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Prevalence of Ovine Lungworm in and Around Hawassa

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Abstract

A cross-sectional study was conducted from November, 2014 to April, 2015 to estimate the prevalence of lungworm infection and to investigate some of the risk factors associated with it in and around Hawassa, southern Ethiopia. Faecal samples were collected from randomly selected 384 sheep (196 male and 188 female) to estimate first stage larvae (L1) using modified Baerman technique. The overall prevalence recorded by faecal examination was 19.01%. *Dictyocaulus filaria, protostrongylus rufescens,* and *Mullerius capillaris* were identified, *Dictyocaulus filaria* was the most prevalent species found in the study area accounting 6.77% of total positive sheep which is statistically significant($\chi 2=3.840$, $p< 0.05$). The prevalence rate between male and female sheep showed significant differences ($\chi 2=11.902$, $p < 0.05$) with prevalence rate of 12.24% and 26.06% respectively. regarding to the age, the highest prevalence (19.09%)was observed in sheep of 1-3 years of age while the lowest prevalence (15.28%) was observed in sheep of less than 1 years of age with no statistical significant differences ($\chi 2=6.788$, $p >0.05$). there was statistical significant differences ($\chi 2=10.141$, $p <0.05$)on the prevalence of lungworm infection in the sheep between extensive and semi-intensive management system in which the prevalence rate accounts 25% and 12.22% respectively. According to the body condition, the prevalence of lungworm infection revealed that there was statistically significant ($\chi 2= 12.870$, $p<0.05$) between the prevalence of lungworm and body condition of sheep with highest prevalence (30.77%) in poor and lowest prevalence (5.88%) in good body condition. Thus lungworm infection is an important parasitic disease in and around Hawassa and further investigation is warranted to assess its impact on economy and to reduce its incidence.

Keywords: *Dictyocaulus filaria*, Hawassa, Lungworm, *Mullerius capillaris*, Prevalence, *Protostrongylus rufescens*.

Introduction

Livestock production is a major component of the agrarian economy in developing countries and goes well beyond direct food production. Sales of livestock and their products provide immediate cash income to farmers and foreign exchange to the endowed countries (ILCA, 1995). In Ethiopia, agriculture is the mainstay of the country and also the major resources of employment and income. About 85% of population live in rural areas and are primarily engaged in agriculture and related activities. Thus agriculture, directly or indirectly forms an important components of livelihood of more than 60 million people in the country(Atesmachew *et al.*, 2006).

Among the predominant livestock species, sheep play an important role in the socio-economic development of the majority of African countries. They supply more than 30% of domestic meat consumption and generate cash income from export of meat, mainly as live animals and skin and it also provides wool, milk, manures for the soil and serves as investment for the farmers. Hence an increase in sheep production and also to increase export earnings (Fletcher and Zelalem, 1991), however, several factors especially constrains their full utilization. Among these diseases, respiratory diseases have been identified as an important problem of sheep in the highlands of Ethiopia for the last two to three decades. It may account for up to 54% of the overall mortality of in central highlands of Ethiopia (Mukasa- Nugraw *et al.*, 2000).

Helminthes parasites of ruminants are ubiquitous and prevalent, with many tropical and sub-tropical environments of the world providing nearly perfect conditions for their survival and development. However, the clinical signs they cause in infected animals can be less obvious than signs of other of other livestock diseases partly for this reason, infections with gastro-intestinal and other helminthes parasites are among the most neglected areas of veterinary in much of the developing world. It has however been established that high prevalence rates of infection with less obvious sign associated with poor production and unthriftness (Hansen and Perry, 1994). Among the respiratory diseases endoparasites such as *dictyocaulidae* and/or certain *metastrongylidae* are known to exist in east Africa (Ethiopia, Kenya and Tanzania) and South Africa (Alemu*et al.,* 2006). Endoparasites including *Dictyocaulus filaria*, are major causes of death and morbidity on farms in Ethiopian highlands. Up to half of all sheep deaths and morbidity on farms in Ethiopia highlands are caused by pneumonia and endoparasites (ILCA, 1995).

