Global Veterinaria 10 (1): 93-98, 2013
ISSN 1992-6197

DOI: 10.5829/idosi.gv.2013.10.1.71184

The Prevalence of Lungworms in Naturally Infected Sheep of Ambo District, Oromia, Ethiopia

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Abstract: A cross-sectional study was carried out in Ambo district, West Shewa Zone, from November, 2009 to March, 2010 with the aim of determining the prevalence and identification of species of lungworm infection in sheep. Coprological examination was conducted on 384 sheep, kept under extensive management systems. Of these animals, 134 were found to be positive for lungworm infection with an overall prevalence of 34.90% (95%CI = 30.13-39.90). The prevalence of species of lungworm in infected sheep were *Dictyocaulus filaria* (17.4 %), *Protostrongylus rufescens* (7.3%), *Muellerius capillaris* (3.9%) and 6.3% of mixed infection. There was no statistically significant difference (P>0.05) observed in infection rates between the study sites. There was a statistically significant difference (X^2 = 4.58; df = 1, P=0.032) observed between male and female animals with prevalence of 28.83% and 39.37%, respectively. Analysis on the basis of age of the animals indicated that there was a statistically significant difference (P<0.05) observed between young and adult (X^2=8.74, df = 1, P =0.003) with the prevalence of 43.59 % and 28.95%, respectively. Animals with poor body condition were highly infected with significant difference (P<0.05) than moderate and good body condition(X^2=29.34, df = 2, P=0.000). There was also highly significant difference (P<0.05) between animals that have manifested clinical respiratory signs and that do not manifest with the prevalence of 57.94% and 25.99%, respectively. *Dictyocaulus filaria* was also found to be the dominant lungworm species. Due to its impact on production, emphasis should be given for the control and prevalence of lungworm infections.

Key words: Lungworm · Prevalence · Sheep · Ambo · West Shewa · Ethiopia

INTRODUCTION

In Ethiopia; ruminants contribute about 80% of the total food production from livestock in tropical Africa. Of this, small ruminants account for about 22%, it has been estimated that ruminants supply over 3.2 million tone of meat per year, representing over 72% of total meat production [1]. The population of sheep and goats in Ethiopia is estimated to be 26.1 and 21.7 million respectively [2].

The major problems that greatly affect the economy of sheep and goat production in Ethiopia are diseases [3]. Disease alone accounts for 30% mortality in young's and 20% in adults. A loss of US $81.8 million is reported annually due to helminth parasite infection. In a country confronted with such enormous losses caused by helminth parasites, it is unaffordable to the country [4]. Helminthes parasite of ovine is ubiquitous, with many tropical and sub tropical environment of the world providing nearly perfect conditions for their survival and development [5]. Helminthosis is one of considerable significance in a wide range of agro-climatic zones in Sub Saharan Africa and constitute one of the most important constraints to small ruminant production [6]. The production loss is a direct result of clinical and subclinical helminth infections resulting in low productivity due to stunted growth, insufficient weight gain, poor feed utilization and mortality and indirect losses associated with treatment and control costs [7, 8].

In the highland areas, infection with lungworm parasites is the common cause of high mortality and morbidity in sheep population [9]. Lungworms are parasitic nematodes known for infection of the lower respiratory tract, characterized by respiratory distress,

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trachitis, bronchitis and pneumonia [10]. The lungworm in sheep is most commonly by three species such as *Dictyacaulus filaria* (*D, filaria*) *Muellerius capillaris (M.capillaris)* and *Protostrongylus rufescens (P. rufescens)* [11]. These nematode parasites belong to two super family, Trichostrongyloidea (*D. filaria*) and Metastrongyloidea (*P.rufescens* and *M. capillaries*). *D. filaria* has a direct life cycle whereas *M. capillaries* and *P. rufescens* have indirect life cycles [11, 12]. Dictyocaulidae and/ or certain Metastrongylidae are known to exist in East Africa (Ethiopia, Kenya and Tanzania) and South Africa [13]. 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 [6].

A study on required optimal environmental conditions for growth and survival of lungworm larvae in the pasture showed that *D. filaria* could survive well at temperature of 4°c-5°c and high humidity [14]. However, at temperature above 21.1°c the viability of the larvae is seriously degenerated. The larvae of *M. capillaries* can survive for several months in faecal pellets, on herbage and soil under optimum natural climate condition. Since the larvae are able to survive for long periods in intermediate hosts, control of this parasite can be achieved by good grazing management [15]. Thus, control of lungworms need basic information on epidemiology of the parasite and factors affecting the transmission dynamics. Therefore, the objectives of this study were to determine the prevalence of lungworms in sheep and identifying the circulating species and to assess the association between risk factors influencing the occurrence of the worms/disease.

