep and goats account for about 90% of live animals (CSA, 2008-9). Despite the large numbers of small ruminants' population of Ethiopia, the economic benefits remain marginal due to prevailing diseases, poor nutrition, poor animal production systems, reproductive inefficiency, management constraints and general lack of veterinary care. The diseases have a major impact on morbidity and mortality rates, with annual losses as high as 30–50% of the total value of livestock products of Ethiopia (Tibbo *et al*., 2003).

Helminths infection in domestic ruminants are of major importance in many agro-ecological zones in Africa and had the highest index as an animal health constraint to the poor keepers of livestock worldwide through losses due to reduced weight gains, growth rate, reduced nutrient utilization, lower meat, wool and milk production, involuntary culling, cost of treatment, mortality and condemnation of affected organs at slaughter (Sissay *et al*., 2007). Gastrointestinal nematodes are among the most destructive pathogen affecting ovine production, given the high prevalence in flocks and the serious consequences of infection (Francisco *et al*., 2007). However, the effects of helminth infection on the production of particular livestock species depend mostly upon the age of the animals, the breed, the parasite species involved and the intensity of the worm population within the definitive host. Several factors are known to determine the epidemiological patterns of the associated disease conditions. These include weather conditions, husbandry practices, and the physiological status of the animal (Tembel *et al*., 1997*).*

The nematode genera Trichostrongylus, Ostertagia, Cooperia, and Nematodirus often occur together in the alimentary tract of ruminants. Their combined effects on the host, together with those of other alimentary nematodes such as *Oesophagostomum* and the *hookworms*, are commonly known as parasitic gastroenteritis (Radostitis *et al.*, 2007). Nematodes are cylindrical worms, both ends being usually somewhat pointed. In the center of the body runs the alimentary canal, which is a tube usually consisting of a mouth at the anterior end of the worm, muscular esophagus and an intestine leading to an anus. In most male worms a copulatory bursa and genital papillae are present, and in females, a vulva is present (James *et al.*, *2003*).

The main parasites that influence livestock farms are the *Nemathelminthes* which include many superfamilies of veterinary importance. These are *Trichostrongyloidea, Strongyloidea, Metastrongyloidea, Ancylostomatoidea, Rhabditoidea, Trichuroidea, Filarioidea, Oxyuroidea, Ascaridoidea and Spiruroidea* (Sissay *et al.*, 2007). However, in small ruminants, gastrointestinal nematodes are Important members of the order *Strongylida*. This contains *Trichostrongyloidea, Strongyloidea, Metastrongyloidea*, and *Ancylostomatoidea*, but most of them belong to the superfamily *Trichostrongyloidea*. Small ruminants are infected with a group of these *strongylid* nematodes, causing clinical effects known as parasitic gastroenteritis (Zajac *et al*., 2006).

In the nematode, the sexes are separate and the males are generally smaller than the females which lay eggs or larvae. During development, a nematode molts at intervals shedding its cuticle. In the complete life cycle, there are four molts, the successive larval stages being designated L1, L2, L3, L4 and finally L5, which is the immature adult (Taylor *et al*., 2007; Urquhart *et al*., 1996). The prophylactic treatment of nematode infection depends basically on the use of anthelmintics (Mickael *et al.*, 2003). Notably, the availability of safe, broad-spectrum anthelmintics has helped to reduce the incidence of a great number of worm diseases. In general, anthelmintic groups are greatly effective against the immature and mature stages of virtually all of the important gastrointestinal nematodes as well as many extraintestinal helminth species (Kohler *et al*, 2001).the available literature in the current study suggests that nematode infestation is one of a major problem against livestock production. Furthermore, assessing the current status of the small ruminant nematodes at the area found to be necessary. Therefore, the objective of the current study was to estimate the prevalence of small ruminant nematodes based on fecal examination and to assess the associated risk factors with the small ruminant nematodes in Wolayta soddo.

