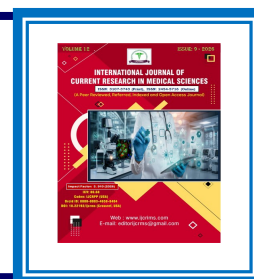




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Prevalence of ovine lungworm and its associated risk factors in and around Haramaya town

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Abstract

A cross sectional study was conducted from November 2022 to May 2023 in and around Haramaya town, Ethiopia. The objectives of study were to estimate the prevalence of Lungworm infection and associated risk factors in sheep. Accordingly a coproscopic examination was done using a modified Baermann technique from 241 sampled sheep. 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 241 sheep examined, 96 (39.8%) were found to be positive for one or more species of Lungworm parasites. In this study *Dictyocaulus filarial* 54 (22.4%) was the predominant species of parasite identified; while the least identified species were *Dictyocaulus filarial* and *protostrongylus rufescences* (mixed infection) 17 (7.1%). The prevalence of these parasitic species were found statistically significant across the ($P < 0.05$) across the risk factors of body condition score, study sites and management systems. On the other hand, the prevalence of the parasites among breeds, age groups and sexes showed no significant difference ($P > 0.05$). The prevalence is study comparably lower than other study site of the country, ovine Lungworm is still a constraint to sheep in the study area. Therefore, vigorous controlling strategy should be implemented to reduce the prevalence of infection and as well, awareness creation is tie to undertake to tackle the prevalence of the disease.

Keywords: Haramaya; Lungworm; Prevalence; Risk Factors and Sheep

1. Introduction

Domestic sheep are a highly common small ruminant species that are primarily farmed for their wool, meat, milk, and hides. They are raised in a variety of production systems around the world, which reflects the socioeconomic and environmental situation (FAO, 2022). Ethiopia has one of the largest livestock populations in Africa. About 39.89 million sheep are estimated

to be in the country, of which about 70.28 percent are females and about 29.72 percent are males. Ethiopia is home to at least 9 breeds and 14 traditional sheep populations (Gizaw et al., 2007). Sheep are the most numerous of man's domestic livestock. In Ethiopia, sheep are the dominant livestock providing up to 63% of cash income and 23% of food substance value obtained from livestock production (Bogale *et al.*, 2012; Ibrahim and Godefa, 2012). In 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 in the central high lands where mixed crop-livestock production system is practiced (Wilsmore, 2006; Asaye and Alemneh, 2015). Other reasons were for breeding purposes (stock replacement), social security, holiday ceremonies, and manure (Kiflay *et al.*, 2019).

Sheep are used for meat production and immediate cash income next to poultry. However, the productivity is much less when compared with the population size of small ruminant in Ethiopia (Fentahun *et al.*, 2012), and also half of all sheep mortality and morbidity on farms in Ethiopian highlands are caused by pneumonia and endoparasitism including lung worms (Alemu *et al.*, 2006; ILRI, 2000) and the economic benefits to the farmers remain marginal due to different constraints. There are different constraints on sheep production in Ethiopia. Farmers rearing sheep confess a range of interlinked technical, socioeconomic, and institutional bottlenecks due to feed and grazing land shortages, income, drought, marketing problems, lack of inputs, lack of extension and support, lack of technology and innovations, lack of credit, disease, general lack of veterinary care, water scarcity, and loss of sheep by predators. Among these major constraints, feed shortages, income, and diseases were the top three constraints across the country (Kiflay *et al.*, 2019).

Major constraints of health problems are the widespread of disease and parasites, shortage of feed and water, lack of veterinary institutions, lack of animal health professions, shortage of medicines, and drought (Sisay and Kefyalew, 2015). Ruminants are particularly sensitive animals to the development of lung pathologies (Lacasta *et al.*, 2019). Pneumonia can also be caused by physical and chemical agents as well as by toxins arriving hematogenously, by inhalation, or by aspiration of food or gastric contents and malfunction may be caused by viral, bacterial, fungal, or parasitic agents, as well as by hypersensitivity reactions, such as localized allergies and anaphylaxis (Aiello and Moses, 2016; Constable *et al.*, 2017).