The production losses due to helminthes is associated with direct direct consequences of clinical and sub-clinical infections resulting in low productivity due to stunted growth, reduce weight gain, poor feed utilization or loss due to mortality or indirect loss associated with cost of treatment and control measures (Ayalew, 1995; Desalegn, 1999).

Control of these parasites is therefore, essential for releasing the potentials of sheep production. For the proper control to be knowledge of parasitic diseases and their dynamics must dangerous to lay down rigid rules of their control which are applicable for all regions. For these reasons a study of epidemiology of each parasitic disease should limited small areas (Radostitis *et al*., 2006). Therefore, to increase the potential of small ruminant production and to get the maximum benefits from them prevention and control of lungworm is very important.

Although environmental factors are conductive for lungworm infections in sheep in Hawassaand lungworm infection is considered as an important disease in this region.

Therefore, the objectives of this study were;

- To determine prevalence of ovine lungworms infection in and around Hawassa.
- To investigate some of the risk factors associated with it.

Materials and Methods

Study area

This study was carried out in and around Hawassa, Sidama zone, South Nation Nationalities and People Regional State. Hawassa is located at a distance of 275 km from Addis Abebaand 20 km away from shashemene on the shore of one off the rift valley lakes. It is situated at 1500-2000 meters above sea level. It is geographically lies between $4^{0}27'$ and $8^{0}3'$ north latitude and $34^{0}21'$ and $39^{0}12'$ eat longitude. The total human population of Hawassa was estimated to be 150,000. The town covers an area of 50 km^2. The annual rainfall and temperature range of the town is 800-1000mm and 20-25^{0} respectively. The total livestock population of Sidama zone is estimated to constitute 1,573,318 cattle, 183, 462 goats, 221, 505 sheep, 49, 150 horses, 53, 950 mules, 1, 196, 506 poultry and 73, 479 bee hives (CSA, 2004).

Study population

The study population was sheep in and around Hawassa. Sheep in the study are kept under extensive and semi-intensive management system. These sheep are maintained in small household flocks of mixed age group and sex for subsistence and small scale private farm for sale.

Study design

The study was cross-sectional study carried out to determine the prevalence of ovine lungworm infection and to investigate some of the risk factors associated with it in and around Hawassa. A total proportion of 384 sheep obtained from selected sites of Hawassa. The variable of interest considered as an output variable versus risk factors during the study was faecal samples for larvae of lung worm. The explanatory variables considered were the age, sex, management and body condition score.

Sample size determination

The size required for this study was determined based on sample size determination in random sampling for infinitive using expected prevalence of sheep lungworms at 5% desire absolute precision according to (Thrusfield, 2005) as follows:

$$N = \frac{1.96 \text{ x Pexp (1-Pexp)}}{d^2}$$

Where,

N = required sample size

Pexp = expected prevalence

d = desired absolute precision

Since there was no similar work done in the area previously, expected prevalence was taken as 50% and the confidence interval was chosen as 95% and desired precision was 5%. By substituting these values in the formula, the sample size was 384.

Sampling Procedure

Samples were collected from sheep occasionally from visits to field. In any case sheep were selected randomly. Faecal samples were collected directly from rectum of all selected sheep and stored in vials until examination. During the collection of the faecal samples, the following data are recorded; age, sex, management system, and body condition score. Sampled sheep were categorized in to three age groups as group I = <1 years, group II = 1-3 years and group III = >3 years of age. Age of study sheep were determined based on owners information and dental estimation methods (MoARD, 2009) and body condition score as good, medium and poor (Alemu and Merkel, 2008).

In the laboratory, five grams of fresh feaces was weighted from each sheep. It was wrapped with gauze, fixed on to string in a beaker filled with water. The Baerman apparatus was left for 24 hours. The larvae in the feaces migrate to the gauze and settle at the bottom of the glass. After siphoning off the supernatant, the sediment was examined under low power of the microscope as stated by Charles (2006).

Identification and characterization

In the laboratory following conventional methods of Baerman technique was used for the identification of lungworm larvae. Five grams of fresh faeces was weighted from each sample for the extraction of L1 larvae and enclosed in gauze fixed on to string rode and submerged in a clean glass tube filled with slightly warm water. The whole apparatus was left for 24 hours and then the sediment was examined under low power of the microscope after siphoning of the supernatant. When positive, a drop of 1% iodine solution was used to immobilize the larvae for the identification of the species, otherwise it was registered negative for lungworm infections (Fraser, 1991; Urquhart *et al.*, 1994).

