

## Ovine Lungworm Infestation Rate on Fecal Larvae Recovery Basis

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**Abstract:** A cross-sectional study was conducted on 381 sheep randomly sampled with the objective to determine prevalence of lungworm infestation and identifying the species of respiratory helminthes circulating in and around Assela. Modified Baermann technique was used to detect first stage larvae (L1). *Dictyocaulus filaria* (*D. filaria*) was the dominant lungworm species with prevalence of 27.80% (95% CI=49.1-61.1%), followed by *Protostrongylus rufescens* (*P. rufescens*), 13.9% (95% CI=10.4-17.4%), *Mulliries capillaries* (*M. capillaries*), 6.6% (95% CI=4.1-9.1%) and Mixed infection, with two or more of the common sheep lungworm infection, 6.8%. There was statistical significant difference in susceptibility between young and old age groups (Chi square = 28.9, 1df, P<0.05), the young being more affected. Significant differences (P< 0.05) were found among areas of different altitude with an infection rate of 46.4%, 52.7% and 66.1% at low, medium and higher altitude areas, respectively. The overall results obtained during this investigation showed that *D. filaria* is the most common lungworm species in its not only high prevalence rate, but also high degree of association with occurrence of clinical respiratory signs. Due to its impact on sheep production of the area, due emphasis should be given for the control and prevention of lungworm infestation.

**Key words:** Dicyocaulous filarial • Prevalence • Respiratory helminthes

### INTRODUCTION

Ethiopia ranks second in Africa and sixth in the world in terms of sheep population. Ethiopia with its estimated 25.5 million sheep together with its variation in agro climatic zones represents a good reservoir of small ruminant genotypes [1]. Arsi covers only 2% of the total land area in the country and has an estimated 988,603 sheep population. The economic benefits of livestock goods and services, now estimated at 113 billion EB, are more than three and a half times greater than the MOFED's original estimate of the value added from livestock in 2008-09. Of the roughly 80 billion EB increase in benefits, about 15 billion EB are derived from recalculating the value of livestock products and the remaining 65 billion come from broadening the estimation to include livestock services. Small ruminants constitute wide verities of uses to the rural economy [2].

Unlike the large potential of small ruminants in the country, their productivity is low. Endo-parasitic infection is known to be the main factors that affect productivity.

Helminth parasites are among the causes of substantial productivity losses in ovine production of the country [3]. Other pioneer finding of lungworm infection in sheep in the country indicated its high prevalence and economic importance of the infection in certain areas. Respiratory diseases resulting from helminth parasites are of a great economic concern in sheep production in the highlands of Ethiopia where sheep are important livestock units [4-6].

The three respiratory parasites that cause a significant damage in small ruminant production are *D. filaria*, *P. rufescent* and *M. capillarius*. These lungworms particularly *D. filaria* can suppress the immunity of the respiratory tract and causes death, poor weight gain or loss of body weight as well as greatly affects the potential productivity of sheep industry in the areas where it is prevalent [4-9]. Few studies have been conducted in some areas of Ethiopia indicated high prevalence of lungworm infection in sheep population. Knowledge of the current epidemiological situation of lungworm infection in sheep population in the present

study area contributes its part to design a control strategy at local, regional and national levels. Therefore, the objectives of this study were, to determine the prevalence of lungworm infection in sheep, identifying the major lungworm species circulating in and around Assela and factors affecting the prevalence.

## MATERIALS AND METHODS

**Description of the Study Area:** Arsi is situated at 6°59'1-8°49' N altitudes and 38°41'-40°44' E longitude in central Ethiopia, 175 km south east of Addis Ababa. The altitude of the area ranges from 1780-3100 m.a.s.l and characterized by mid subtropical weather ranging from 5°C-28°C. The average rainfall is 1200 mm and mostly with clay type of soil in rare case black soil. The area covers 23674.72 km squared representing 2% of the total land surface of the country. Topographically, Arsi has highland escapement (Kulu, 2700m.a.s.l.), midland (Kobolcha, 2000 m.a.s.l.) and lowland (Dugdaukulu, 1650 m.a.s.l.) areas. The high land areas are found centrally and the low lands dominate the periphery of the area. Livestock are major agricultural resource in the area. Arsi has livestock population of 5,234, 598 (2,249,479 cattle, 928, 603 sheep, 467, 221 goats, 154, 701 donkey; 197, 365 horse; 36.016 mules, 11,716 camel, 1,189,497 poultry) [1, 10].

**Study Population:** The study population includes all sheep in selected three peasant associations of Tiyo wereda, which are rearing under extensive management system. During sampling, sex, age, body condition and sheep those have clinical respiratory sign and apparently healthy are recorded.

