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Original Research

A Study on Prevalance of Ovine Lungworm Infection in and around Kombolcha, Ethiopia

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Abstract

A cross-sectional study was carried out in and around Kombolcha district of north eastern Ethiopia, from November, 2015 to April, 2016 to determine the prevalence and the predominant species of lungworms infection in sheep and to relate lungworm infection with different risk factors in the study area. Fecal samples were randomly collected from 407 sheep in and around Kombolcha town and laboratory examination was done using Modified Baerman technique. The overall prevalence of lungworm infection in the study area for this current study was 40% (163/407). The lungworm parasite species identified by the fecal sample examination were Muelleries capillaries, Dictyocaulus filaria and Protostrogylus rufescens, with prevalence rate of 44.8% (73/163), 30.1% (49/163), 9.8% (16/163) respectively and also mixed infection 15.3% (25/163) was present. Among those, Mullerus capillaries were more prevalent in study area than Dyctyocaulus fillaria and Protostrongylus rufescens. The sex of animals in study area did not show significant association with the prevalence of lungworm infection (P= 0.68). The prevalence rate of lungworm parasite was higher in adult 46.72% (107/229) and lower in young animals 31.46% (56/178). This indicates there is a significant association between the prevalence of lungworm infection and age of sheep (P = 0.002). The body condition of animals was also found to be significantly associated to the prevalence of lungworm infection (P=0.00) and highest in animals which have poor body conditions 72.22% (65/90) than medium and good scores. Management system was another factor found to be significantly associated (P= 0.001) with high prevalence rate under extensive management system 46.72% (114/244) than semi-intensive Management system 30.06% (49/163) with lungworm parasite infection. The present study shows that lungworm infection was one problem of sheep in the study area. Thus, control and prevention of lungworm infection in the study area need due attention.

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INTRODUCTION

Africa hosts 205 and 174 million sheep and goats representing 17 and 13 percent of the world total small ruminant population, respectively. The population of small ruminants in sub-Saharan Africa is estimated to be274 million (Samson and Frehiwot, 2010). Currently, the population of livestock found in Ethiopia is estimated to be 53.4 million cattle, 25.5 million sheep and 22.78 million goats. Livestock are an important component of nearly all farming systems in Ethiopia and provide draught power, milk, meat, manure, hides, skins and other products (Kefyalew & Tegegne, 2012).

Sheep has many purposes as major sources of livelihood and contribute to the sustenance of landless, smallholder and marginal farmers especially to the poor in the rural areas throughout the developing countries, and also they are very important for resource poor smallholder systems of rural Ethiopia due to their ease of management, short generation cycles and high reproductive rates which lead to high production efficiency and significant role in provision of food and generation of cash income. They serve as a living bank for many farmers, closely linked to the social and cultural life of resource poor farmers and provide security in bad crop years (Tsedeke, 2007).

Although sheep represent a great resource for the nation, the productivity per animal is low and therefore the rich potential from the sector is not efficiently exploited. Sheep diseases, poor management and lesser efforts provided to improve the performance of the animals are to be responsible for the reduced productivity (Ademosun, 1992). In this regard, diseases due to parasites take the lion's share in limiting the productivity of these animals all over the World. This is especially true in many tropical and subtropical regions. Small ruminants under intensive and extensive production systems are susceptible to the effects of wide range of helminthes (Abebe & Esayas, 2001).

The occurrence of lungworms is associated with different nutritional status, level of immunity, rain fall, humidity, altitude, temperature, feeding habit of small ruminants, the type of plants used for animal feed, the use of marshy area for grazing, animal management system, the presence of longer time wet or rainy warmer seasons and the presence of suitable intermediate hosts in the area are the preconditions for the development of lungworm infection (Bradford, 2002). Respiratory diseases resulting from helminthes parasites are of a great economic concern in sheep production in the highlands of Ethiopia where sheep are important livestock units. Dictyocaulidae and certain Metastrongylidae are known to exist in East Africa (Ethiopia, Kenya and Tanzania) and the South Africa (Tony, 2006).