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 Nematelminthes and grouped under Metastrongyloidea or Trichostrongyloidea super families and (Tewodros, 2015). Lung worm infection is also called Verminous Bronchitis or Verminous Pneumonia which caused by the three economically important species of lungworm of sheep namely, *Protostrongylus rufescence*, and *Muellerius capillaries* (Chakraborty *et al.*, 2014; Abebe *et al.*, 2016).

Most of lungworms, *Dictyocaulus filarial*, species can suppress the immunity of the respiratory tract and cause death, poor weight gain, or loss of body weight, as well as greatly affect the potential productivity of the sheep industry in the areas where it is prevalent (Ibrahim and Godefa, 2012). The prevalence of lungworm infection of small ruminants depends on different factors like the climate, altitude, intermediate hosts, and favorable ecological conditions such as rainfall, humidity, temperature, and marshy area for grazing (Serkalem *et al.*, 2014).

Lungworm infection in sheep is highly prevalent and widely distributed in Ethiopia (Kassahun *et al.*, 2018). Several studies have indicated their widespread presence at varying Prevalences (Selam *et al.*, 2015; Semira and Mukarim, 2016; Hussen *et al.*, 2017; Yirga *et al.*, 2018; Asrat *et al.*, 2020). Several authors demonstrated the presence of lungworm infection among sheep in central parts of Ethiopia (Mebratu and Tewodros, 2015; Niguagus *et al.*, 2016; Yihenew and Temesgen, 2017; Robel and Biruk, 2019). The commonly reported lungworm species in the country are *D. filaria*, *P. rufescens* and *M. capillaries* (Asrat *et al.*, 2020; Nageso *et al.*, 2020; Haben and Mesfin, 2021). These different anthelmintic usage habits in society are due to low veterinary services, low prices of anthelmintics, or low public awareness about anthelmintic usage (Guelph University, 2019). Respiratory diseases are major causes of

morbidity and mortality in sheep in Ethiopia. On the other hand, Merkinet al. (2017) reported that the overall morbidity rate in sheep was 22.27% and morbidity from respiratory disease was 10.84%. Mortality associated with respiratory diseases accounted for 54.4% of total deaths in sheep (Markos et al., 2003). In the highlands of Ethiopia about half of all small ruminant mortality and morbidity is caused by endoparasites including lungworms (ILRI, 2000; Mebratu and Tewodros, 2015; Kemer et al., 2017). Although fragment studies have been done and reports are available, there was a little information has been documented on the status of ovine Lungworm infection. Moreover, there was dearth of information has been documented on the status and associated risk factors of the disease in ovine particular in Haramaya district. Therefore, this study was aimed to determine the prevalence of Lungworm infection and its associated risk factors in sheep population in selected areas of Haramaya district

2. Methodology

2.1. Study Area

The study was conducted in and around Haramaya town, Eastern Hararghe zone of Oromia Regional State of Ethiopia. The Haramaya town is located at 506 Km from Addis Ababa at an elevation of 1400 to 2340 meter above sea level. The town situated between a latitude and longitude of 9°24'N and 42°01'E respectively. The mean annual rainfall received range from 560 to 1260 mm with bimodal nature Minimum and maximum annual temperature range from 60C to 120C and 170C to 250C respectively. There are four seasons; a short rain season (from March to mid-May), a short dry season (from end of May to end of June), a long wet season (early July to mid-October) and a long dry season (end of October to end of February). The relative humidity varies between 60% to 80%. The farming system in the area is mixed type (crop-livestock production). The estimated animal population in the area is about 115,989 cattle, 88,144 sheep, 133,520 goats, 33,466 donkeys, 578 camels and 137,545

chickens. The production system of the district is mixed type (HWADB, 2016) (CSA, 2012).