MATERIALS AND METHODS

Description of the Study Area: Ambo is situated at 8°56'30" - 8°59'30" N latitude and 37° 47'30" -37°55'15" E longitude in central Oromia, Ethiopia, 114 km south of Addis Ababa. The altitude of the area ranges from 1380-3030 m.a.s.l, characterized by warm temperate weather which is locally called *Bada-dare* (mid altitude). The temperature ranges from 15°C-29°C with average temperature of 22°C. It receives a mean annual rain fall ranging from 800-1000 mm with an average of 900 mm. The highest rainfall concentration occurs from June to September and the mean monthly relative humidity varies from 64.6% in August to 35.8% in December, which is comfortable for human life. The soil types encountered are Red soil (36.25%), Black soil (34.37%) and Brown soil (29.38%). Livestock are major agricultural resource in this area. Ambo has a livestock population of 272,168 (137,448 cattle; 40,985 sheep; 20,968 goats; 11,901 donkeys; 8,679 horses; 337 mules and 51,850 poultry). The total human population of Ambo is estimated to be 112,129 with a total of 55,491 (50.08 %) and 769 (57.69%) female and 55, 305 (49.92 %) and 564 (42.31%) male in rural and urban, respectively [16].

Study Population: The study population were indigenous breed of sheep in selected three Peasant Association (PAs) of Ambo (Awaro Kora, Kisose and Uko Korke), which are kept under extensive management system. During sampling; sex, age, body condition and sheep with clinical respiratory sign and apparently healthy were recorded.

Study Methodology: A cross-sectional study was conducted from November, 2009 to March, 2010 in a randomly selected study sites to determine the prevalence of lungworm infection and simple random sampling technique was utilized. Sheep from each selected house hold of PAs was examined with equal sample size (128) from each Peasant Association.

Sample Size Determination: A lungworm prevalence of 50% was taken into consideration since there was no any research conducted on lungworm infection in the area. The desired sample size for the study was calculated using the formula given by Thrusfield [17] with 95 % confidence level (CI) and 5% desired absolute precision. Accordingly, the estimated sample size was 384 animals.

Sample Collection and Parasitological Examination: Fresh faecal samples were collected per rectum from individual sheep and immediately transported to the Ambo University, Veterinary Technology Laboratory and processed by using Modified Baermann Techniques as described by Hansen and Perry [5]. Briefly, 5 gm of faecal material was wrapped in double layered guaze and suspended in beaker containing warm water using a clip wire. The faeces were partially immersed in the water and allowed to stand for 24 hours. Then after the wrapped faeces were removed and the supernatant discarded from the beaker, the sediment was transferred to the petridish for examination of L_1 under stereomicroscope. All larvae were identified morphologically as described by previous workers [5, 12,15,18].

Data Analysis: The MS-excel spread sheet program was employed to create database and STATA software version 7.0 was used to analyze the data. Descriptive statistics was used to summarize the data. Prevalence was calculated as the number of positive sheep harboring the worms divided by the total sheep examined. Chi-square statistics were used to test the association between variables. P- value less than 0.05 at 95% confidence level was considered in interpreting the results.

RESULTS

From a total of 384 faecal samples originated from the three Peasant Association, 134 (34.9%, 95%CI =30.13%-39.90%) were found to be positive for lungworm. The prevalence variations exist between the kebeles, among these the highest being at Uko Korke (40.63%) followed by Awaro Kora (33.59%) and the lowest at Kisose (30.47%)**.** There was no statistically significant difference (P>0.05) in infection rates between the study sites (X^2 =3.05, df = 2, P=0.218) as shown in the table 1.

The lungworm infection prevalence in sex was recorded to be 47(28.83%) in the male and 87(39.37%) in the female animals. There was statistically significant difference (P<0.05) in infection rate between both sexes (X^2 = 4.58; df = 1, P=0.032) as shown in table 2.

The lungworm infection in different age groups was detected to be 68(43.59%) in the young age group and 66(28.95%) in the adult animals. There was statistically significant difference (P<0.05) between young and adult (X^2=8.74, df = 1, P =0.003) as presented in table 2.