2. Materials and Methods

2.1 Study Area:

The study was conducted from October 2017 to June 2018 in Wolayta Soddo town, Southern Ethiopia. Wolayta Zone has a total of 4471.3 Km^2 areas, and is located between $6.4^0 – 7.2^0$ N and $37.4^0 – 38.2^0$ E and 383km far from Addis Ababa and 165kms far from Hawassa town. The Wolayta Soddo town lies between the altitude range of

2000-2500 meters above sea level and annual average rainfall ranges from 450millimeters -1446 millimeters. The mean annual maximum and minimum temperature are $26.6C^0$ and $11.4C^0$, respectively. The predominant farming system is a mixed livestock and crop production system (WZFEDD, 2003).

2.2 Study Design

A cross-sectional survey was conducted to estimate the overall prevalence of small ruminant GIT nematodes in Wollayta Soddo district based on coproscopic examination. Villages known for their small ruminants population was purposely selected and animals were picked by moving throughout the owners' house and restraining at the grazing field with the help of owners. Following fecal sample collection, biodata of the individual animal was captured using a semi-structured questionnaire.

2.3 Study animals

The study animals were sheep (195) and goats (95) of both sexes and different age groups in and around Wollayta Soddo. The animals were of local breeds, kept under traditional extensive management system. Conventionally, the age of small ruminants classified as ` young` when less than one year while ` adult` when greater than or equal to one year (Steele *et al*., 1996) and Body condition scoring of sampled animal was carried out according to the method described by Thompson and Meyer (2002) and categorized into two scores as poor and good. The poor body condition was recorded when an individual spinous process was sharp to touch and easily distinguished, in addition, the bony structure of the animals were easily noticeable. The eye muscles are of moderate depth. Good body condition was recorded when the top and side of the backbone in the loin area immediately behind the last rib and above the kidney were covered with muscles.

2.4 Sample Size Determination

The desired sample size was calculated using the standard formula described by Thrustfield, (2005) and expected prevalence of 77.4 that taken from the previous finding at the area by Yemisrach and Amenu, (2017) as follows;

$$N = \frac{1.96^2 p_{exp} (1-p_{exp})}{d^2}$$

Where
n = Sample size
p_{exp} = Expected prevalence (77.4%)
1.96 = the value of Z of 95% confidence level
d = Desired absolute precision = 5%

Accordingly, the calculated sample size was 268 heads of small ruminants. However, 270 animals were sampled in the study to increase precision.

2.5 Sampling method and sample collection

The study conducted in the Wolita Soddo Zuria Worade, out of the 31 Kebele 4 were selected purposely based on small ruminant population. The selected sites were Offagandabba, Fana, Warazoshaho and Kokate. Equal proportions of samples were collected from each site and animals were picked randomly. The animals breed, body condition scores, estimated age group, and sex were recorded. A fresh fecal sample was collected in every month throughout the study period directly from the rectum of each animal. Collected fecal samples were put in the sampling bottle containing 10% formalin and transported to Wollayta Soddo regional veterinary laboratory and stored at the refrigerator in a 4°C temperature until processing. In the laboratory, fecal samples were examined for the detection of nematode eggs using standard procedures of flotation as described by Charles, (2006) and the floatation solution used was NaCl (sodium chloride).

2.6 Data management and analysis

The prevalence was calculated for all data as the number of infected individuals divided by the total number examined times a hundred. The data were first entered and managed into Microsoft excel worksheet and analyzed using Statistical data analysis (STATA) software version 12. The degree of association between different variables and outcome variables was evaluated and for all analysis, a p-value less than 0.05 at 95% confidence level were taken as significant.

