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Prevalence of ovine lung worm at Jucavm open air veterinary clinic, Southwest Ethiopia

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ABSTRACT

A cross sectional study was conducted in Jimma university veterinary clinic, Ethiopia from April 2018 to May 2018. The objectives of study were to estimate the prevalence of lungworm infection and associated risk factors in sheep. Coproscopic examination was done by using a modified Baermann technique. Fecal samples were collected from randomly selected sheep of systematically chosen households.

The study animals were composed of different breeds, age groups, sexes, management systems, and subjected to different health care conditions. Out of 384 sheep examined, 69 (17.9%) were found to be positive for one or more species of lungworm parasites. *Dictyocaulus filaria* (6.8%) was the predominant species of parasite identified followed by *Muellerius capillaries* (4.7%) *Protostrongylus rufescens* (2.6%) and mixed infection of *D. filaria* and *M. capillaries* (3.9%). There was statistically significant difference in prevalence of lungworm parasite ($P<0.05$) among the risk factor like body conditions of animals. Animals with young age, not dewormed, and managed under extensive production system were more infected with the parasites.

On the other hand, the prevalence of the parasites among management, age groups, deworming history and sexes showed no statistically significant difference ($P>0.05$). Despite the smaller prevalence observed in this study, ovine lungworm is still a constraint to sheep in the area in different season of the year, and therefore, vigorous controlling strategy should be implemented to reduce the prevalence of infection.

1. INTRODUCTION

Among African countries, Ethiopia is known by having the highest number of livestock population. Sheep are among the most important livestock species kept by highlanders' in the country; used for meat production and immediate cash income next to poultry. However, about half of all sheep mortality and morbidity on farms in Ethiopian highlands are caused by pneumonia and endo-parasitism including lungworms (Alemu *et al*., 2006)

Lungworm is the common parasitic disease of sheep in the country because of it is ubiquitous and prevalent within many tropical and subtropical environments that provide nearly perfect conditions for survival and development of their larval stage. The parasites are round worms (nematodes) belonging to the phylum Nemathelminthes and grouped under Metastrongyloidea or Trichostrongyloidea super families (Tewodros, 2015)

Prevalence of small ruminant lungworm is different based on geographical and climatic factors of spatial area. It is host specific and common in areas of mild high rain fall and abundant grass. The prevalence of infection is low in spring and summer and rises rapidly in the autumn and winter (Radostitis *et al.,* 2007).

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. Severe infection with lungworm can cause vasculitis and perivasculitis with infiltration of inflammatory cells in and around the vascular wall and thickening of interalveolar walls and mononuclear cell infiltration due to inflammatory response in lung, the resulting effect is known as verminous pneumonia (Dar L *et al.,* 2012).

In the highland areas, infection with lungworm parasites is the common cause of high mortality and morbidity in sheep population (FAO, 2002). Lungworms are parasitic nematodes known for infection of the lower respiratory tract, characterized by respiratory distress, trachaeitis, bronchitis, and pneumonia (Kimberling, 1988). Common lungworms in sheep are *Dictyocaulus filaria*, *Muellerius capillaris*, and *Protostrongylus rufescens* (Radostits *et al.,* 2007).

These nematodes belong to two super families, Trichostrogyloidea (*D. filaria*) and Metastrongyloidea (*P. rufescens* and *M. capillaries*) (Urquhart *et al*., 1996; Radostits *et al.,* 2007). Dictyocaulidae and certain Metastrongyloidea are known to exist in East Africa (Ethiopia, Kenya and Tanzania) and South Africa (Torncy, 1989). Endoparasites, including *D. filaria*, are major cause of death and morbidity in the

Ethiopian highlands. Up to half of all sheep deaths and morbidity on farms in Ethiopia highlands are caused by pneumonia and endoparasites (ILCA, 1990).