The lungworm infection according to the physical body condition was recorded to be 68.09% in the animals with poor body condition, 34.86% in those with medium body condition and 25.31% in the animals with good body condition. There was statistically significant difference (P<0.05) in lungworm infection rate among the physical body conditions (X^2=29.34, df = 2, P=0.000) (Table 2).

Among the animals with detected clinical respiratory signs, 57.94% were found infected with lungworms while 25.99% not detected clinical respiratory signs animals were detected to harbour lungworm.

Table 1: Prevalence of Ovine lungworm infection by study sites

Site (PAs)	Number examined	Number Negative	Number Positive	Prevalence (%)	[95% CI]
Awaro kora	128	85	43	33.59	25.4-42.48
Kisose	128	89	39	30.47	22.65-39.22
Uko Korke	128	76	52	40.63	32.04-49.66
Total	384	250	134	34.90	30.13-39.90

Table 2: Prevalence of ovine lungworm infection based on different risk factors

Variables	Number examined	Number Negative	Number Positive	Prevalence (%)	[95% CI]	X^2	Pvalue
Sex							
Female	221	134	87	39.37	32.88-46.14		
Male	163	116	47	28.83	22.02-36.44	4.58	0.032
Age							
Young	156	88	68	43.59	35.68-51.75		
Adult	228	162	66	28.95	23.15-35.30	8.74	0.003
Body condition							
Good	162	121	41	25.31	18.81-32.73		
Medium	175	114	61	34.86	27.82-42.41	29.34	0.000
Poor	47	15	32	68.09	52.88-80.91		
CRS*							
Detected	107	45	62	57.94	48.01-67.42		
Not detected	277	205	72	25.99	20.93-31.58	34.68	0.000
*Clinical Respiratory Signs							

Table 3: Summary of lungworm species

Species of worm	Number Positive	Prevalence %	X^2
Pvalue			
D. filaria	67	17.4	384
P. rufescens	28	7.3	0.000
M. capillaries	15	3.9	
Mixed infection	24	6.3	
Total	134	34.90	

There was statistically significant difference (P<0.05) in lungworm infection rate between animals with respiratory signs and apparently healthy animals (X^2=34.68, df=1, P<0.05) as shown in table 2.

Out of 384 examined sheep, 134 were found invariably infected with different species of lungworm. Of the total prevalence of 34.90%, 17.4% were infected with *D. filaria*, 7.3% with *P. rufescens*, 3.9% with *M. capillaris* and 3.9% with mixed infection (either with two or three species) (Table 3).

DISCUSSION

The result of the present study conducted from November, 2009 to March, 2010 in three PAs of Ambo Woreda, West Shewa Zone indicated that lungworm infection is one of the most common respiratory diseases of sheep with an overall prevalence of 134 (34.9%),(95%CI =30.13%-39.90%).

High prevalence of ovine lungworm has been reported by other workers; 58.58% in and around Assela [20], 50% in Dessie and Kombolcha [21], 59.4% in Addis Ababa [22] and 44.7% in Bahir Dar [23] compared to the present study. The possible explanation for variation in the infection rate could be attributed to the variation in the altitude, rain fall, humidity and temperature in different areas of the country [15, 24 and 25]. The other options for variation may be due to the expansion of animal health extension and veterinary services like intervention of nearby private veterinary drug shops/ pharmacies/. Contrary to the present finding, [26] has reported prevalence of 24.4% in Wollo. This variation might be attributed to the differences in infestation level of the study areas and the previous works might conducted in the dry season, low land areas, well managed and treated animals.

The study area has shown to have an insignificant effect (P>0.05) on the prevalence of lungworm infection with prevalence record of 40.63% in Uko Korke, 33.59% in Awaro Kora and 30.47% in kisose Pas with insignificant difference that agrees with the report of Wondwossen [20] in and around Assela. In contrary to the present study, an area has a significant difference as a result reported by Alemu [27]. This result of area significant is due to the previous worker collected their samples from highland, mid land and low land altitudes where as in the present study, samples were collected all from mid land altitude areas.

Prevalence of 28.83% and 39.37% was recorded in male and female animals respectively. This shows that there was statistically significance difference (P<0.05) between the two sexes indicating female animals are more susceptible to lungworm infection than males. Similar results that support the present finding were reported by [23, 26-28]. However, some workers found that there was no sex variation [20, 29,30]. In this work most males are kept for fattening to be sold later, thus, males receive more attention by farmers. The high prevalence in females could due to the fact that resistance to infection is abrogated at the time of parturition and during early lactation. This preparturient relaxation of resistance results in the female's inability to expel adult worms [31].