During identification the larvae, the presence of *D. filaria* was confirmed by the finding of the first stage larvae with the anterior protoplasmic knob and black granular intestinal inclusions. The larvae of *P. rufescens* and *M. capillaris* are differentiated by their characteristic features at the tip of the tail. *P. rufescens* has a wavy outline at the tip of its tail, but devoid of dorsal spine. On the other hand *M. capillaris* has undulating tip and dorsal spine (Schneider, 2000).

Data management and analysis

Data was entered and managed in Microsoft excel work sheet and analyzed using statistical software programs (SPSS version 16.0). Prevalence of lungworm at sheep was expressed as percentage with 95% confidence interval (CI) by dividing the total number of animals positive to the lungworms to the total number of animals examined. A was considered positive for for lungworm if it was positive for faecal examination. The significance of differences between the prevalence of lungworms was determined using chi square test. The explanatory variables (sex,age, management and body condition score) were considered as risk factors to see their association with the level of prevalence.

Results

Coproscopic examination

A total of 384 sheep faecal samples were examined by modified Baerman technique, out of the examined sheep 73 were found to be with one or more of lungworm species with an overall prevalence of 19.01%. The lungworm species encountered during the study period were *Dictyocaulus filaria, mullerius capillaris* and*protostrongylus rufescens* which accounted for the prevalence of 6.77%, 3.71%, and 4.69% respectively. The prevalence of mixed infection was 3.65% in which *Dictyocaulus filaria* (6.77%) was the most prevalent species of lungworm in the study area (Table 1).

Table 1: prevalence of lungworm species

Lungworm species	Positive	prevalence
Dictyocaulusfilaria	26	6.77
Protostrongylusrufescens	18	4.69
Mulleriuscapillaris	15	3.91
Mixed infection	14	3.65
Total	**73**	**19.01**

Prevalence of lungworm infection based on age

Sheep were categorized in to three age groups as Group I = <1 years of age, Group II = 1-3 years of age and Group III = above three years of age. Among the 384 sheep, the highest prevalence (19.90%) was observed in age of 1-3 years sheep while the lowest prevalence (15.28%) was observed in sheep less than 1 year of age. The differences among the prevalence of different age groups were not statistically significant ($x^2 = 6.788$, $p>0.05$) (Table 2).

Table 2: prevalence of lungworm infection in sheep based on age

Age	Total Examined	Lungworm species				TOTAL
		DF (%)	***MC (%)***	***PR (%)***	***MI (%)***	
<1 Year	72	5(6.94)	1(1.39)	3(4.17)	2(2.78)	11(15.28)
1-3 Year	191	15(7.85)	8(4.19)	6(3.14)	9(4.71)	38(19.90)
>3 Year	121	6(4.98)	6(4.98)	9(7.44)	3(2.48)	24(19.83)
TOTAL	**384**	**26(6.77)**	**15(3.91)**	**15(4.69)**	**14(3.65)**	**73(19.01)**

($\chi2=6.788$, p = 0 = 0.560)

DF= Dictyocaulusfilaria, MC = mulleriuscapillaris, PR = Protostrongylus rufescens, MI = Mixed infection

Prevalence of lungworm infection based on sex

As the study was made on lungworm infections in the relation to the sex of sheep and accounted for a prevalence rate of 12.24% in males and 26.06% in females. There was statistically significant difference ($x2 = 11.902$, $p<0.05$) on the prevalence of lungworm infection between female and male sheep (Table 3).

