

## Prevalence and Associated Risk Factors of Ovine Lung Worm Infection in Debrebirhan Town, Ethiopia

Gebremedhin Yohannes\* and Desta Kifle

Hawassa University, College of Veterinary Medicine, Ethiopia

\*Corresponding Author: Gebremedhin Yohannes, Hawassa University, College of Veterinary Medicine, Ethiopia.

Received: August 12, 2019; Published: February 07, 2020

### Abstract

A cross-sectional study was conducted from November, 2018 to April, 2019 in and around Debre Birhan town with the objectives of determining the prevalence of ovine lungworm infection in sheep, identifying the species of the lungworm circulating in the area and assessing possible risk factors of lungworm infection in sheep in the study area. From 300 fecal samples collected, 93 (31%) were found to be positive for ovine lungworm by modified Bearmann technique. Out of the 93 (31%) ovine lungworm, 60(20%) were infected by *Dictyocaulus filaria*, 15(5.33%) were by *Muellerius capillaries*, 10(3.33%) were by *dictyocaulus filaria* and *Muellerius capillaries* and 7 (2.33%) were *Protostrongylus rufescens*. Among the potential risk factors, management system ( $X^2 = 10.335$ ,  $P = 0.001$ ), body condition ( $X^2 = 13.392$ ,  $P = 0.001$ ), breed types ( $X^2 = 9.808$ ,  $P = 0.007$ ) and deworming ( $X^2 = 10.777$ ,  $P = 0.001$ ) were found to be significantly associated with the occurrence of ovine lungworm infection. The highest prevalence of ovine lungworm infection was found in sheep with poor body condition 47(43.1%). The prevalence of lungworms in extensive and semi-intensive managements system was 37.9% and 20.3% respectively. The prevalence of lungworms in dewormed and non-dewormed sheep, were found to be 19.6% and 37.8%, respectively. On the other hand, age ( $X^2 = 1.26$ ,  $P = 0.533$ ) and sex ( $X^2 = 0.196$ ,  $P = 0.658$ ) were not statistically significant with the occurrence of the lungworm infection in this study. Therefore, due to its great impact on production of sheep in general as a country, emphasis should be given to regular and strategic de-worming to control and prevent parasitic infection and further study should be conducted in future to identify the temporal pattern of ovine lungworm infection.

**Keywords:** Debre Birhan; Fecal Examination; Prevalence; Lungworm; Risk Factors; Sheep

### Abbreviations

BCS: Body Condition Score; *D. arnfieldi*: *Dictyocaulus arnfieldi*; *D. filaria*: *Dictyocaulus filaria*; *D. viviparus*: *Dictyocaulus viviparus*; GIT: Gastro Intestinal Tract; IH: Intermediate Host; L1: First Stage of Larvae; L2: Second Stage of Larvae; L3: Third Stage of Larvae (Infective Stage); M.a.s.l: Mean Above Sea Level; *M. capillaries*: *Muellerius capillaries*; *P. rufescens*: *Protostrongylus rufescens*;  $x^2$ : Pearson Chi Square Value

### Introduction

Ethiopia has the largest livestock inventories in Africa, including more than 54 million cattle, 25.5 million sheep, 24.06 million goats, 456,910 camels, 5.7 million equines and 30.86 million chickens with livestock ownership currently contributing to the livelihoods of an estimated 80% of the rural population [1]. Of the total sheep population, 75% are raised in tropical and highlands with altitudes above 1,500 meter above sea level [2]. In Ethiopia, Sheep are the dominant livestock providing up to 63% of cash income and 23% of food

substance value obtained from livestock production [3,4]. Small ruminants provide a significant value of the national meat and skins production [5]. In central highlands of Ethiopia, small ruminants provide 33% of meat and 14% of milk consumption and accounts for 40% of cash income and 19% of the house hold meat consumption [6]. Sheep breed around Debre Birhan known as Menz breed; they are high wool producers. Farmers in the area have experienced and getting benefit from wool production; consequently, sheep remain a source of wool for the last fifty years to Debre Birhan blanket factory [7].

Unlike the large potential of small ruminants in the country, their productivity is low due to morbidity and mortality from different parasite infection. Among these parasite infections, lungworm is the common parasitic disease of ruminants [8]. Lungworms are parasitic nematode worms of the order Strongylida that infest the lungs of vertebrates. The most common lungworms belong to one of two groups, the superfamily Trichostrongyloidea or the superfamily Metastrongyloidea [9]. The lungworms in the superfamily Trichostrongyloidea include several species in the genus *Dictyocaulus* that infest cattle (*D. viviparus*), small ruminants (*D. filaria*) and equines (*D. arnfeldi*). These parasites have direct life cycles [10]. The lungworms in superfamily Metastrongyloidea include Protostrongylidae (*Protostrongylus rufescens*, *Muellerius capillaries*) that infest sheep and goats and this group have indirect life cycle which involve intermediate host (IH) of either snail or slug [11]. These lungworms are widely distributed throughout the world but are particularly common in countries with temperate climates and in the highlands of tropical and subtropical countries and it is common in Ethiopia [12]. Epidemiological distribution of lungworm depends more on pasture contamination by carrier animals. Pasture infectivity is related to rainfall, which stimulates the activity of both the larvae and the mollusk [13].