The previous findings of lungworm infection in Ethiopia (Bekele *et al.*, 1981; Netsanet, 1992; Wondwossen, 1992; Paulos, 2000; Mihreteab and Aman, 2011; Abeje et al., 2016) are in Arsi and Bale, Wollo, Debre Birhan, Asella, Chilalo, and Tiyo respectively showing prevalence ranging from 30.74 to 73.25% which indicated the high prevalence of the infection in certain parts of the country; however, there was no research done on ovine lungworm in Jimma university open air veterinary clinics, Jimma Zone, Oromia Regional State, South west Ethiopia. Therefore, the objectives of this research were:

- To determine the prevalence of ovine lung worm infections at jucavm open air veterinary clinic
- To investigate the lungworm species involved in the study area

2. LITERATURES REVIEW

Lungworm (Verminous pneumonia)

Verminous pneumonia is a chronic and prolonged infection of sheep and goats caused by any of several parasitic nematodes, characterized clinically by respiratory distress and pathologically by bronchitis and bronchopneumonia. It is infection of the lower respiratory tract, resulting in bronchitis or pneumonia, or both (Fraser *et al.*, 1991).

2.1. Etiology

Lungworms of domestic ruminants are nematodes that belongs to the phylum Nemathelmenthes commonly named as round worms; classified under the super family Trichostrongyloidea and Metastrongyloidea. Of which, *Dictyocaulus* and *Protostrongylus* are causes of lungworm infection in ruminants. The common causes of verminous pneumonia in sheep and goats are *Dictyocaulus filaria, Protostrongylus rufescens* and *Muellerius capillaris*. *Dictyocaulus filaria* belongs to the super family Trichostrongyloidea while the latter two belong to Metastrongyloidea, which have direct and indirect life cycles respectively. Although mixed infection may occur, *D. filaria* predominates in most outbreaks (Schneider *et al.,* 2000).

2.2. Epidemiology

Epidemiology 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. Moisture is essential for the survival and development of the larvae. The larvae is active at moderate temperature of 10-21°C. Larvae survive best in cool, damp surroundings especially when the environment is stabilized by the presence of long herbage of free water. Under optimum conditions the larvae can persist for over one year (Taylor *et al.*, 2007).

Lungworm parasites are host specific and common in areas of mild high rain fall and abundant grass. The prevalence of infection is low in spring and summer and rises rapidly in the autumn and winter. When most clinical cases are seen, wet summers give rise to heavier burden in the following autumn and winter. Over stocking, deficient feeding, previous or concurrent infections predispose to infection. Sheep of all age are susceptible, but lambs of 4-6 months of age are severely affected with lungworms. Generally, only young ruminants in their first grazing season are clinically affected, since on farms where the disease is endemic older animals have a strong acquired immunity (Radostits *et al*., 2000).

Goats appear to be more susceptible to helminthes than sheep as they appear to develop less immunity. Sheep predominantly graze; pick up more parasites so have higher acquired resistance than goats which mostly consume browse. Goats with their browsing behavior consume uncontaminated matter with parasite larvae, so being less exposed to infective larvae, and may therefore have lower acquired resistance than sheep (Taylor *et al.,* 2007).

2.3. Life Cycle

Lungworms of domestic ruminants have two forms of life cycle. One form is direct life cycle (Dictyocaulidae) in which the free living larvae undergo two moults after hatching and infection are by ingestion of the free L_3. The other form is indirect life cycle (Protostronglidae) whereby the first two moults usually take place in an intermediate host (snails or slugs) and infection of the final host is by ingestion of intermediate host (Urquhart *et al*., 1996).

2.4. Pathogenesis

The pathogenic effect of lugworms depend on their location within the respiratory tract, the number of infective larvae ingested, the animal immune state, and on the nutritional status and age of the host. The relative pathogenicity of each lungworm depends on its predilection site. *D. filaria* lives in the trachea and bronchi so aspirated eggs, larvae and debris affect a large volume of lung tissue. It is therefore the most pathogenic species. Adult *P. rufescens* are found in smaller bronchioles, so associated lesions are much smaller (Schneider *et al.,* 2000).