Table3: prevalence of lungworm infection based on sex

Sex	Total examined	Lungworm species				Positive (%)
		***DF* (%)**	***MC* (%)**	***PR* (%)**	***MI* (%)**	
Female	188	17(9.04)	10(5.32)	11(5.85)	11(5.85)	49(26.06)
Male	196	9(4.59)	5(2.55)	7(3.57)	3(1.53)	24(12.24)
Total	**384**	**26(6.77)**	**15(3.91)**	**18(4.69)**	**14(3.65)**	**73(19.01)**

($\chi2= 11.902$, p = 0.012)

DF= Dictyocaulusfilaria, MC = mulleriuscapillaris, PR = protostrongylusrufescens, MI = Mixed infection

Prevalence of lungworm infection based on management

The study was conducted by categorizing sheep in to two groups as extensive and semi-intensive management system. There was significant differences ($x2 = 10.141$, $p< 0.05$) 0n the prevalence of lungworm infection between two different management system in which the prevalence was high (25%) in sheep maintained under extensive management system than (12.22%) semi-intensive management system (table 4).

Table4: prevalence of lungworm infection based on management

Management system	Total examined	Lungworm species				Positive (%)
		***DF* (%)**	***MC* (%)**	***PR* (%)**	***MI* (%)**	
Extensive	204	20 (9.80)	9(4.41)	13(6.34)	9(4.41)	51(25)
Semi-intensive	180	6(3.33)	6(3.33)	5(2.77)	5(2.77)	22(12.22)
Total	**384**	**26(2.66)**	**15(3.91)**	**18(4.69)**	**14(3.65)**	**73(19.01)**

($\chi 2$ = 10.141, p = 0.01)

DF= Dictyocaulus filaria, MC = mullerius capillaris, PR = protostrongylus rufescens, MI = Mixed infection

Prevalence of lungworm infection based on body condition

The study was conducted to see the influences of body condition on the prevalence of lungworm infection and revealed that there was statistically significant (x2 = 12.870, p<0.05) between the prevalence of lungworm and body condition of the sheep with a prevalence rate of 30.77%, 18.04% and 5.88% in poor, medium and body condition, respectively (Table 5).

Table 5: prevalence of lungworm infection in different body condition

Body condition	Total examined	Lungworm species				Positive (%)
		***DF* (%)**	***MC* (%)**	***PR* (%)**	***MI* (%)**	
Poor	78	9(11.54)	3(3.85)	9(11.54)	3(3.85)	24(30.77)
Medium	255	16(6.27)	11(4.31)	9(3.53)	10(3.92)	46(1804)
Good	51	1(1.96)	1(1.96)	0	1(1.96)	3(5.88)
TOTAL	**384**	**26(6.77)**	**15(3.91)**	**18(4.69)**	**14(3.65)**	**73(19.01)**

($\chi 2$= 12.870, p= 0.015)

DF= Dictyocaulus filaria, MC = mullerius capillaris, PR = protostrongylus rufescens, MI = Mixed infection

Discussion

This cross-sectional study revealed that the presences of three lungworm species affecting the respiratory tract of sheep with an overall prevalence rate of 19.01% in and around Hawassa. This findings agrees with the work done by other researchers who reported 21.5% in Tigray (Mengstom, 2008), 17.5% around Bahir Dar town (Denberga *et al.,* 2013) and 13.24% in and around Mekele (Frewengel, 1995). On the other hand, the 19.01% prevalence rate observed in this study is lower than 44.7% prevalence rate reported by Sisay (1996) in and around Bahir Dar, 34.90% by Beyene *et al* (2013) in Ambo, 57.1% by Bekele and Abu (2011) in Tiyo district, 28.6% by Gabreyohannes et al (2013) in MekedellaWoreda and 27.8% by Brook *et al* (1986) in Assela.

The differences in the prevalence of lungworms of sheep in the above study might be associated with the differences in the methods followed for the detection of larvae of lungworms and/or the study area which favors the survival of the larvae of lungworm or it may be due to nutritional status of the animals in the respective study areas which can influence the prevalence harboring the intermediate host, management practice of animals, rainfall, humidity and temperature differences and season of the examination on the respective study area. The reason for the low prevalence of the disease in this study could be attributed to the establishment of open air clinic, increasing number of private veterinary pharmacy, and increase awareness of farmers to deworm their sheep.

With regard to age, the high prevalence (19.9%) was observed in sheep of one to three years of age followed by the prevalence observed in sheep of greater than three years of ages, while the low prevalence (15.28%) in sheep of less than three years of ages. This is not statistically significant (p>0.05) which agree with Gabreyohannes *et al* (2013).