2.2. Study Design

A cross sectional study design was selected to determine the prevalence of ovine lung worm in the study area, the predominant species of Lungworm and to evaluate the effect of major host related risk factors on the occurrence of the parasites in and around Haramaya town.

2.3. Study Population

The study animal is sheep population which is owned by smallholder farmers under extensive and semi-intensive management system. The study was conducted on two breed of sheep (i.e. hararghe highland breed and black head Ogaden) and was selected from five Kebele in and around Haramaya town. During collection of samples the age, sex, body condition, management system and origin of the animals will be recorded. The age of the animals determined by teeth were categorized into young (≤ 6 months) milk teeth that have started to wear down or are fully spread out and adult (>24 months) those with erupted and growing 1st pair of permanent teeth according to ESGPIP (2008). In this study, sheep were categorized into different body conditions (poor, moderate, and good) according to the guidelines set by (Abebe, 2007).

2.4. Sampling

2.4.1. Sampling Techniques and Sample Size Determination

Random sampling techniques were used to select the study area and sample the study animals. The sample size required for this study was calculated depending on the expected prevalence of 17.9% as gained by Sheferaw (2019) using desired 95 % confidence interval and 5 % desired absolute precision. The sample size was computed using the formula given in Thrusfield (2005).

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

When: N =required sample size; P_{exp} = expected prevalence; d = desired absolute precision.

226 sample sizes were calculated according to formula, and totally 241 fecal samples were collected by adding 15 samples to increase the precision, of the research.

2.4.2. Sampling Method

Random sampling technique was selected animals and to determine the prevalence ovine lung worms and to assess the associated risk factors in and around Haramaya town during the study period.

2.5. Sample collection and laboratory examination

Fecal samples were collected per-rectum from fresh deposits using plastic gloves in clean plastic bags (universal bottle) by using modified Baerman technique. While collecting fecal sample; sex, age, body condition and management system were properly recorded on the prepared format, labeled and kept in icebox. Specimens are transported to Parasitological Laboratory, College of veterinary medicine, Haramaya University. In the laboratory, feces sample examination for the presence of L1 larvae was conducted using technique of larvae recover from fresh feces sample.

Three up to five grams of feces was taken and the specimens were wrapped enclosed with double layer of gauze fixed on to a string rod and suspended into beaker, then the feces were covered with warm water (approximately 18°C). The whole apparatus was left for 24 hours overnight. Then supernatants were discarded and samples left at the bottom were examined for moving lung worms larvae under stereo-microscope. Positive samples were subjected to further examination for species identification under low power objective microscope fixed by iodine solution (1%). Species identification of lung worms was performed using the methods described by Van et al. (2004).

Accordingly, larvae (L1) of Dictyocaulus filarial were characterized by larger size, brown color due to food granules in their intestinal cells with cranial cuticular knob and blunt tail while L1 of Muellerius capillaris were found to be smaller in size, whitish in color with “S” shaped tip and dorsal spine while L1 of Protostrongylus refuscences were uniquely identified by whitish color and smaller size possessing similar “S” shaped tip that is similar with L1 of Muellerius capillaris but without dorsal spine.

2.6. Data Management and Analysis

The results of fecal examination were entered into Microsoft Excel spread sheet (Microsoft® office excel 2007) and SPSS version 20 for two way analysis. Descriptive analysis was used to describe the result of proportion analysis. Prevalence was estimated as the number of samples detected positive to lungworm from the total sample analyzed. Chi-square was done to study association between lungworm infection and risk factors (breed, age, sex ,management system, and origin of animals). For(X^2)test, $p\text{-value} \leq 0.05$ was considered significant whereas $p\text{-value} > 0.05$ considered non-significant.

3. Results

3.1. Over All Prevalence of Lungworm Infection

Coprological examination revealed that from the total examined sheep (241), 96(39.8%) was found positive for lungworms. Major parasitic species identified were D. filarial 54(22.4%), P. refuscences 25 (10.4%) and mixed infection with D. filarial and P. rufescences 17 (7.1%) respectively.