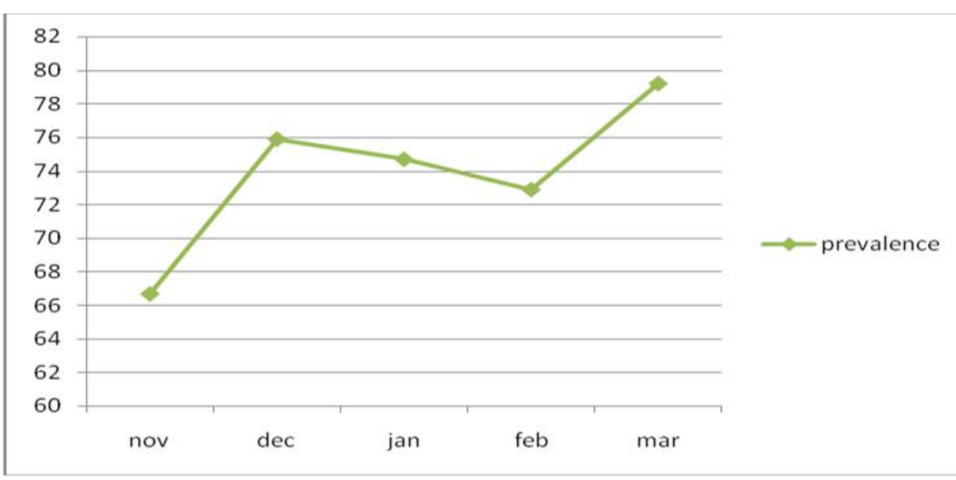
3. Results

In the current study, the fecal sample of 270 small ruminants was examined and 74.1% of them were found to be positive for ova of GIT nematodes. The observed proportion between the two species was not statistically significant (P > 0.05). Among the study small ruminants, 96 of them were young as they were all less than one year of age while remaining animals (174) with greater than or equal to one year were considered in the adult category. Seventy-five percent of the young age groups were observed to have one or more parasitic egg in their feces. In the adult category, 73.6% of them have identified to harbor the nematodes egg. Regarding sex, 74.6% of the females and 72.6 % of males were positive for nematode egg in their feces. Statistically, there was no significant difference between the two sex groups (P > 0.05). Fecal sample collected from animals with poor body condition were more frequently positive for parasitic egg than the corresponding animals with good body condition. In the category, the prevalence difference observed between the two groups was statistically significant (P < 0.05) (Table 1). Data summary for the prevalence of gastrointestinal nematode infections across months was made for five months. The lowest proportion of 66.7% was reported in November, while the highest 79.2% was reported in March and the statistical significant variation was not seen between months (P > 0.05) as described graphically below on figure (Figure 1).

Table 1: Prevalence of GIT nematodes and Association of results with risk factors

Factors		No. examined	No. positive	Percentage	95% CI	P-value
Species	Ovine	175	132	75.43	69.6-81.8	.491
	Caprine	95	68	71.6	62.5-80.6	
	Total	270	200	74.07		
Sex	Female	197	147	74.6	68.5-80.1	.737
	Male	73	53	72.6	62.4-82.8	
	Total	270	200	74.07		
Age	Young	96	72	75	66.3-83.7	.797
	Adult	174	128	73.6	67-80.1	
	Total	270	200	74.07		
BCS	Poor	50	43	86	76.4-91.2	.022
	Good	220	157	71.4	61.4-77.5	
	Total	270	200	74.07		

Figure1: Prevalence of major GIT nematodes based on months



4. Discussion

The current study revealed the existence of major GIT nematode parasites with an overall prevalence of 74.07% in small ruminants. Out of all study animals, 75.43% sheep and 71.6% goats were infected with one or more nematodes. This finding was lower than the results of other surveys in sheep and goat carried out in Bishoftu by Abuna *et al.,* (2008)who reported prevalence of 78.1% in sheep and 76.6% in goat, in Gondar by Tewodros and Girja, (2012)who reported prevalence of 81.2% in sheep and 73.5% in goat, in Kombolcha by Ketame *et al.,* (2011)who reported a rate of 81.35% in sheep and 72.6% in goat, in Ogadenby Kumsa and Wossene, (2006)who found a rate of 91.2% in sheep and 82.9% in goat, and in Hawassa by Thomas *et al.,* (2006) who reported a rate of 81.1% in sheep and76.5% in goat. This difference could be due to extensive use of anthelmintics by the farmers, difference in agro-climatic conditions that could support prolonged survival and development of an infective larval stage of most nematodes (Rossanigot *et al.,* 1995). However, the current finding was higher than the finding of Tefera *et al.,*(2009) who reported a prevalence of 69.5% in sheep and 65% in goats from Bedale, western Ethiopia. The difference might be due to the difference between the management system of examined animals and geographical and environmental location of the area.