In highland area of Ethiopia respiratory lungworm parasites are the most common cause of high morbidity and mortality rates of sheep (FAO, 2006; Alemu *et al.,* 2006**).** Lung worm infection is infection of lower respiratory tract, resulting in bronchitis or pneumonia or both. These lungworms particularly *Dictyocaulus filarial* 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 in the areas where it is prevalent (Gelagay *et al.,* 2005). Control of these parasites is therefore essential for releasing the potential of sheep production. For proper control to be carried out knowledge of parasitic diseases and their dynamics must be understood to lay down rigid rules for their control which are applicable to all regions. For this reason, a study of epidemiology of each parasitic disease should be limited to small areas (Radostits *et al.,* 2007). To increase the potential of sheep production and to get the maximum benefit from sheep, prevention and control of lungworm is very important. Although cases of lungworm parasites have a great impact

on livestock productivity, there is lack of relevant information on the magnitude, distribution and risk factors of lungworm infection of sheep in and around South Wollo, Kombolcha. Therefore, the objectives of this study were to:

1. estimate the prevalence of lungworm parasites and identify the species of the lungworms in study area
2. determine the risk factors of lungworm infection in sheep in the study area

MATERIAL AND METHODS

Study Area

The study was conducted at Kombolcha Town, which in found in South Wollo Administrative Zone of Amhara National Regional State in North Eastern Ethiopia. The study area is located 376 km north of Addis Ababa with 110084'49'' N latitude and 0.390737' 46''0E longitude at an altitude of 1840 meter above sea level (m.a.s.l). The Kombolcha town experiences a bi-modal rainfall, the short rainy season occurs usually from March 15 to May. The minimum and maximum mean annual rainfall in and around Kombolcha ranges from 750 to 900mm. The average minimum and maximum daily temperature during short and long rains are11.7oc and 23.9oc respectively and the relative humidity of the area varies from 23.9% to 79%. The topography of zone generally is marked by the presence of numerous mountains, plateaus, hilly and sloppy area and river were present, the farming system in the area is mixed farming and sheep are the dominant animal species kept by farmers. The grazing land comprises water logged areas, forest margins, hill tops, mountain sides, stony land and road sides (NMSA, 2013).

Study Animals

The study animals were sheep of all age and sex group which come to Kombolcha veterinary clinic for treatment and vaccination purpose during the study period and also sheep found at different farms in the town and rural households.

Sampling Method and Sample Size

The sample was selected by using simple random sampling based up on the different categories like age, sex, body condition, and management system to take the required sample. The sample size was decided based on formula described by (Thrusfiled, 2005). Sample size was calculated using 50% expected prevalence, 5% absolute precision and 95% confidence interval and the calculated total sample size was 384.

The formula; $n = [1.96^2 p_{exp} (1-p_{exp})]/d^2$

$= [(1.96)^2 0.5(1-0.5)] (0.05)^2$

= 384 but the total sample collected was increased to 407 to increase precision and accuracy

Where: n= sample size required

1.96 =the value of Z at 95% confidence interval

P_{exp} =expected prevalence

d = desired absolute precision

Data collection methods

Collection and transportation of fecal sample

Individual animals were selected randomly from Kombolcha veterinary clinic and different farms. Accordingly, age, sex, management system and body conditions of the animals were recorded during sampling. Fecal samples were collected directly from the rectum of all selected animals using disposable gloves and stored in plastic bag under the ice box and then taken to Kombolcha Regional Veterinary Laboratory for processing. Each plastic bag was properly labeled corresponding to the animal (Urquhart *et al*., 1996).

Fecal (Coprological) examination

Using Barman technique 25 grams of fresh feces was weighed from each sample. The larvae and enclosed gauze fixed on to astringe rode were submersed in a clean glass tube which was filed with warm water left for 24 hours and the sediment were transferred to the Petri dish for examination of L_1 under lower power of microscope after siphoning off the supernatant. Finally, if a larvae was identified a drop of 1% iodine solution was added to the slide to immobilized the larvae as soon as the larvae are detect under microscope to identify the species of the larvae by morphological feature of the larvae and If not identified under microscopes, the examined samples was registered as negative for lung worm infection. In both cases, the result that was obtained for each sample was recorded to their corresponding specific animals (Anne and Gray, 2006).