The prevalence of lungworm infection of small ruminants depends on different factors like, the climate of area, altitude, intermediate hosts and favorable ecological conditions such as rain fall, humidity, temperature and marshy area for grazing, sheep and goat management system for the development of lungworm species [14]. The prevalence of infection is low in spring and summer and rises rapidly in the autumn and winter [15].

*Dictyocaulus* accompany direct life cycle. The adult females in the bronchi lay larvated eggs. The eggs are coughed up and swallowed with mucus and the L1 hatch out during their passage through the GIT and L1 are excreted in faeces. On pasture, the larvae molt into the second stage (L2) and develop to the infective L3. Then it is ingested by the animal while grazing in the pasture [16]. *Protostrongylus* and *Mulleries* have indirect life cycle involving IH of several snails and slugs [17]. Adult worms lay eggs, which then coughed up with sputum toward bronchi and trachea. The eggs became hatched to first stage larvae (L1- larvae) in the trachea or during its passage in GIT and L1-larvae are passed in the feces. Once in the environment, larvae penetrate into the snails and develop to infective L3-larvae. Livestock becomes infected after eating contaminated snails or slugs while grazing [18].

The pathogenesis of lungworms depends on their location within the respiratory tract, the number of infective larvae ingested, the animal immune state and the nutritional status and age of the host [15]. The signs of lung worm infection (Vermineous pneumonia), range from moderate coughing with slightly increased respiratory rates to sever persistent coughing, Dyspnea, nasal discharge, weight loss, in case of associated bronchopneumonia also reveals death [19].

Although environmental condition are conducive for lung worm infections in sheep in the highlands of Debre Birhan and lungworm infection is considered an important disease in this town, very limited studies have been conducted so far and particularly no reports about exotic breeds. In Debre Birhan, town lungworm infection remains an important disease causing high mortality and weight loss of sheep.

### Objectives of the Study

Therefore, the objectives of this study were:

- To determine the prevalence of lungworm infection in sheep in Debre Birhan town.
- To identify lungworm species those are involved in the area.
- To assess major risk factors associated with the occurrence of the disease.

### Materials and Methods

#### Study area

The study was carried out from November 2018 to April 2019 in and around Debre Birhan town. Debre Birhan is located at a distance of 130 kms from Addis Ababa Northeast direction. The area is located at a latitude and longitude of 9°41'N 39°32'E respectively with an elevation of 2,840 m.a.s.l. It is found at sub tropical zone of Ethiopia. This area is mountainous with large plane grazing lands and dissected by two rivers, namely Dalicha and Beressa. In the study area indigenous and cross breed of cattle and sheep are the major livestock with traditional crop-livestock farms and some smallholder farms. The area is endowed different vegetation such as, eucalyptus, juniper, alfalfa, bean, barely, wheat and different type of grass. The average annual temperature of the city during day and night was 20.7°C and 8.2°C, respectively with precipitation 964 mm. It covers the total area of 14.71 km<sup>2</sup> (5.68 sq m). The area has a bimodal rainfall consisting of long (June to September) and short (March to April) rainy season. The average annual rainfall and temperature of the area are 1728 mm and 15.84°C, respectively. Livestock population comprises of 144,638 bovine, 97,815 sheep and 47,970 goats, 39,038 equine and 96,821 poultry [1].

#### Study animals

The study population consisted of 300 sheep randomly selected from the sheep population in the study area. The present study was conducted in different breed of sheep such as 194 local Menz, 51 Pure Dorper and pure Awassi and 56 Dorper menz cross and Awassi Vs Menz breeds. Of the total sampled animals, 175 were female while 125 males. The age of the animals was determined based on the farmers' response and crosschecked by teeth inspection. Based on the response, the animals were categorized in to three age groups: < 1 year, 1 - 3 years and > 3 years old. The number of sheep in each age category was 115, 121 and 64, respectively. Body condition scoring (BCS) was performed according to Ethiopia Sheep and Goat Productivity Improvement Program (Forety, 2001). The assessment revealed that 79, 112 and 109 sheep had good, moderate and poor BCS, respectively. With regard to the management system, 182 study sheep were free ranging on communal lands (extensively managed) whereas 118 kept under semi-intensively managed. As to their deworming status, 112 sheep were known to be treated with a broad spectrum anthelmintic (i.e. albendazole) within 3 months prior to the onset of the study while 188 animals did not receive any treatments.

#### Study design and sampling method

A cross-sectional study design was employed to address the objective of the study. The sampling procedure used was a simple random sampling technique, which means that all the animals in the study area had equal chance of being part of the sample.

#### Sample size determination

The desired sample size for the study was determined using the formula described by Thrusfield [20].

$$n = (1.96)^2 (P_{exp}) (1 - P_{exp}) / d^2$$

Where, n = required sample size,

$P_{exp}$  = expected prevalence,

$d$  = desired absolute precision (5%),

$1.96^2$  = z- value for 95% confidence interval.

The sample size was determined by taking the prevalence of 18.3% lungworm infestation [8] in and around Debre Birhan. Accordingly, 230 animals could be sampled, but in order to increase the precision 300 study animals were used.