M. capillaris is found in the lung parenchyma where it becomes encysted in fibrous nodules; lesions are therefore confined to its immediate surroundings. Consequently, this worm is generally considered as involves heavy mixed protostrongyloid infection and impair pulmonary gaseous exchange. It is suggested that when the larval stages of *M. capillaris* migrated through the walls of small intestine, the resulting damage may predispose to enterotoxaemia. Infection with more than one species is common and course of infection is usually chronic (Alemu *et al*., 2006).

2.5. Clinical Finding

The clinical course of lungworm infection depends on severity of infection, age and immunological status of the animal. Signs range from moderate coughing with slightly increased respiratory rates to sever persistent coughing, persistent respiratory distress and failure. The most common signs of *D. filaria* are coughing and unthriftness which in endemic areas is usually confined to young animals (Kassai, T., 1999).

In more severe cases, dyspnea and tenacious nasal discharges are also present. The signs may be accompanied by diarrhea and anemia due to concurrent gastrointestinal Trichostrongylosis of fasciolosis. In *M. capillaris* and *P. rufescens* infection, pneumonic signs have rarely been observed and infections are almost always unapparent being identified only at necropsy (Urquhart *et al.,* 1996).

2.6. Diagnosis

The factors that suggest lungworm infection are a history of exposure to previously grazed pasture by animals of the same species, the presence of the disease in the area and failure to respond to standard treatments to bacterial or viral pneumonia (Howard *et al.,* 1993).

2.6.1. Laboratory Diagnosis

In laboratory, 25 gram of fresh faeces will be weighed from each sample for the extraction of L_1 larvae using modified Baermann technique. The paste enclosed in gauze fixed on string rod and submerged in clean glass tube filled with fresh water. The whole apparatus will be left for 24 hours. The larvae leave the faeces and migrate through the gauzes and settle at the bottom of the glass. After siphoning of the supernatant, the sediment is examined under the lower power of the microscope (Urquhart *et al.,* 1994).

Dictyocaulus species of lungworms of cattle and sheep are usually seen in the sputum as egg containing larvae rather than larvae in the faeces. In *Muellerius capillaris,* those larvae which reach the lungs of sheep remain in the parenchyma and become encysted in fibrous nodules and because such nodules may not contain adults of both sexes, fertile eggs may not be deposited in the air passages. For this reason, the number of larvae in the faeces is often no indication of the degree of infestation (Sissay *et al*., 2006).

During identification of the larvae, the presence of *D. filaria* was confirmed by the finding of the first stage larvae with an anterior protoplasmic knob, and black granular intestinal inclusions in the faeces. The larvae of *P. rufescens* and *M. capillaris* are differentiated by their characteristic feature at the tip of their 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 an undulating tip and a dorsal spine (Geoffrey, 1962).

Dictyocaulus fillaria lung worm of sheep and goats

Muellerius capillaries lung worm of sheep and goats
Figure 2: Species of Lungworms in Small ruminants

2.6.2. Postmortem Examination

Lungs from selected animals were palpated for the presence of Protostrongylidea nodule. If the nodule present they were trimmed off and worms extracted from the tissue by gentile comprising a small non-calcified nodule or part of large nodule between two glass slides and then carefully testing the worm away from the tissue. Air passages were opened starting from the trachea to the small bronchi with fine blunt pointed scissors to detect the presence of adult Dictyocaulidae (Schneider *et al*., 2000).

At necropsy, most lesions are found in the respiratory system. With infection by *D. filaria*, the bronchi, especially those of the diaphragmatic lobes, contain tangled masses of worms mixed with frothy exudates. Atelectatic and infected lobules often surround or extend ventrally from infected bronchi. Bronchioles infected with *P. rufescens* often are closed with worms and exudates; consequently, affected lobules may be atelectatic and infected (Henderson, C., 1994).