Definition of Variables

Body condition scoring (BCS): Three scores of body condition was used (Poor, medium and good) as described by Gatenby (1991) (Annex 5.)
Age: Age was grouped in to two (Adult >1 year and Young <1 year) as described by Dar *et a*l (2012) (Annex 4).
Management system: Management system of the animals was classified as semi intensive and extensive as described by Terefe *et al (*2013).

Data Management and Analysis

The data was entered and manage in Microsoft Excel. All the data analysis was done by Statistical Package for Social Science (SPSS) software version 20. Descriptive statistics such as percentages and frequency distributions were used to describe the data. The association of different risk factors with the prevalence disease was computed by using Chi - square (x^2) test.

RESULTS

From a total of 407 sheep examined for lungworm infection 40.0% (163/407) were positive for one or more of the lungworm parasites. Mullerus capillaries, Dyctyocaulus fillaria, Protostrongylus refuse were identified. Among those, Mullerus capillaries 44.8% (73/163) were more prevalent in study area than Dyctyocaulus fillaria 30.1% (49/163), and Protostrongylus refuse 9.8% (16/163) and also mixed infcection 15.3% (25/163) was observed. The higher prevalence rate was encountered in sheep with poor body condition 72.22% (65/90) than those have medium 33.6% (41/122) and good 29.23% (57/195) body condition and with statistically significant association (x^2 =51.05, P =0.00). The prevalence rate of lungworm infection was found to be higher under extensive management system 46.72% (114/224) than in semi-intensive management system 30.06% (49/163) and showed statically significant association (x^2 = 11.2, P = 0.00). The prevalence rate of lungworm infection did not show statistically significant association with sex of the animals (x^2 = 0.22, P = 0.068). In comparison of age groups, the prevalence rate of lungworm infection shows high prevalence rate in adult 46.72% (107/229) than young 31.46% (56/178) with significant association (x^2 = 9.72, P = 0.002) (Table 2).

As indicated following table 1, the three species of ovine lungworm infection (Mullerus capillaries, Dyctyocaulus fillaria and Protostrongylus refuse) and mixed infcection were identified.

Table 1: prevalence of lung warm infection on the basis of lung warm species identified

Lungworm species	No examined	Prevalence (%)
Mullerus capillaries	73	44.8
Dyctyocaulus fillaria	49	30.1
Protostrongylus refuse	16	9.8
Mixed infection	25	15.3
Total	163	100.0

Table 2: Prevalence of Lungworm infection in sheep and associated risk factors in the study area

Risk factor	No. of tested animal	Positive animal	Prevalence (%)	X^2	p. value
Sex					
Female	228	89	39.03%	0.22	0.68
Male	179	74	41.34%		
Age					
Young	178	56	31.46%	9.72	0.002
Adult	229	107	46.72%		
Body condition					
Poor	90	65	72.22%	51.05	0.00
Medium	122	41	33.6%		
Good	195	57	29.23%		
Management					
Extensive	244	114	46.72%	11.2	0.001
Semi-Intensive	163	49	30.06%		

DISCUSSION

In this study, the overall prevalence rate of lung warm infection identified by using coporological examination was found to be 40% (163/407). This finding was lower than the previous report by Hasen *et al* (2013) in Assela, Mihreteab and Aman (2011) in Tiyo district, Netsanet (1992) in Debre Birhan and Basaznew *et al* (2012) in Dessie Zuria district with the prevalence rate of 55.1%, 57.1 %, 73.75%, and 43.33% respectively. but the current prevalence was higher than 28.6% prevalance in Mekedella (Gebreyohannes *et al*, 2013), 22.7% prevalence in and around Bahirdar (Tawadros, 2010) and 21.7% prevalance in Tigray (Mengstom, 2008) and 18.16% prevalence in Bahir Dar (Muluken, 2009). The variation may be due to the difference in agro ecological zones of the study areas which may favors or suppress the survival of the larvae of the lungworms. It might be also due to the nutritional status of the animals in the respective study areas which can influence level of immunity to be infested by lung worms. The topography of the area might also highly influence the prevalence by harboring the intermediate host (Bradford, 2002).