### Study Methodology

#### Sample collection and fecal examination

Faecal samples were collected directly from the rectum of selected animals in a universal bottle and packed in an icebox and then transported to Debre Birhan Agricultural Research Center Veterinary Laboratory and each sample was processed by modified Bearmann technique as described by Urquhart [21]. While collecting faecal sample, the species of the animals, sex, age, breed, overt clinical signs of lungworm infection and date of sampling and examination of sampling must be properly recorded.

**Principle:** The modified Bearmann technique is used to isolate lungworm larvae from fecal sample. When feces are suspended in lukewarm water, the larvae are initiated and migrate into the water. They sink to the bottom and can be collected for identification.

In the laboratory, fresh faeces were subjected to coprological examination for the detection of L1 larvae using modified Bearmann techniques [22]. According to Taylor, the procedure was conducted as follows: 10 - 15 gram of feces was placed in a piece of double-layer cheesecloth, which is gathered around the sample so that it is fully enclosed. Use a rubber band to fasten the cloth, passed through the rubber band by two applicator sticks, which rest the edge of glass suspended the sample. Dip the feces with nylon into conical glass filled with lukewarm water. Allow the feces to stand at 24 hours and discard the feces with nylon, collect the material at the bottom of a hollow stem Petri dish, examine with 10x objective lens and then transfer to microscopic slide to identify the species by using a pipette. The species of lungworm was identified based on the morphological features given for each species [23]. The larvae of *P. rufescens* is confirmed by larvae found in the feces which elongate 300 to 400 micrometers with a characteristic tapering tail and a wavy outline but without dorsal spine [24] and that of *M. capillaries* (250 to 300 micrometers long) is also confirmed in the feces with its characteristic tapering and a wavy outline tail and a dorsal spine [18] and larva of *D. filaria* (550 - 585  $\mu$ m in length) could be identified by having head with protruding knob, bluntly pointed tail and brownish intestinal granules [16].

#### Data management and analysis

Data obtained from faecal examination were entered into Microsoft Excel spreadsheet after coding. All statistical analyses were performed on STATA 11.1 software (StataCorp 4905 Lake Way Drive, College Station, Texas 77845 USA). The prevalence of lungworm infection was calculated by dividing the number of animals affected by the total number of animals examined. Pearson chi-square ( $\chi^2$ ) test was employed to assess the existence of association between occurrence of ovine lungworm and different potential risk factors considered in the study. For this analysis  $P < 0.05$  were considered significant and 95% of confidence interval.

### Result

#### Prevalence of lung worm infection in sheep

The current prevalence of lungworm infection of sheep in the study area was determined by coprological investigation of fecal samples for the presence of larvae (L1). Out of 300 Sheep faecal samples examined, 31% (93/300) were positive for one or more the lungworm

parasites. The prevalence rate of major parasitic species; *D. filaria*, *M. capillaries* and *P. rufescens* were identified. Among those, *D. filaria* 20% (60/300) was the most prevalent in study area than *M. capillaries* 5.33% (16/300) and *P. rufescens* 2.33% (7/300) and mixed infections 3.33% (10/300) was observed as shown in figure 1 below.

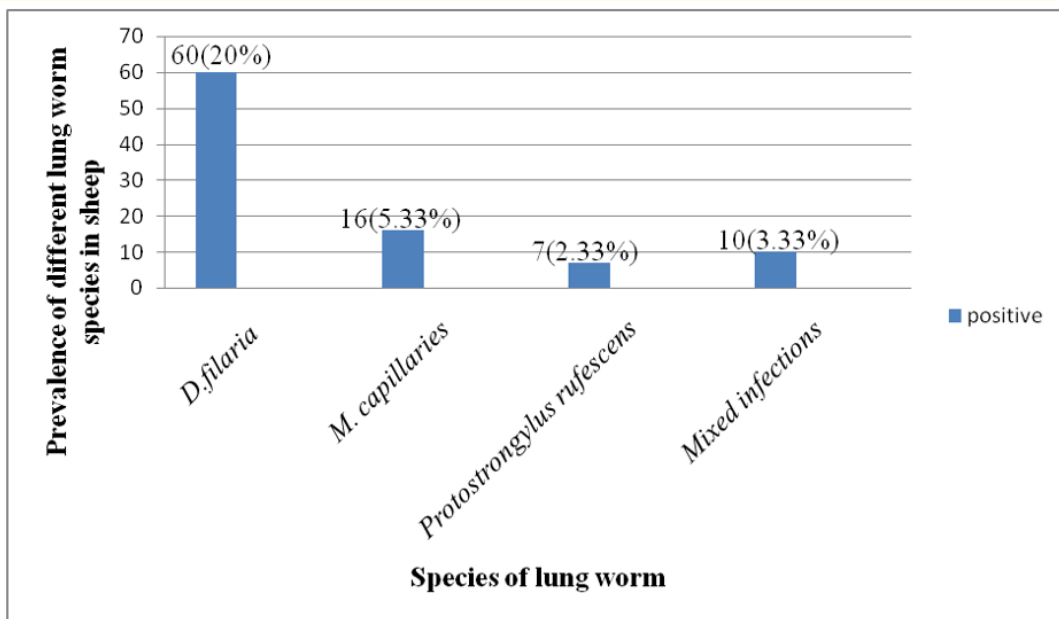


Figure 1: Prevalence of Lungworm species in sheep in the study area.