TABLE 1: PREVALENCE OF DIFFERENT SPECIES OF LUNGWORM IN TOTAL EXAMINED SHEEP.

Lungworm species	No. of sheep examined	No.of positive	Prevalence (%)
D. filarial	241	54	22.4
P.refuscens	241	25	10.4
Mixed infection	241	17	7.1
Total	241	96	39.8

3.2. Prevalence of Lungworm Infection According to Sex

Sex based prevalence of lungworm revealed that from 109 males examined 52(21.6%) and from 132 females 44(18.2%) were positive for

lungworm. The prevalence of lungworm was relatively higher in male animals than female; however, sex wise significant difference was not recorded with the p-value of greater than 0.05.

TABLE 2: SEX WISE PREVALENCE OF LUNGWORM INFECTION IN THE STUDY AREA

Sex	No Examined	No positive	Prevalence of Lung Worm Species (%)			Total (%)	χ^2	P- Value
			DF	PR	MIX			
Male	109	52	26(10.8%)	15(6.2%)	11(4.6%)	52(21.6%)	7.041	0.071
Female	132	44	28(11.6%)	10(4.1%)	6(2.5%)	44(18.2%)		
Total	241	96	54(22.4%)	25(10.4%)	17(7.1%)	96(39.8%)		

DF= D. filarial , PR= P.refuscens and MIX=Mixed infection

3.3. Prevalence of Lungworm Infection According to Age of Study Animals

The prevalence of lungworm infection according to age of the study animals indicated that from 150 adults sheep examined 55(22. %), were

positive for lungworm and 91 young's sheep examined 41(17%). Although the prevalence of lungworm was relatively higher in adults animals than young's however, the difference was not statistically significant ($p>0.05$).

TABLE 3: PREVALENCE OF LUNGWORM INFECTION ACCORDING TO AGE OF STUDY ANIMALS

Age	No Examined	No positive	Prevalence of Lung Worm Species (%)			Tot. Prev. (%)	χ^2	P- Value
			DF	PR	MIX			
Young	91	41	20(8.3%)	12(5.0%)	9(3.7%)	41(17%)	3.45	0.326
Adult	150	55	34(14.1%)	13(5.4%)	8(3.3%)	55(22.8%)	7	
Total	241	96	54(22.4%)	25(10.4%)	17(7.1%)	96(39.8%)		

Note: Mix= Mixed infection, DF= Dictyocaulus filarial, PR= Protostrongylus refuscences, MIX=mixed infection, P-value= Pearson's value, Tot. = Total, χ^2 = chi-square, Preval. =prevalence

3.4. Prevalence of Lungworm Infection According to Body Condition

Prevalence of lungworm infection according to body condition of study animals was 12.1%, 21.1%, and 6.6% in poor, moderate, and good body condition animal respectively. In this study,

animals having moderate body condition were found to have higher prevalence of ovine lungworm infection than poor and good body conditions and the difference among the different body condition categories was statistically significant ($p < 0.05$).

TABLE 4: PREVALENCE OF LUNGWORM INFECTION ASSOCIATION WITH BODY CONDITION OF THE STUDY ANIMALS

BCS	N _o examined	N _o +ve	Prevalence of Lung Worm Species			Tot. Prev. (%)	χ^2	P- Value
			DF	PR	MIX			
poor	44	29	13(5.4%)	11(4.6%)	5(2.1%)	29(12.1%)	50.7	0.000
moderate	97	51	33(13.7%)	8(3.3%)	10(4.1%)	51(21.1%)		
Good	100	16	8(3.3%)	6(2.5%)	2(0.8%)	16(6.6%)		
Total	241	96	54(22.4%)	25(10.4%)	17(7.1%)	96(39.8%)		

3.5. Prevalence of ovine lungworms According to Kebeles/Pas

Peasant association wise prevalence of lungworm revealed 10.3%, 9.6%, 6.6%, 6.2% and 5.1% in Ifa Oromia, Tuji Gabisa, Tinike, Adele and Ifabate, respectively. The highest prevalence was

observed in Ifa Oromia and the lowest prevalence was observed in Ifabate. However, statistically significant difference was recorded (P value=0.048) in the prevalence of lung worms among the kebeles.