Lungs infected with *M. capillaris* contain red, grey or green lobules 1 to 2 mm in diameter. These lesions, located in the sub-pleura of the diaphragmatic lobes, vary in consistency, number, and shape. Lung nodules as a result of *M. capillaris* infection have the feeling of lead shot. Infestation of goats by *M. capillaris* leads to a diffuse infection quite different to the nodular reaction in sheep and to the production of an interstitial pneumonia (Thomson *et al.*, 1988).

Figure 3: Adult Lungworms isolated from the respiratory tract of small ruminants by postmortem examination

2.7. Treatment

Strong acquired resistance against dictyocauliasis of bovine and ovine species by natural infection is well documented fact. However, owing to the undetermined number of infective larvae that could be ingested in the field and the accompanying disease process makes it unreliable (Mulugeta *et al.*, 1984).

Treatment of lungworm necessitates the use of appropriate Anthelmentics which are effective against lugworm infection. The effective Anthelmentics including Benzimidazoles, Levamisols or Ivermectin should be used in the treatment of the disease since clinical signs associated with pulmonary pathology are not rapidly resolved by mere removal of adult lungworms (Henderson, C., 1994).

2.8. Control and Preventions

The objective of prevention and control can be achieved most effectively by integration of three interrelated approaches of anthelmentic drugs, immunization and improved management practice. Management practice such as provision of ample nutrition increases the resistance of the host and therefore it is important for the control of Dictyocaulosis. Larvae of *Dictyocaulus* may persist and develop in swampy pastures and may serve as a source of infection; therefore, those susceptible animals should not be allowed to have access to such areas because young hosts of all kids are more susceptible to *Dictyocaulus* than adults. Animals must be placed on dry pasture and supplied with clean drinking water; moist pasture must be avoided while dry pasture is fairly safe, because the infective larvae are not very resistance to dryness. Young stock should be separated from other stock (Urquhart *et al.,* 1996).

Extinction of the snail intermediate host is an additional measure important for the control of Metastrongyloidea. This technique enables to control the nude slugs and shelled snails more easily, and spreading of lime has been recommended for this purpose. The snails creep up plants in the early morning and evening and rainy weather, the animals should, therefore, not be allowed to graze at such times, particularly in the autumn when the infection most frequently occur.[30]. Control of lungworm infection in first year grazing sheep and goats has been achieved by the use of prophylactic anthelmintic regimens either by strategic early season treatment or by administration of rumen bolus (Alemu *et al.*, 2006).

The best method of preventing verminous pneumonia is to immunize all young sheep and goats with lungworm vaccine. Vaccine for *D. filaria* is available where this worm is a particular problem. This live vaccine, consisting of larvae attenuated by irradiation, is given orally to young's aged 8 weeks or more. Two doses should be administered in order to allow a high level of immunity and to develop resistance. Vaccinated animals should be protected from challenge until two weeks after their second dose (Urquhart *et al.,* 1996).

3. MATERIALS AND METHODS

3.1. Study Area

The study was conducted at jucavm open air veterinary clinic to determine the prevalence of ovine lung worm infections and to investigate the lungworm species involved in the study area. JUCAVM is located in Jimma town; Jimma town is located in Oromia region, south west of Ethiopia, at a distance of about 352 km from Addis Ababa. Geographically, Jimma is located at 7°13' and 8°56' N latitude and 35°52' and 37°37E longitude. The climatic condition of the area is 'midland with altitude ranging between 1720 to 2110 m above sea level and receives annual rainfall which ranges between 1200 to 2000 mm. There are two rain seasons, short rainy season (November to April) and long rainy season (July to October). The annual mean temperature ranges from about 12.1°C to 28°C (JZARDO, 2009).

3.2. Study animals

A total of 384 local breed of sheep was included in the study at Jimma university veterinary clinic. Both sexes were included in the study. The age was categorized in to two groups as young below six months and as adult above six months by following description of (Aiello and Mays, 1998).

3.3. Study design

Across-sectional study was carried out starting from July 2012 to September 2013 to determine the prevalence of ovine lung worm in the study area.