Association between prevalence of lung worm infection with different risk factors

The overall prevalence of lungworm infection in sheep was found to be different in different age, sex, breed, management system deworming history and body condition categories of sheep. The overall prevalence of lungworm infection in relation to sex of animals was found to be 32% (56/275) and 29.6% (37/125) in female and male groups with statistically insignificant ( $P = 0.658$ ), respectively. The prevalence of different species of lungworms was also different in different sex groups of sheep and from the total positive animals in coprological examination of fecal samples as shown in table 1 below.

Sex	No of sheep examined	No of Positive	Prevalence (%)	Prevalence of d/t species of lungworm				$\chi^2$ (p-value)
				<i>D. filaria</i>	<i>M. capillaries</i>	<i>P. rufescens</i>	<i>D. filaria</i> and <i>M. capillaries</i>	
M	125	37	29.6	23 (18.4%)	5 (4%)	4 (3.2%)	5 (4%)	0.196 (0.658)
F	175	56	32	37 (21.1%)	11 (6.3%)	3 (1.7%)	5 (2.9%)	
Total	300	93	31	60 (20%)	16 (5.33%)	7 (2.33%)	10 (3.33%)	

Table 1: Prevalence of different species of lungworm infection in relation to sex of sheep. ( $\chi^2 = 0.196$ ,  $P = 0.658$ ).

The overall prevalence of lung worm infection in relation to different age groups of animals was found to be 34.8% (40/115), 28.9% (35/121), 28.1% (18/64) in < 1 year, in 1 - 3 years and > 3 years sheep respectively. It was found that the prevalence of different species of lungworms was also different in different age groups of sheep with lack of statistical difference between age groups as shown in table 2.

Age (year)	No of sheep examined	No of Positive	Prevalence (%)	Prevalence of d/t species of lungworm				X <sup>2</sup> (p-value)
				D. filaria	M. capillaries	P. rufescens	D. filaria and M. capillaries	
< 1	115	40	38.8	25 (21.7%)	5 (4.3%)	6 (5.2%)	4 (3.5%)	1.260 (0.533)
1 - 3	121	35	28.9	23 (19.0%)	6 (4.9%)	1 (0.8%)	4 (3.3%)	
> 3	64	18	28.1	12 (18.8%)	5 (7.8%)	0 (0%)	2 (3.1%)	
Total	300	93	31	60 (20%)	16 (5.33%)	7 (2.33%)	10 (3.33%)	

**Table 2:** Prevalence of different species of lungworm infection in relation to age group of sheep. (X<sup>2</sup> = 1.260, P = 0.533).

The overall prevalence of lung worm infection in relation to different body condition categories of sheep was found to 43.1% (47/109), 27.7% (31/112) and 18.98% (15/79) in poor, medium and good body condition categories of sheep respectively with statistically significant association. Similarly, the prevalence of different species of lungworms was also different in different body condition categories of sheep as shown in table 3 below.

(BCS)	No of sheep examined	No of Positive	Prevalence (%)	Prevalence of d/t species of lungworm				X <sup>2</sup> (P-value)
				D. filaria	M. capillaries	P. rufescens	D. filaria and M. capillaries	
Poor	109	47	43.1	28 (25.7%)	8 (7.3%)	3 (2.8%)	8 (7.3%)	13.392 (0.001)
Medium	112	31	27.7	21 (17.4%)	5 (4.1%)	3 (2.5%)	2 (1.7%)	
Good	79	15	18.98	11 (13.9%)	3 (3.8%)	1 (1.3%)	0 (0%)	
Total	300	93	31	60 (64.5%)	16 (17.2%)	7 (7.5%)	10 (10.8%)	

**Table 3:** Prevalence of different species of lungworm infection in different body condition of study sheep. (X<sup>2</sup> = 13.392; P = 0.001).

Higher prevalence of 37.1% (72/194) was seen in local Menz breed followed by 21.4% (12/56) Cross breed (Awassi Vs Menz and Dorper Vs Menz) and 17.6% (9/56) exotic (Pure Dorper and Pure Awassi) breeds. There was statistically significant difference among breeds in harboring the parasite. The prevalence of different species of lungworms was also different among the breeds and from the total positive animals in coprological examination of fecal samples as in table 4.

Breeds	No of sheep examined	No of Positive	Prevalence (%)	Prevalence of d/t species of lungworm				X <sup>2</sup> (P-value)
				D. filaria	M. capillaries	P. rufescens	D. filaria and M. capillaries	
Local	194	72	37.1	43 (22.2)	13 (6.7%)	6 (8.3%)	8 (3.1%)	9.808 (0.007)
Cross	56	12	21.8	9 (16.1%)	2 (3.6%)	1 (8.3%)	1 (1.8%)	
Exotic	51	9	17.6	8 (15.7%)	1 (1.9%)	0 (0%)	1 (1.9%)	
Total	300	93	31	60 (20%)	16 (5.33%)	7 (2.33%)	10 (3.33%)	

**Table 4:** Prevalence of different species of lungworm infection in relation to breed of sheep. (X<sup>2</sup> = 9.808, P = 0.007).

Based on the management system practiced, a prevalence of 37.9% (69/182) in extensively managed and 20.3% (24/118) semi-intensively managed animals were found positive. There was statistically significant difference in prevalence of lungworm between the different management systems. The prevalence of different species of lungworms was also different between management system and from the total positive animals in coprological examination of fecal samples as shown in table 5 below.