In this study, there was no significant difference (x^2 = 0.22, *P* = 0.68) in the prevalence of lungworm infection between male 41.3% (74/179) and female 39.03% (89/228) animals, but the prevalence of male animal slightly greater than female animal. This finding was different from previous findings by Tewodros, (2010) in and around

Bahirdar and Gebreyohannes *et al*. (2013) in Mekedella. This might be due to sample size and study methodology difference.

The prevalence of lungworm infection in adult sheep 46.72% (107/229) was significantly greater than (x^2 =9.72, P = 0.002) in young sheep 31.46% (56/178), this finding agrees with (Bekele, and. Abu, 2011; Basaznew *et al* (2012). This might be the adult animal highly exposure to the contamination of pasture and restrict mobility of the young animal, so the adult animals have the heaviest infection and the highest prevalence (Urquhart *et al.,* 1996; Basaznew *et al.,* 2012*).*

With regard to the species of lungworms, it was observed that *M. capillaries* were the highest prevalent species in the study area followed by *D. filaria* and *P. rufescens.* This finding is supported by Basaznew *et al*. (2012) in Dessie Zuria District, Sissay (1996) in and around Bahir Dar, Mezgebu (1995) in Addis Ababa. In contrast to this finding, Nemat and Moghadam (2010) in Tabriz, Mekonnen *et al*., (2011) in Gonder, Mihreteab (2011) Tiyo Ditrict, Dawit (2012) in Jimma, and Nuraddis and Yared (2012) in Mekelle who reported *Dictyocaulus filaria* to be the highest prevalence in their survey. The reason for this high prevalence of *Mullerius capillaries* compared with *Dictyocaulus* could be partly attributable to its wide range of intermediate host and the ability of larvae to over winter in the Mollusks. Additional factors which play a part in ensuring the endemicity of the worm are, first, the ability of L1 (First stage larva) to survive for months in fecal pellets and secondly, the persistence of the L3 (third stage larva) in the intermediate host for the life time of the Mollusks (Taylor et al., 2007).

There was a significant difference in lungworm infection (*P* =0.001) between the two management systems. That is, the prevalence was significantly higher lungworm under extensive management system 46.72% (114/244) than those kept under semi-intensive management system 30.06% (49/163) this finding is in consistent with the report of Terefe *et al.,* (2013) in North Gondar. In this study, sheep under extensive management system had more infection than those kept under semi-intensive management system. The reason for this 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 mal-nutrition which reduces the host-parasite response and favors the fecundity of the parasites that allows the animals for continuous larvae exposure under extensive system (Soulsby, 1986).

The prevalence was significantly highest in animals which have poor body conditions 72.22% (65/90) than in those have medium 33.3% (41/122) and good 29.23% (57/195) body conditions. The findings of the present studies were in line with Mihreteab and Aman (2011), who reported that the prevalence was significantly highest in animals which have poor body conditions than in those with medium or good body conditions. 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 (Serkalem, 2014). 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 (Radostits *et al*, 2007).

CONCLUSION AND RECOMMENDATIONS

The result of the present study showed that lungworm infection is one of the problems of

sheep production in and around Kombolcha. The different species of lungworm identified by the current investigation were *Mullerius capillaries, Dictyocaulus fillaria and Protostrongylus rufescens*. The more prevalent species of lungworm identified was *Mullerias Capillaries.* Adult sheep were found to be more affected by the infection of lungworms than young. Body condition and management system were found to affect the prevalence of lungworm in sheep in the study area. Thus, it needs intervention of responsible bodies to control and prevent the infection of sheep lungworm to get the intended benefit from it in the area. Therefore, based on the above conclusion the following recommendations were forwarded:

- Animal health workers should give attention to animal health extension to practice the control and prevention of lungworm infection.
- It is better to the animal owners to practice the improved animal husbandry to keep their animals healthy.
- More detail epidemiological study should be conducted to get full documentation on the distribution and magnitude of lungworm infection in the area.

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