3.4. Sampling method and sample size

The total number of ovine required for the study was calculated based on the formula given by thrusfield (2005) using random sampling method to calculate the sample size. There is no the previous lung worm prevalence report in the study area. For this case we take 50% of expected prevalence and 5% absolute precision was used and according to the sample size was determined.

$$n = \frac{1.96^2 (p)(1-P)}{d^2}$$

$$n = \frac{3.84 (0.5)(1-0.5)}{0.05^2}$$

n= 384

Where, N= Sample size

P= Prevalence

D = desired level of precision (5%)

Therefore, based on the above formula the total sample size; 384 small ruminants were sampled.

3.5. Sampling methodology

3.5.1. Sample collection

Fecal for parasitological examination collected directly from the rectum of each animal. Using disposable parasitic glob and paced in near screw capped universal (sampling) bottle. Each sample will clearly leveled with the animal identification place of convection, sex, age, body condition, deworming history of the animals and months of sampling of the animal was considered and recorded properly on the prepared format in laboratory fecal examination for the presence of L1 larvae was conducted using modified baerman technique (Urquhart *et al*., 1996).

3.5.2. Modified Berman technique

Baerman technique was a procedure which helps to assess the presence of larvae infectious through warp the faces with in double larvae gauze by completely covered with lack warm water in the beaker for 24 hrs and covert the aliquot in the test tube, avow the larvae to settle at the bottom for 30 minutes and discard the supernatant and examine the sediments for larvae (Urquhart *et al*., 1996).

3.6. Data analysis

The data was coded and entered to MS excel 2010 spread sheet. The data was analyzed by using SPSS statistical software version 20. Chi- square test (X^2) was used to see statically significant association between sex, age, body condition and altitudes.

4. RESULTS

A total 384 ovine fecal sample were examined by modified baerman technique the prevalence 69 (17.9%) were found positive out of the total 384 ovine examined 35(9.1%) was observed in adult animals. While the lower prevalence 34(8.8%) was observed in young animals (table 1). Generally, the prevalence between the two age group was statistically non significant.

Table 1: Total prevalence of lungworm infection based on age

Age	No. of examined	Prevalence of lungworm species (%)						
		D. filaria	Mixed Infection	M. capillaries	P. rufescens	Total positive (%)	X^2	P-value
Young	169(44%)	15(8.9%)	6(3.6%)	7(4.1%)	6(3.6%)	34(8.8%)	3.472	0.482
Adult	215	11(5.1%)	9(4.2%)	11(5.1%)	4(1.9%)	35(9.1%)		
Total	384	26(6.8%)	15(3.9%)	18(4.7%)	10(2.6%)	69(17.9)		

Out of the total of 384 ovine examined higher prevalence was observed in female animals 40 (10.4%) while lower prevalence was observed in male animals 29(7.55%) (Table 2). The prevalence between male and female animals was statically non significant.

Table 2: The prevalence of lungworm infection on sex

Sex	No. of examined	Prevalence of lungworm species (%)						
		D. filarial	M. capillaries	P. rufescens	Mixed infection	Total Positive (%)	X^2	P-value
Male	162	12(7.4%)	4(2.5%)	8(4.9%)	5(3.1%)	29(7.55%)	1.937	0.747
Female	222	14(6.3%)	11(5.0%)	10(4.5%)	5(2.3	40(10.4%)		
Total	384	26(6.8%)	15(3.9%)	18(4.7%)	10(2.6%)	69(17.9%)		

Out of the total 384 ovine examined the higher prevalence was observed in medium body condition animals 30(7.8%) while the lower prevalence 17(4.42%) was observed in good body condition animals (Table 3). There was a statistically significant difference ($\chi 2=18.30$; P=0.019) in prevalence of lungworm between body conditions of animals.