Mgt system	No of sheep examined	No of Positive	Prevalence (%)	Prevalence of d/t species of lungworm				x <sup>2</sup> (p-value)
				D. filaria (%)	M. capillaries (%)	P. rufescens (%)	D. filaria and M. capillaries (%)	
Extensive	182	69	37.9	42 (23.1)	13 (7.1)	6 (3.3)	5 (2.7)	10.335 (0.001)
Semi intensive	118	24	20.33	18 (20.3)	3 (2.5)	1 (0.8)	5 (4.2)	
Total	300	93	31	60 (20)	16 (5.33)	7 (2.33)	10 (3.33)	

**Table 5:** Prevalence of different species of lungworm infection in relation to management system of sheep. (X<sup>2</sup> = 10.335, P = 0.001).

The prevalence of 19.6% and 37.8% was seen in dewormed and non-dewormed animals, respectively. The infection rate was statistically significant in non-dewormed animals. The prevalence of different species of lungworms was also different between among deworming history as shown in table 6 below.

Deworming history	No of sheep examined	No of Positive	Prevalence (%)	Prevalence of d/t species of lungworm				x <sup>2</sup> (p-value)
				D. filaria	M. capillaries	P. rufescens	D. filaria and M. capillaries	
Dewormed	112	22	19.6	18 (16.1%)	2 (1.8%)	0 (0%)	2 (1.8%)	10.777 (0.001)
Non dewormed	188	71	37.8	42 (22.3%)	14 (7.4%)	7 (3.7%)	8 (4.3%)	
Total	300	93	31	60 (20%)	16 (5.33%)	7 (2.33%)	10 (3.33%)	

**Table 6:** Prevalence of different species of lungworm infection in relation to deworming history of sheep. (X<sup>2</sup> = 10.777, P = 0.001).



## Discussion

In this study, an overall ovine lungworm infections rate was 31%. This finding is closely agree with the work done by other researchers who reported by Tefera [25] who found 31% around Dessie and Kombolicha by Mekonnen, *et al.* [26] who found 32.7% in Gondar; by Fantahun [27] who found 29.04% in and around Jimma town and by Beyene, *et al.* [28] who found 34.9% in Ambo district.

However, this finding is relatively lower as compared to other findings reported by Alemu, *et al.* [29] who found 53.6% from six districts of Wollo; Regassa, *et al.* [30] who found 48.2% in and around Dessie and Kombolicha; Niguagus, *et al.* [31] who found 52.3% in Merhabete district; Abebe, *et al.* [32] who found 58% in and around Asella Arssi zone; Tefera and Mekuria [7] who found 56% in and around Debre Birhan town; Eyob and Matios [33] who found 72.44% in Asella central Ethiopia; Mihreteab and Aman [34] who found 51% in Tiyo district were reported. The reasons for low prevalence in this study as compared to the above research reported could be attributed to the development of open aired clinic and awareness of farmers to deworm their sheep. Although lungworms are widely distributed throughout the world, the rate of infection is particularly common in countries with temperate climates and in the high lands tropical and sub tropical countries Kebede, *et al* [14].

On the other hand, the current prevalence was higher than 21.5% [35] in Atsbi (Tigray), 18.16% [36] in and around Bahir Dar, 22.7% [37] in and around Bahir Dar, 13.1% [2] in and around Wukro Eastern Tigray.

The difference in the prevalence of lungworms of sheep in this study might be due to the variation of nutritional status, level of immunity, management practice of the animal, rainfall, humidity and temperature and altitude differences in the respective study area. In addition, the difference in these studied areas, which favor the survival of the larvae of the lungworm, or the snail intermediate in case of *M. capillaries* and *P. rufescens* bring in difference of results Mekonnen [26].

From the total prevalence (31%) of lungworm infection, *Dictyocaulus filaria* was the predominant species in the study area (20%) followed by *Muellerius capillaries* (5.33%), *D. filaria* and *M. capillaries* (3.33%) and *Protostrongylus rufescens*, (2.33%), which was the least prevalent species. This finding in agreement with various reports from different parts of Ethiopia Mekonnen, *et al.* [26], Fantahun, *et al.* [27], Weldesenebet and Abdu [38], Borji, *et al.* [13], Garomssa, *et al.* [39], Bekele and Shibbiru [8]. But, the researchers like Alemu, *et al.* [29], Regassa, *et al.* [30] and Basaznew, *et al.* [40] showed that *M. capillaries* was the predominant species involved in the infection rather than *D. filaria*.

The highest prevalence of *D. filaria* over the other species is most likely associated with its direct lifecycle. In contrast, *M. capillaries* and *P. rufescens* have indirect lifecycles, with land snails and slugs acting as the intermediate hosts. Transmission occurs when infected slugs or snails are accidentally ingested during grazing. Therefore, their geographical distribution and prevalence is mainly determined by the distribution of the intermediate hosts, which in turn is affected by the availability of suitable environmental conditions [21]. *P. rufescens* was the least prevalent in the present study and this is probably due to its intermediate host range being restricted to certain species of snails unlike *M. capillaries*, which has a wide range of intermediate hosts Radostitis, *et al* [10].