In the present study, a relatively higher prevalence of GIT nematodes was observed in sheep than in the goats which were in agreement with other reports in Ethiopia by Ketame *et al*., 2011; Thomas *et al*., 2006 and this might assumed to be due to the grazing habit of the sheep where they graze closer to the ground fostering opportunity of exposure to nematodes. However, it was in contrary to reports from Western Ethiopia by Regassa *et al.,* 2006 and Eastern Ethiopia by Abebe and Esayasu, 2001. 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 risk of acquiring the infection from the sheep (Dagnachew *et al.* 2011). Furthermore, it might be assumed that sheep do have a considerably higher immunological response to gastrointestinal parasites compared with that of goats (Urquhart et al., 1996).The study further revealed that the age of the animal did not show significant association with the prevalence of the nematodes infection which was in agreement with the report of Haftamu *et al*., (2012). The absence of an association between age groups wasin disagreement with previous reports of Regassa *et al*., (2006) and Dagnachew *et al.*, (2011) in Ethiopia. Age was considered an important risk factor in GIT nematodes (Raza *et al*., 2007). Several authors had documented that adult and old animals develop acquired immunity against nematode infections as they get mature due to repeated exposure and this will help expel the parasite before it establishes itself in the gastrointestinal tract (Dagnachew *et al.* 2011; Urquhart *et al.*, 1996).

The present study revealed that sex of the animal did not show significant association with the prevalence of the nematodes infection. The absence of an association between sexes and prevalence was in agreement with previous reports of Haftamu *et al*., (2012) and Regassa *et al*., 2006. This indicated that male and female small ruminants have an equal chance of infection if they are exposed to the same contaminated communal grazing pasture. However, Dagnachew *et al*., 2011 reported that female animals are more susceptible to parasitism. It might be assumed that sex might be a determinant factor influencing the prevalence of parasitism, and females were more prone to parasitism during pregnancy and peri-parturient period due to stress and decreased immune status (Iqbal *et al.,* 1993).The difference in body condition score was statistically significant ($P < 0.05$) with gastrointestinal nematode infection such that shedding of nematodes eggs increased with poor body condition (86%) than in good body condition (71.4%).This finding agrees with Bisset *et al*., (1986) who suggest that well-fed animals develop good immunity that suppresses the fecundity of the parasites.

In seasonal wise, the difference in a month was statistically insignificant ($p>0.05$) with GIT nematodes infection. This might be due to the absence of rain fluctuation during study time. Obviously, the wet season might be favorable for the development and survival of free-living stages of nematodes. However, the absence of an association between month and prevalence was in disagreement with previous reports of Haftamu *et al*., 2012.

Conclusion and Recommendation

The overall prevalence of gastrointestinal nematodes in the study area indicates that GIT nematodes were important health problem due to its high prevalence (74.07%). The study indicated that the prevalence was higher particularly in animals with poor body condition than good body condition regarding the animal category in body condition. There was no statistically significant difference noted in any of other risk factor categories considered under the investigation. Based on the above conclusions, the following recommendations are forwarded:-

- ➢ The animal health extension program should take placeto increase farmers awareness on the impact and prevention of parasitic diseases
- ➢ Integrated parasitic management practice that involves reducing pasture contamination should be implemented.
- ➢ Strategic deworming practice needs to be introduced in the area.

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