This may be associated with the apparent inability of the host to develop acquired immunity so that the adult animals have the highest infection and the highest prevalence (Alemu *et al.*,2006) and large number of samples taken from age group of one to three years.

In the current study higher level of prevalence was observed in female (26.06%) sheep compared to the level of prevalence in male sheep (12.24%). The result was consistent with Denbarga *et al* (2012) who report that that there was a significant variation in the infection rate of lungworms in male and females. The difference of prevalence between male and female animals may associated with the fact that resistance to infection is abrogated at the time of parturition and early lactation which results in the females inability to expel adult worms and causes higher level of larvae detection (Craig, 1998). The way that males and females treated in the terms of nutrition may also attribute for such differences. Males are kept for fattening to be sold later, except some which are kept for breeding, receives more attention by sheep producers. Crop left over and ruminants after human consumption, for instance, are provided primarily for male animals (Alemu *et al.,* 2006).

In the current study, species of lungworms of sheep were tried to be identified via coprological examinations. *Dictyocaulus filarial* was isolated more frequently followed by *Protostrongylus rufescens* while *Mullerius capillaris* was the latest identified species of lungworms. This is statistically significant ($p<0.05$) which agree with Beyene *et al* (2013) in Ambo district and Gabreyohannes *et al*(2013) in Mekedella Woreda. This difference in the prevalence of the different species of lungworm might be associated with the difference is in their life cycles. *Dictyocaulus filaria* has direct life cycle; takes less time to reach the infective stage and the larvae can appear in the feaceswith in five weeks after ingestion (Soulsby, 1982). The tranismission of *protostrongylus rufescens* and *Mulleries capillaries* is complex involving host, parasite, intermediate host and climate. Furthermore, development from first stage to infective stage larvae in the snail takes 12 to 14 days. Therefore the probability of infection, transmisstion and re-infection takes longer time compared with *Dictyocaulus filaria* and causes for the lower frequency of infection in these parasites (Urquhart *et al*., 1996).

In the present study, different level of prevalence were observed in sheep which have poor body condition (30.77%), medium body condition (18.04%) and in sheep of good body condition (5.88%) (Kimberling, 1998). This implies a significant variation ($p<0.05$) which agrees with Beyene *et al* (2013) in Ambo district. This signifies that poor body condition animals are more susceptible to an infection. The reason for this partly due to the fact that poorly nourished animals appear to be less competent in getting ride- off lungworm infection.

In the present study, the level of prevalence was compared between sheep kept under extensive and semi-intensive management systems. The prevalence was higher (25%) in sheep kept under extensive system of management, and the differences between the prevalence was statistically significant ($p<0.05$) which agree with Denberga *et al* (2013). The possible reason for the current findings could be increased the degree of pasture contamination in extensive system of management which increases the degree of exposure (Kahn, 2005). Furthermore, the response of lungworm infection varies widely depending on the nutritional status, age, age of host, and the number of larvae ingested (Alemu *et al.,* 2005).

Conclusion and Recommendation

The study on prevalence of lungworm infection of sheep by faecal examination in and around Hawassa revealed that a prevalence of 19.01%. The respiratory nematodes identified are *Dictyocaulus flaria*, *Mullerius capillaris* and *Protostrongylus rufescens*. This high prevalence of verminous pneumonia as the result of this three species is considered as one the important nematodes infection of sheep in the study area. In the study, the infection prevalence of lungworm has no significant association with age of sheep; other epidemiological risk factors such as management system, sex and body condition have great contribution to the prevalence of lungworm infection in the study area. Coproscopic examination confirms the existence of lungworm infection in and around Hawassa.

Therefore, based on the present findings, the following recommendations are forwarded;

- Regular strategic deworming of the whole flock with broad spectrum antihelimentics should be undertaken.
- Animals should not be allowed to have access to moist and swampy area.
- Additional shed should be provided to sheep to make well-nourished and good body condition.

- Farmers who keep small ruminants should advise not to keep their sheep in extensive management system.
- In the rainy weather conditions are intermediate host, snails and slugs, become active. Therefore, there should be prohibition of sheep to graze early in the morning and evening.

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