TABLE 5: PREVALENCE OF DIFFERENT SPECIES OF LUNG WORM INFECTION BASED ON THE ORIGIN

Origin	N _o Examined	N _o positive	Prevalence of Lung Worm Species			Tot. Prev. (%)	χ^2	P- Value
			DF	PR	MIX			
Adele	37	15	14(5.8%)	0.0%	1(0.4%)	15(6.2%)	21.161	0.048
Ifa	63	25	16(6.6%)	6(2.5%)	3(1.2%)	25(10.3%)		
oromia								
Tuji	59	23	12(5.0%)	7(2.9%)	4(1.7%)	23(9.6%)		
gabisa								
Ifabate	39	17	4(1.7%)	6(2.5%)	7(2.9%)	17((5.1%)		
Tinike	43	16	8(3.3%)	6(2.5%)	2(0.8%)	16(6.6%)		
Total	241	96	54(22.4%)	25(10.4%)	17(7.1%)	96(39.8%)		

Note: MIX= Mixed infection, DF= Dicytocaulus filarial, PR= Protostronglus refuscens, P-value= Pearson's value, Tot. = Total, χ^2 = chi-square, Prev. =prevalence

3.6. Prevalence of Lungworm Infection based on management systems

In this study, animals kept under extensive management (28.2%) were found to have higher prevalence to ovine lungworm infection than animals kept under semintensive management

(11.6%) and the difference among the different management system categories was statistically significant ($p < 0.05$) (Table 6). Dictyocaulus filarial was highest prevalent (22.4%) and (10.4%) for animals kept under extensive and semintensive management respectively.

TABLE 6: MANAGEMENT WISE PREVALENCE OF OVINE LUNGWORM

Mgt. system	N _o examined	N _o +ve	Prevalence of Lung Worm Species (%)			Tot. Prev.	χ^2	P- Value
			DF	PR	MIX			
Extensive	149	68	34(14.1%)	20(8.3%)	14(5.8%)	68(28.2%)	8.748	0.033
Semi-intensive	92	28	20(8.3%)	5(2.1%)	3(1.2%)	28(11.6%)		
Total	241	96	54(22.4%)	25(10.4%)	17(7.1%)	96(39.8%)		

Note: Mgt= management, total Prev=total prevalence, Tot. = Total, DF=Dictyocaulus filarial, PR=Protostrongylus rufescences, MIX=Mixed infection

4. Discussion

The present study result revealed an overall prevalence of 39.8% in ovine in the selected study area. This level of prevalence is nearly slightly similar with reports of previous studies conducted in different parts of Ethiopia; That of reported a prevalence of Muktar et al.,(2013), 41.9% in Ambo town, Wondewsen(1992) in Assela 39.78%, Tigist and Regassa,et al.,(2009) 36.0%, 36.9% North and south Gondar, Dessie and kombolcha respectively, Terefe et al., (2013) 39.8% in North Gondar zone, Regassa *et al.*, (2010) reported a prevalence of 40.4% in Dessie and Kombolcha districts,Yitagele *et al.*, (2011) 42% in North Gondar,Yitagele (2011) 42% in North Gondar, Basaznew,et al., (2011) 43.33% in Dessie zuria, Engdawork (2019) reported prevalence of 43.33% in Dessie Zuria District, Northeastern Ethiopia, Sissay (1996) 44.7% in and around Bahir-Dar city, Basaznew et al. (2012). But this study was considerably lower, when compared with the previous researcher's reports; Jovanovic, et al. (1962) in highland of Shoa province 83% to 99.5%, Eyob, et al.(2012) in Asella province, 72.44%, Sefinew (1999)in six district of Wollo,71.3%,Munesa district, 66.67%, by Abdella, et al.(2016), Debra Tabor Awraja, 70.7%, by Yohannes (1989),Asella, 59.9%, by Hussein, et al.(2017), Bassona Worena district, 62.67%, by Zelalem (2011), Debra Birhan, 64.7%, by Eyob, Matios (2012) in Assella Central Ethiopia reported a prevalence of 72.44%, Abebe et al. (2014) reported a prevalence of 58% in and around Assela, Arsi zone, Ethiopia, by Hasen et

al.(2013) in Asella,55.10%, and in Tiyo District ,Central Ethiopia by Asrat *et al.*(2020), 46.5%.