Table 3: Total prevalence of lungworm infection based on body condition of animals

	No. of	Prevalence of lungworm species (%)

BCS	examined	**D. filaria**	**M. capillaries**	**P. rufescens**	**Mixed infection**	**Total Positive (%)**	**X^2**	**P-value**
Good	59	7(11.9%)	4(6.8%)	2(3.4%)	4(6.8%)	17(4.42%)	18.3	0.019
Medium	177	14(7.9%)	2(1.1%)	10(5.6%)	4(2.3%)	30(7.8%)		
Poor	148	5(3.4%)	9(6.1%)	6(4.1%)	2(1.4%)	22(5.7%)		
Total	384	26(6.8%)	15(3.9%)	18(4.7%)	10(2.6%	69(17.9%)		

Based on the management system practiced, a prevalence of 14.58% in extensively managed and 3.38% semi-intensively managed animals were found positive. There was statistically no significant difference ($\chi2=8.364$; P=0.079) in prevalence of lungworm between the management systems.

Table 4: Total prevalence of lungworm infection based on Management

Mgt	No. of examined	Prevalence of lungworm species (%)						
		D. filaria	M. capillaries	P. rufescens	Mixed infection	Total Positive (%)	X^2	P-value
Extensive	259	22(8.5%)	12(4.6%)	13(5.0%)	9(3.5%)	56(14.58%)	8.364	0.079
S/intensive	125	4(3.2%)	3(2.4%)	5(4.0%)	1(0.8%)	13(3.38%)		
Total	384	26(6.8%)	15(3.9%)	18(4.7%)	10(2.6%)	69(17.9%)		

The prevalence of 12.3% and 5.7% was seen in dewormed and non-dewormed animals, respectively. The infection rate was statistically non significant.

Table 5: Total prevalence of lungworm infection based on Deworming History

DWH	No.of examined	Prevalence of lungworm species (%)						
		D. filaria	M. capillaries	P. rufescens	Mixed infection	Total Positive (%)	X^2	P-value
NDW	231(60.15%)	19(8.2%)	11(4.8%)	10(4.3%)	7(3.0%)	47(12.23%)	3.86	0.425
DW	153(39.8%)	7(4.6%)	4(2.6%)	8(5.2%)	3(2.0%)	22(5.7%)		
Total	384(100%)	26(6.8%)	15(3.9%)	18(4.7%)	10(2.6%)	69(17.9%)		

5. DISCUSSION

The present study revealed that over prevalence of 17.9% lungworm infection in ovine. The prevalence of lungworm infection was D.filaria (6.8%), M.capillaris (3.9%), P.rufescens (4.7%) and mixed infection (2.6%). This result corroborates the reports of Shibiru (2017) in Debre Berhan Town 18.3%, Temesgen Bihonegn (2017) in Minijar Shenkora Woreda 15.5%, Friewengils (1995) in Tigray 15.47%, Sisay (1996) in Bahirdar 11.24% and Tefera (1993) in dessie & Kombolcha 13%. However, the finding was lower than the prevalence of Nethanet (1992) in DebreBrihan 73.25% and Alemu *et al.*, (2006) in N/west Ethiopia 53.6%.

The difference in the prevalence of lung worm of sheep in the above studies might be associated with the difference in the method followed for the detection of the larvae of lung worm and or the study area which is not favors for the survival of the larvae of lung worm. The reason for lower prevalence of the disease in this study could be attributed to the establishment of open air clinic, increasing no of private clinic, and increase awareness of farmers to deworm their sheep.

In the present study the level of prevalence was compared between animal of different age groups. Then the studies shows that lower prevalence of infection 34(8.8%) was observes in young animals than the adult one 35(9.1%). These difference may as a result of immunity variation which helps to expel adult lung worms and the different between the prevalence was statistically non significant ($P<0.05$) which is ingreement with Alemu *et al.*, (2006) and Sisay (1996). However this was in contrary with the work of Muluken (2009) in Bahirdar. The other possible reason for higher prevalence in adult animals is may be due to pasture contamination with high degree.