In this study, there was no statistical significant difference in the prevalence of lungworm infection between male 29.6% (37/125) and female 32% (56/175) animals, but the prevalence of female animal slightly greater than male animal. This result is in a general agreement with the report of various studies Fantahun, *et al.* [27] in and around Jimma town; Bogale, *et al.* [3] in Dessie Zuria District; Hasen, *et al.* [41]; Beyene, *et al.* [28]; in Ambo District 39.37% in females and 28.83% in males, [33] in Asella province 72.8% in females and 72.2% in males and Gebreyohannes, *et al.* [42] in Mokedella district 32.3% in females and 23.8% in males.

However, this result in contrary with the findings of Moges, *et al.* [43] in Wogera District and Weldesenebet and Mohamed [38] in Jimma, who reported higher prevalence of lungworm infection in male than female animals. The higher infection rate with lungworm in



females could be associated with their physiology of reproduction and difference in management Craig [44]. The variations may also be due to the improper distribution of sample selection between the two sexes Mekonnen [26].

In the present study, although *D. filaria* prevalence tended to decrease with age, the variation among the three age categories of animals was not statistically significant in sheep ( $p > 0.05$ ). The prevalence in the younger animals ( $< 1$  Year) was higher than in older animals ( $> 3$  Years). This finding is consistent with some of the previous studies Alemu., *et al.* [29]; Eyob and Matios [33]; Mekonnen., *et al.* [26]; Weldesenebet and Mohammed [38]. In contrast to the current findings, other authors Regassa., *et al.* [30]; Fantahun., *et al.* [27]; Terefe., *et al.* [45] reported a significantly higher infection of *D. filaria* in young than adult animals. The absence of significant variation between young and old animals in the present study might be due to failure of the older animals to develop strong immunity to reinfection associated with the dry season feed shortage. It could also be attributed to sampling of small and disproportionate number of animals between the two age categories. Nevertheless, further investigation using large and proportional sample size is warranted in a season where adequate feed is available to determine the effect of age on lungworm infection.

An attempt was furthermore made to know the influence of breeds of sheep on the overall prevalence of lungworm infection and there is statistically significant difference ( $P < 0.05$ ) in the infestation rate among breed types. The prevalence was significantly highest in menz breed 37.1% than that of cross breed 21.8% and exotic breed 17.6%. The finding of the present study is disagreeing with Tefera and Mekuria [7] who reported that the prevalence was not statistically significant between breeds. This is may be due to genetic make-up and pedigree, poor management system and shortage of feed availability of their sheep.

The prevalence was significantly highest in sheep, which have poor body conditions 43.1% (47/109) than in those have medium 27.7% (41/122) and good 19% (15/79) body conditions. The findings of the present studies was in line with Mihreteab and Aman [34]; Kebede., *et al.* [14]; Selam., *et al.* [2] who reported that the prevalence was significantly highest in animals which have poor body conditions than in those with medium or good body conditions. However, it disagrees with the finding of Weldesenebet and Mohammed [38] who reported higher prevalence rate in animals with good body condition. The achievable explanation for this observation could be due to immune suppression of animal and infection by other parasites including GIT helminthes and/or malnutrition. Poorly nourished sheep appear to be less competent in getting rid of lungworm infection. Evidently, the infection with a parasite by itself might results in progressive emaciation of the animals [10].

There was a statistically significant difference in lungworm infection ( $P < 0.005$ ) between the two management systems. That is, the prevalence was significantly higher lungworm under extensive management system 37.9% (69/182) than those kept under semi-intensive management system 20.3% (24/118) this finding is in consistent with the report of Terefe., *et al.* [45]; Yimer and dessie [46], Bekele and Shibbiru [8]. This could be because sheep in extensive management system have a chance of grazing in the field contaminated with intermediate host for *M. capillaries* and *P. rufescens* or they possibly infested with larvae as well as easily obtained *D. filarial* from the herbage [10].

Another explanation could be increased cultivation of land, which restricts animals on communal grazing land so that large numbers of the animals are kept together. This could increase the degree of pasture contamination leading to higher prevalence rate. Management practice such as provision of ample nutrition increases the resistance of the host under the semi-intensive system, contrary to this malnutrition, which reduces the host-parasite response and favors. The fecundity of the parasites that allows the animals for continuous larvae exposure under extensive system [47]. However, it contradicted with the result of Weldesenebet and Mohamed [38] who reported higher prevalence of lungworm infection in sheep under semi-intensive management system than in extensive management system.

The variation with anthelmintic usage was clearly indicating as the non-dewormed sheep with higher infection prevalence than dewormed counter parts. When the infection prevalence on anthelmintic usage base was subjected to analysis, the difference is statistically significant ( $P < 0.05$ ). The observation noted on the dewormed sheep in this study was in agreement with the work of Regassa.,

*et al.* [30]; Bekele and Shibbiru [8]. Even though the dewormed sheep revealed low infection prevalence compared to non-dewormed groups, about 19.6% of them were still infected with lungworm. The reason behind this result probably, is that sheep which have only cough and/or tachypnea are usually in the prepatent stage of the disease or have small adult worm burden and the anthelmintic used for the treatment of these sheep may be only temporarily suppress egg production of the adult worms [10].