On the other hand, the result of the present work was higher than the observations of other works; Kassa and Abdu (2011-2012) 20.2% in Bahir Dar, Yifat Denbarga (2013) 17.5% ni Bahir Dar,Uqubazqhi (1990) in Hamassien 27.6%, Gebreyohannes, et al.,(2013) in Mekedella 28.6%,Ibrahim and Degefa(2012)in Mekelle Town 13.4%,Mersha Chanie (2010- 2011) in Deneba 30.46%. These differences might be associated with variation in sample size and study area, nutritional status, level of immunity, method used for the detection of the larvae, difference in agro-ecology and season of study period management practice of the animal, rain fall, and humidity and temperature differences or difference in the study areas of topography, which has conducive environment for the survival of larvae and intermediate hosts, slug or snails which can influence the larvae in the respective study areas (Radostits, et al., 2007; Debela and Yobsan, 2020).

From the total prevalence (39.8%) of lungworm infection, the species of lungworm helminthes parasites were distinguished: D. filarial (22.4%), .Prevalence of lungworm infection caused by D. filarial (22.4%) was found to be the highest. This result it is quite agreement with Alemu et al. (2006) 23.3% in Debresina town, Dinka et al. (2011) 23.3%, P. rufescences (10.4% coincide with Alemu et al., (2006) 9.8% in Debresina and mixed infection (7.1%) slightly approached Fantahun et al ., (2012) 8.77% in Jimma town

Addis et al., (2011) 11.07% in Gondar town. The possible reason for the predominance of *D. filarial* in the study area might be attributed to the difference in the life cycles of the parasites. Thus, *D. filarial* has a direct life cycle and requires shorter time to develop to an infective stage. After ingestion, the free living larvae of these parasites can be shed with feces within 5 weeks and also takes less time to reach the infective stage and after ingestion (Temesgen et al., 2017). Unlike *D. filarial* the transmission of *P. refuscences* and *M. capillaries* needs an intermediate host (snail, slugs) for completing its life cycle (Tewodros, 2015). In addition to this the absence prevalence of *M. capillaries* and lower prevalence of *P. refuscences* in the study area might be attributed to the fact that study was done in dry season which does not favor the development of the snail intermediate hosts.

The present study revealed the direct impact of sex on the disease occurrence indicating higher prevalence of (21.6%) in males compared to (18.2%), in females. The association of lungworm infection in relation to sex of animals was found to be not statistically significant ($P > 0.05$). This finding agrees with the previous works done by Habte and Simeneh (2019) in Dangla district, Western Amhara, North West Ethiopia, Mihreteab and Aman (2011) in Tiyo District, South East Ethiopia, Alemu, et al. (2006) in North East Ethiopian, Temesgen et al. (2017) in Minijar Shenkora Woreda, North Shoa, Ethiopia. But disagree with many researchers reported in different parts of Ethiopia; Asrat et al. (2020), Addis, et al. (2011), Hussein et al. (2017) and, Debela and Yobsan (2020). These differences might be either due to improper distribution of sample selection between sampled or most of the sampled female are not in preparturient period during the study time that make both sexes equally susceptible to disease. In addition high prevalence was recorded in male attribute to less management system and the farmers focus on female animals for breeding purpose.