In the current study on attempt was made to see the influence of sex on the overall prevalence of infection. The high level of prevalence was observed in female 40(10.41%) and the lower of the prevalence was observed in male 29(17.55%). This result was consistent with Sisay (1996) and Alemu *et al.*, (2006). The reason for high prevalence in female could be less management system and the farmers to focus on male animals.

The prevalence rate of lung worm in medium body condition animals was higher 30(7.8%) while the prevalence rate of good body condition animals was lower 17(4.42%). However, the prevalence rate was statistically non significant. This difference due to the felt that medium body condition animals are patented (exposed) to infections and non infectious disease than good body condition animals. Because of these and other related reasons they were immune suppressed than good body condition animals. This report agrees with Mengistome (2006) and Muluken (2009). Their results were a significant difference between poor body condition animals and medium body condition animals.

In the present study three species of huge worm were identified in sheep in coprological examination, however, with different proportional D.filaria and P.rufescens were the most prevalent species identified in sheep while M,capillaries was the least dominant in ovine. This finding is in consisted with previous studied (Alemu *et al*., 2010), Regassa *et al*., (2010), where the marked difference in proportion between D.filaria and the other two species (M.capillpris and P.refuscens) is associated with the difference in life cycle of those lung worms D.filaria has direct life and also takes less time to reach the infective stage and after ingestion.

The larvae can appear in the feces in a few weeks (Souls, 1982) compared with *D.filaria* the transmission of P.rufescens and M.Capilaris is epidemiologically complex event involving the animal host parasites and intermediate host. Furthermore the developing of 1st stage to infective stage larvae in the snail take 2-3weeks and the prevalent period in the final host reaches 5-6weeks. The probability of infection transmission and reinjection would be much lower compared with *D.filaria* (Urquart *et al*., 1996). *M. capillaries*

The level of prevalence was compared between animals kept under extensive and semi-intensive management systems; greater prevalence rate of lungworm infections was observed in animals under extensive management system, than those kept in semi intensive management system. It has a significant difference (P<0.05) and coincides with the previous results of the study by (Yitagel *et al.,* 2013) in North Gondar Zone, Eyob and Matios (2013) in Assella province and Yimer and Desie (2016) in Northern Ethiopia. This could be due to the fact that sheep in extensive management system have a chance of grazing in the field contaminated with intermediate host for *P. rufescens* and *D. filarial* or they possibly infested with larvae as well as easily obtained *M. capillaries* from the herbage (Radostitis *et al.,*). Another possible explanation for the massive infection of sheep in extensive production system is that they were not supplied with appropriate nourishment which provides high computation, getting wide of lungworm infection (Kimberling, 1988). However, it contradicted with the result of Weldesenebet and Mohamed (2012) 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 Sefinew (1999). Even though the dewormed sheep revealed low infection prevalence compared to non-dewormed groups, about 7.1% 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 (Radostitis *et al.,* 2007).

6. CONCLUSION AND RECOMMENDATIONS

The prevalence of ovine lungworm infection recorded was relatively smaller at jucavm open air veterinary clinic. However, associated risk factors such as age, sex, management systems and deworming history were found no significantly related with the prevalence of ovine lung worm infection in the study area. Extensively managed sheep were found to be more infected with lung worm than those in semi-intensive management system. The highest prevalence was observed in non-dewormed animals than animals of the corresponding group. Despite, lower prevalence of lungworm infection obtained in the present study within the specified study period, it is still a constraint among different season of the year in the area and hence requires strong attention.

Therefore, in light of the above conclusion the following recommendations are forwarded:

- Farmers who keep sheep should be advised not to keep their animals in extensive management system of production
- 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.
- Prohibition of sheep and goats from grazing early in the morning and evening and in swampy areas to protect them from infection.
- Extensive extension service should also be launched to make the sheep owners aware of the disease for improvement of the economic benefits and productivity of their animals.
- Due to its impact on production, emphasis should be given for the control and prevention of lungworm infections.

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