### Conclusion and Recommendations

The findings obtained in this study revealed that lungworm infection was an important problem in the study area. *Dictyocaulus filaria* 20% (60) was found the most dominant lungworm species in the studied area and affect the health and productivity of sheep. Higher prevalence of lungworm infection was recorded in local sheep breeds (37.1% (72), in extensive management system (37.9% (69), in sheep with poor body conditions (43.1% (47) and non-dewormed sheep (37.8%). Therefore, the local sheep breeds, extensive management system, poor body conditions and non deworming were the potential risk factors with the occurrence of the lungworm infection in the studied area.

Therefore, based on the above conclusion the following recommendations were forwarded:

- Traditional (extensive) production system of sheep should be modernizing (semi intensive/intensive system) for general health care and production advancement.
- Vigorous controlling activities like regular strategic deworming (at the end of dry season before the rain starts and after long heavy rainy season) of the whole flock rather than treating individual animals should be performed to decrease the occurrence of disease.
- Adequate feed supplement according to the requirements should be practiced to improve body condition and immune resistance.

### Bibliography

1. CSA (Central Statistics Authority), The federal democratic republic of Ethiopia Central Statistical Agency Agricultural Sample Survey 2009/2010. Report on area and production of major crops, statistical bulletin. Addis Ababa, Ethiopia (2010): 221.
2. Selam T, *et al.* "Ovine Lung Worm Infection and Associated Risk Factors in and Around Wukro, Eastern Tigray Ethiopia". *European Journal of Biological Sciences* 7.3 (2015): 120-124.
3. Bogale B., *et al.* "Ovine lungworm infection: Prevalence, species composition and associated risk factors in Dessie Zuria district, Northern Ethiopia". *African Journal of Basic and Applied Sciences* 4.3 (2012): 73-76.
4. Ibrahim N and Godefa Y. "Prevalence of Ovine Lung Worm Infection in Mekelle Town, North Ethiopia". *The Internet Journal of Veterinary Medicine* 9.1 (2012): 1-15.
5. Tibbo M. "Productivity and Health of Indigenous Sheep breeds and crossbreds in the Central Ethiopian Highlands. In PhD Thesis". Swedish University of Agricultural Sciences, Uppsala (2006): 17.
6. Asaye M and Alemneh T. "Prevalence of Lungworm Infection of Small Ruminants in and Around Bahir Dar City, Amhara Regional State, Ethiopia". *Journal of Veterinary Science and Technology* 12.2 (2015): 60-70.
7. Tefera Y and Mekuria S. "Lungworm Infection in Ovine: Prevalence and Associated Risk Factors in Debre Birhan Town Ethiopia". *Journal of Veterinary Science and Technology* 7.2 (2016): 2157-7579.
8. Bekele T and Shibbiru T. "Prevalence of ovine lungworm and its associated risk factors in and around Debre Birhan town, Ethiopia". *Internet Journal of Veterinary Health Science and Research* 5.6 (2017): 190-195.

9. Merck Veterinary Manual. "Lungworm Infection: Introduction". The Archived from the original on (2006): 2007-12-18.
10. Radostitis O., *et al.* "A textbook of diseases of cattle, horses, sheep, pigs and goats". (10<sup>th</sup> edition), St. Louis, Philadelphia, London (2007): 1568- 1569.
11. Mandal S. "Veterinary Parasitology at a Glance". (2<sup>nd</sup> edition), IBDCO, India (2006): 254-258.
12. Abebe R., *et al.* "Lungworm Infection in Small Ruminants in and Around Wolaita Soddo Town, Southern Ethiopia". *Journal of Veterinary Science and Technology* 7.2 (2016): 302.
13. Borji H., *et al.* "Study on small ruminant lungworms and associated risk factors in northeastern Iran". *Asian Pacific Journal of Tropical Medicine* 5.11 (2012): 853-856.
14. Kebede S., *et al.* "On farm and Abattoir study of Lungworm infection of small ruminants in selected areas of Dale District, Southern Ethiopia". *International Journal of Current Microbiology and Applied Science* 3.4 (2014): 1139-1152.
15. Tewodros A. "A Review on: Lungworm Infection in Small Ruminants". *Journal of World Pharmaceutical Life Science* 1.3 (2015): 149-159.
16. Jemal A. "Lungworm infection of small ruminant in Ethiopia: A Review". *World journal of pharmaceutical and life sciences* 2.3 (2016): 22-25.
17. Kahn M. "The Merck Veterinary Manual. (9<sup>th</sup> edition), Washington Merck and Co. Inc, USA (2005): 55-67.
18. Junquera P. *Protostrongylus Rufescens*, parasitic lungworms of Sheep and Goats. Biology, prevention and control *Protostrongylosis* (2015).
19. Kassa T and Abdu M. "Prevalence of Ovine Lung Worms- around Bahir Dar, East Africa, Ethiopia". *Acta Parasitologica Globalis* 4.3 (2013): 71-79.
20. Thrusfield M. "Veterinary epidemiology". (2<sup>nd</sup> Edition), Black well science, UK (2005): 182-189.
21. Urquhart G., *et al.* "Veterinary parasitology. (2<sup>nd</sup> Edition), black well science, Scotland (2006): 39-58.
22. COWS (Control of Worms Sustainably), Control of lungworm in cattle (2014).
23. Taylor M., *et al.* "Parasite of Respiratory System". In *Veterinary Parasitology* (3<sup>rd</sup> edition), UK: Black Well (2007): 195-198.
24. Elshei H and Khan N. "Essentials of Veterinary Parasitology". (1<sup>st</sup> edition), Caister Academic Press, Norfolk, UK (2011): 52-69.
25. Tefera S. "Prevalence of ovine lungworms around Dessie and Kombolicha, DVM Thesis, Addis Ababa University, Debre Zeit Ethiopia. (Unpublished) 10 (1993).
26. Mekonnen A., *et al.* "Study on the Prevalence of Lungworm Infection in Small Ruminants in Gondar Town, Ethiopia". *Journal of Animal and Veterinary Advances* 10.3 (2011): 1683-1687.
27. Fantahun T., *et al.* "Prevalence of lungworm infection in small ruminants in and around Jimma town, Southwest Ethiopia". *Global Veterinaria* 9 (2012): 580-585.
28. Beyene D., *et al.* "The prevalence of lungworms in naturally infected sheep of Ambo District, Oromia, Ethiopia". *Global veterinaria* 10.1 (2013): 93-98.
29. Alemu S., *et al.* "Study on small ruminant lungworms in northeastern Ethiopia". *Journal of Veterinary Parasitology* 142.3-4 (2006): 330335.