In the present study the levels of prevalence was compared between animals of different age groups. Then the studies shows that lower prevalence of infection 41(17%) was observed in

young animals than the adult one 55(22.8%). There was no a statistically significant variation between young and adult sheep. This finding agrees with Mesfin (2008); Alemu et al., (2006) and Sisay (1996). This has been partly explained by the acquired immunity developed in adult and older animals due to previous exposure and sheep that recovered from the infection have better immunity against re-infection. In contrary to this study reported that the highest prevalence of infections in adult than young sheep were difference between this significantly affected by lungworms ($p < 0.05$) who reporters says Basaznew et al., (2012), Alemu et al., (2006), Mihreteab and Aman (2011) and Abdella et al., (2016). The other possible reason for higher prevalence in adult animals is may be due to pasture contamination with high degree of larvae infection.

The present study has confirmed as the selected sites/PAs have statistically significant association ($P < 0.05$) with lungworm infection in sheep. The present study finding agrees with the report of Desta et al. (2013) in Ambo and Wondwossen (1992), in and around Asella. Unlike the present study, no significant association of study area on lungworm infection was reported by Alemu et al. (2006). The significant association of the study area with the disease reported by these researchers could be attributed to the fact that they had collected their samples from differing highland of agro ecological zones which are supposed to influence disease occurrence.

The current study revealed the direct impact of management system on the disease occurrence indicating higher prevalence of 28.2% in sheep kept extensively compared to 11.6% in sheep managed semi-intensively. The association of lungworm infection in relation to management system of animals was found to be statistically significant ($P < 0.05$). This finding is in agreement with the previous results of the study by Bekele and Shibbiru (2017) in and Around Debre Berhan Town, 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 on the field contaminated with

intermediate host for *P. rufescens* and *M. capillaries* or they possibly infested with larvae as well as easily obtained *D. filarial* from the herbage (Radostitis *et al.*, 2007). Another possible reason 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).

The prevalence rate of lung worm in medium body condition animals was higher 51(21.1%) while the prevalence rate of good body condition animals was lower 16(6.6%). Their results were a significant difference between medium body condition and good body condition of animals previously reported on agree with Shiferaw (2019). This difference due to the fact that medium body condition animals are 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. and also other This is because of heavy parasitic loads, stress due to infections, disease which can cause sheep to lose conditions because they are not eating or the nutrients they eat are being diverted to parasites (<http://www.esgpip.org>). Well nourishment and watering of sheep lead to less risk of helminth infection as reported by Anne, *et al.*, (2015). Thus, the variation of lungworm infection according to grazing area may be due to antihelmintic effects of some trees and shrubs browsed from the forest that caused prevalence of lungworm infection low in forest grazing sheep (Rahman and Seip, 2006); prevalence in swampy area was high which might be due to the presence of moisture which is favorable for survival of larvae and intermediate host (Urquhart *et al.*, 1996).

An attempt was furthermore made to know the influence of breeds of sheep on the overall prevalence of lungworm infection and there is no statistically significant difference ($P > 0.05$) I agree as with the previous study by Tefera and Mekuria (2016) in Debre Berhan town, infestation rate among breed types. However, a high level of lungworm infection was recorded specifically

in Hararghe highland and Black head Ogadean breeds in this study. This might be due to the difference in relative adaptability competence in the area and genetic make-up and pedigrees of animals.

5. Conclusion and Recommendations

The result of the present study indicated that lungworm is one of helminthosis of sheep in the study area. Higher prevalence rate of lungworm infection was observed in animals with extensive management. The prevalence of lungworm infection was higher in those sheep with extensive management than in those with semi-intensive management. The prevalence of infection in moderate body condition of animals is higher than other body condition of animals, according to Peasant association the highest prevalence was observed in Ifa Oromia and the lowest prevalence was observed in If Abate and *D. filarial* is the dominant lungworm species in the study area. It can also be concluded that the infections caused by lungworms are significantly common in the study area and are important health problems of sheep which is speculated to cause heavy economic loss. Therefore, in line with the above conclusion the following recommendations have been forwarded:

- Due emphasis should be given for the prevention and control of lung worm infections.
- Education and awareness creation of farmers about lungworm.
- Treat sheep with broad-spectrum antihelmintic at the beginning of rain season would appear to be most effective.

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