**Study Design and Sampling Method:** A cross-sectional study to determine the prevalence of lungworm infestation and stratified random sampling techniques were used to collect the data. Out of 18 PA of Tiyo Woreda, three were selected by considering the difference in altitude. From the selected woredas, households were randomly selected. Sheep from each selected household of PA was examined with equal sample size from each PA (127).

**Sample Size Determination:** The sample size was determined by considering a Pulmonary Helmenthiasis prevalence of 54%, which recorded by Assela regional veterinary laboratory, previously. The sample size for the study was calculated using the following formula [11].

### **Sample Collection and Parasitological Examination:**

The sex, body condition (poor, medium and good), age group (Young and adult) and the clinical respiratory sign as shown by coughing and nasal discharge and apparently healthy animals were considered during the study. Fresh fecal samples were collected per rectum from individual sheep and immediately transported to Assela regional veterinary laboratory and processed by using Modified Burmann techniques [12, 13]. All larvae were identified morphologically as described by previous workers [12].

### **Definition of Measured Parameters Considered During the Study**

**Body condition:** Every sampled sheep was recorded and fall in any of the three scores (Poor, medium and good) with the criteria for scores [14].

**Age:** Every sampled sheep was recorded for age and categorized in to Young and adult [15] using dentition and information from the owners.

**Data Management and Statistical Analysis:** The MS excel spreadsheet program was employed to create database and SPSS statistical software version 15.0 was used to analyze the data. Chi square statistics was used to test the association between variables and descriptive statistics to summarize the data in Tables.

## RESULTS AND DISCUSSION

The present finding clearly indicated that lungworm infection is one of the major respiratory diseases of sheep in and around Assela. The study indicated an overall lungworm infection prevalence of 55.10% (95% CI=49.1-61.1%) in Assela areas. This finding almost coincides with previous report of overall infection rate of 57.1% in Tiyo District, South-East Ethiopia [7]) and 53.6% in northwestern Ethiopia [16]. However, it was higher than reports of Regassa *et al.* [17] in Dessie and Kombolcha districts, northeastern Ethiopia; [18] at Gondar, [6] in Mekelle town, who reported prevalence of 40.4%, 32.7%, 13.4%, respectively. The possible explanation for variation in the infection rate could be attributed variations in agro-ecology of the study areas, which favor or disfavor the survival of parasites larvae. Moreover, according to Bradford [19], the occurrence of lungworms is associated with nutritional status, level of immunity, management practice of the animal, rainfall, humidity and temperature differences and season of

Table 1: Lungworm infestation in sheep by altitudes, age, sex &amp; body condition taken as risk factors for infestation

Factors		Prevalence of lungworm species (%)				Total	X <sup>2</sup> 9.14	P-value 0.024
		D. filaria	P.rufescens	M. capilleries	Mixed infest.			
Location								
Lowland	N127	22.8	10.2	7.1	6.3	46.4a		
Midland	127	25.2	16.5	6.3	4.7	52.7b		
Highland	127	35.4	15	6.3	9.4	66.1c		
Age							28.89	
Young	131	47.3	4.5	4.6	7.6	74a	0.031	
Adult	250	17.6	13.6	7.6	6.4	45.2b		
Sex							0.29	
Male	168	23.2	16.1	6.5	7.7	53.3	0.16	
Female	213	31.5	12.2	12.2	6.1	56.4		
Body condition							61.59	
Poor	139	43.2	20.1	97.2	8.6	79.1a	0.001	
Medium	119	23.5	10.9	10.1	7.6	52.1b		
Good	123	14.6	9.8	2.4	4.1	30.9c		

abc Percentages in the same column without common letter are different at  $P < 0.05$  for each category; N=number of animals examined

examination on the respective study areas. *D. filaria* was the lungworm species that ranks first in prevalence of infections as indicated in Table 1, being the dominant lungworm occurring in sheep with clinical respiratory signs, poor body condition and in the young age groups and this result more or less agrees with reports of other previous studies [4, 6-8, 17, 18, 20, 21].

*P. rufescens* was the second important lungworm species, as the present study indicated with prevalence of 13.9% and followed by *M. capillaries* (6.6%). This result supported by the earlier report of Alemu *et al.* [16] Nematollahi and Moghaddam [20] and Mireteab and Aman [7] who reported *M. capillaries* as the second important following *D. filaria* in their survey. In contrast to this finding, Basaznew *et al.* [5] in Dessie Zuria District reported that *M. capillaris* is the most prevalent. The low prevalence of both *M. capillaris* and *P. rufescens* in the study area might be attributed to the fact that the study was done in dry season which does not favor the development of the snail intermediate hosts. *M. capillaris* and *P. rufescens* in sheep require slugs or snails as intermediate hosts, which must be eaten for infection to occur.