30. Regassa A., *et al.* "Lungworm infection in small ruminants: prevalence and associated risk factors in Dessie and Kombolicha districts, Northeastern Ethiopia". *Journal of Veterinary Parasitology* 169.1-2 (2010): 144-148.
31. Niguagus L., *et al.* "Ovine Lung Worm Prevalence and Associated Risk Factors in Merhabete District, North Shoa, Ethiopia". *Journal of Bacteriology and Parasitology* 7.6 (2016): 298.
32. Abebe M., *et al.* "Prevalence and Identification of Ovine Lungworms in and Around Asella Town, central Ethiopia". *American-Eurasian Journal of Science and Research* 9.5 (2014): 136-142.
33. Eyob E and Matios L. "The prevalence and risk factors associated with ovine lungworm infestation in the Asella province, Central Ethiopia". *Journal of Parasitology and Vector Biology* 5.8 (2013): 116-121.
34. Mihreteab B and Aman A. "Ovine Lungworms in Tiyo District, South- East Ethiopia: Prevalence, Effect of Altitude and Major Host Related Risk Factors". *Global Veterinaria* 7.3 (2011): 219-225.
35. Mengistom G. "Preliminary study on prevalence ovine lungworm infection in Atsbi (Tigray). DVM Thesis, Jimma University, Jimma, Ethiopia (2008): 112-178.
36. Muluken B. "Prevalence of ovine lung worm in. and around Bahir Dar". DVM Thesis, Jimma University, Jimma, Ethiopia (2009): 76-169.
37. Tewodros A. "Prevalence of lungworm infection of small ruminants in and around Bahir DVM Thesis, Gondar University, Gondar, Ethiopia (2010): 88-99.
38. Weldesenebet D and Mohammed A. "Prevalence of Small Ruminant Lung Worm Infection in Jimma town". *Global Veterinaria* 8.2 (2012): 153-159.
39. Garomssa T., *et al.* "Lungworms of Small Ruminants Slaughtered in Restaurants of Ambo, Oromia Regional State, Ethiopia". *Nigerian Veterinary Journal* 33.1 (2012): 387-394.
40. Basaznew B., *et al.* "Ovine Lungworm Infection: Prevalence, Species Composition and Associated Risk Factors in Dessie Zuria District, Northeastern Ethiopia". *African Journal of Basic Applied Science* 4.3 (2012): 73-76.
41. Hasen A., *et al.* "Ovine lungworm infestation rate on faecal larvae recovery basis". *Acta Parasitologica Globalis* 4.1 (2013): 29-33.
42. Gebreyohannes M., *et al.* "Prevalence of Ovine Lungworms in Mekedella Woreda, Ethiopia". *Journal of Animal Production Advance* 3.6 (2013): 208-214.
43. Moges N., *et al.* "Dictyocaulus filaria and Muellerius capillaries are important lungworm parasites of sheep in Wogera district, Northern Ethiopia 3 (2011):465-468.
44. Craig T. "Epidemiology of internal parasites: Effect of climate and host reproductive cycles on parasite survival". Proceedings of the Small Ruminants for the Mixed Animal Practitioner, Western Veterinary Conference, Las Vegas (1998): 114-127.
45. Terefe Y., *et al.* "Prevalence of lungworm infection in small ruminants in North Gondar zone, Amhara National Regional State, Ethiopia". *Journal of Parasitology and Vector Biology* 5.4 (2013): 40-45.
46. Yimer A and Desie A. "Epidemiological Studies on Ovine Lungworm Species in Northern Ethiopia". *Journal of Veterinary Science and Technology* 7.6 (2016): 2157-7579.
47. Soulsby E. "Helminthes, arthropods and protozoa of domestic animals". (7<sup>th</sup> Edition), Lea and Fediger, Philadelphia (1986): 262-266.

**Volume 5 Issue 3 March 2020**

**©All rights reserved by Gebremedhin Yohannes and Desta Kifle.**

---

**Citation:** Gebremedhin Yohannes and Desta Kifle. "Prevalence and Associated Risk Factors of Ovine Lung Worm Infection in Debreberhan Town, Ethiopia". *EC Veterinary Science* 5.3 (2020): 01-12.