In relation to the prevalence of lung worm infection in different age groups 74% of young examined (95% CI=66.5-81.5%) were infected with different species of lung worm while 45.2% of adult sheep, (95% CI=39.1-51.3%), were found infected with different species of lungworm. There is statistically significant difference in age susceptibility, the Young age group being more affected by *D. filaria* (Chi square = 28.898, 1df,  $P = 0.031$ ). This finding is in agreement with Mireteab and Aman [7] who reported that young sheep were found to harbor as

many lungworms as compared with adult sheep. This has been partly explained by the acquired immunity developed older animals due to previous exposure and sheep that recovered from the infection have better immunity against re-infection [22]. On the other hand, infection prevalence of *M. capilleries* and *P. rufescens* did not showed statistical variation between age categories. This may be due to absence of acquired immunity to *M. capilleries* and *P. rufescens* species.

In the present finding both sexes showed equal susceptibility to infection with lungworms, hence sex dependent variation was not encountered. This was coinciding with study reported by Addis *et al.* [23], Nibret *et al.* [4] and Dawit and Abdu [8], but disagrees with report of Alemu *et al.* [16], Mireteab and Aman [7]. These may be because improper distribution of sample selection between the two sexes and most of the sampled sheep are not in preparturient period during the study time. On the attempt to assess the influence of body condition scores on the prevalence of lungworm infection, the prevalence was significantly different among the different physical body conditions ( $P < 0.05$ ). The possible explanation for this observation could be due to immuno-suppression in sheep with poor body conditions, concurrent infection by other parasites including GIT helminthes and/or malnutrition. Poorly nourished sheep appear to be less competent in getting rid of lungworm infection [21, 24] and the infestation with a parasite by itself might results in progressive emaciation of the animals Mireteab and Aman [7].

The present study showed that, 49% (95% CI=57-72.3%) of those apparently healthy sheep and 64.6% (95% CI=42.4%-55.4%) of those showing clinical

Table 2: Lungworm infestation in relation to respiratory signs manifested

Lungworm Species	Animals with respiratory sign (N=150) Prevalence (%)	Apparently healthy animals (N=231) Prevalence (%)	Significance	
			X <sup>2</sup>	P-value
<i>D. filaria</i>	44.7a	16.9b	34.95	0.02
<i>P. rufescens</i>	9.3a	16.9b	7.16	0.05
<i>M. capil.</i>	2.7	9.1	6.02	0.07
Mixed inf.	8	6.1	1.24	0.32
Total	64.6a	49b	11.46	0.04

<sup>ab</sup>Percentages in the same raw with different letters showed significant difference at  $P \leq 0.05$  for the respective parasite species, N=numbers of studied animals

respiratory signs were infected with lungworm, with higher statistically significant variation ( $\chi^2=34.96$ , 1df,  $P<0.05$ ) of *D. filaria* from the other species as clearly indicated in Table 2. During the end of prepatent phase bronchitis, which is responsible for clinical respiratory sign, developed and caused by immature lung worm in the air ways and by cellular infiltration of the epithelium. About 25% of heavily infected and then recovered animals there is a flare-up of clinical signs during the post patent phase and termed post patent parasitic bronchitis [19]. The other obvious fact is that lungworm is not the only cause of clinical respiratory signs. On the attempt made to evaluate the influence of area on the overall prevalence rate, the study clearly indicated that infection with lungworm increase while altitude increases. There is statistically significance difference among the various agro-ecological (Chi square = 9.143, 1df,  $p<0.05$ ). This result is in agreement with the result reported by Alemu *et al.* [16], Mireteab and Aman [7] who found significant difference ( $P < 0.05$ ) in their result.

### CONCLUSION

The result of present study indicated that lungworm is one of the major helminthosis of sheep in and around Assela, Arsi Zone. The prevalence of infection in young animals is higher than adults and *D. filaria* is the dominant lungworm species responsible for outstanding clinical manifestation of respiratory sign. Higher prevalence rate of lungworm infection was observed in animal with poor body condition and relatively higher altitude areas. Treat sheep with broad-spectrum anthelmintic at the beginning of rain season would appear to be most effective. These treatment regimes could reduce the burden and minimize pasture contamination with larvae. Isolation of most susceptible age groups during the time of pasture contamination; immunization of sheep with X-ray, gamma ray eradicated *D. filaria* has been found to mount protective level of immunity.

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