Statistical analysis of infection rates on the basis of age indicated a significant differences (P<0.05) among different age groups. The prevalence of an age group was 43.59% and 28.95% in young and adult, respectively. This indicated that young sheep are more susceptible to infection than adults. The prevalence of *D. filaria* was higher in young than in adult sheep. This fact agrees with the result studies conducted by Uqbazghi [29] andWondwossen[20] and Teffera [21]. The decrease in infection rate as age increase is the result of acquired immunity developed in older animal due to previous exposure and hence, sheep that recovered from the infection have better immunity to reinfection [11, 12].

On the other hand, infection prevalence of *M. capillaries* and *P. rufescens* has showed higher prevalence in adult age group. This is also in line with Sefinew [32] who found an increase in the prevalence of Protostrongylid infection with an increase in the age of the animal while that of Dictyocaulus species decrease with increasing age of the animal.

An infection rate of ovine lungworm was statistically analyzed on the basis of body condition to study the impact of the disease in debilitating/emaciating infected animals. The result of the study indicated that an infection rate of 68.09%, 34.86% and 25.35% in poor, medium and good body condition scores, respectively; implies a significant variation (P<0.05). This signifies that poor body condition animals are more susceptible to an infection. The reason for this could be partly due to the fact that poorly nourished animals appear to be less competent in getting ride-off lungworm infection although it is not unusual for well fed animals to succumb to the disease provided the right environmental conditions are made available [6, 10] has also reported that well nourishment and watering lead to less risk of helminthes infection.

The present study showed that, 25.99% of those apparently healthy sheep and 57.94% of those showing clinical respiratory signs were infected with lungworm infection with a statistical significant differences ($P<0.05$). This result implies that, animals that show detected clinical respiratory signs have high chance of infestation with lungworm infections. During the end of prepatent phase bronchitis, this is responsible for clinical respiratory sign, developed and caused by immature lungworm in the air ways and cellular infiltration of the epithelium [24, 25]. About 25% of heavily infected and then recovered animal, there is a flare-up of clinical signs during the post patent phase and termed post patent parasitic bronchitis [24, 25]. The other obvious fact is that lungworm is not the only cause of clinical respiratory signs.

As the result revealed, *D. filaria* was the dominant lungworm species that ranks first with the overall prevalence of 17.4%. Comparable findings were reported in some parts of Ethiopia as 15.09% in Dessie and Kombolcha [21], 13.24% in and around Mekelle [33] and 13% in and around Bahir Dar [23]. However, apparent difference were also noted with some works, 32.20% in Gayint Awraja [34], 39.79% in and around Assela [20], 30.74% in Chilalo area [30], 73% in and around Debra Berhan [35] and 39% in Hamasien Awraja [29].

P. rufescens was the second important lungworm species, as the present study indicated with prevalence of 7.3%. This result agrees with the report of Teffera [21] in Dessie and Kombolcha (10.57%) and [35] in Gayint Awraja (3.6%) and lowers than the previous study reported by [20] in and around Assela (36.13%) and Paulos [30] in Chilalo area (23.71%). As for *M. capillaries*, this study showed that it is the lowest prevalence in the present study, 3.9%. This report was disagree with the report of Teffera [21] in Dessie and Kombolcha (15.48%), [20] in and around Bahir Dar (39.3%), [30] in Chilalo area 26.61%) and Netsanet [29] in and around Debra Berhan (12.6%) and 28] in Hamasien Awraja (20.5%). The prevalence of mixed infection (6.3%) detected in the present study, this study agreed with Sisay [23] who reported 7.6% in and around Bahir Dar. The present study was almost, in harmony with the prevalence reported by Teffera [21] in Dessie and Kombolcha (58.86%), [-20] in and around Assela (24.08%) and Netsanet [-30] in and around Debra Berhan (14.4%). These variations might be due to the difference in altitude, season of the study time [-20,30] and highly presence of the mollusc, an intermediate hosts in the area.

In conclusion, the result of present study indicated that lungworm is one of the most important helminthosis of sheep in the study area and the prevalence of infection was higher in young age groups, female, poor body condition and those sheep that have detected clinical respiratory signs. Among the species of worms, *D. filaria* was the dominant one in the study area.

ACKNOWLEDGEMENTS

We would like to thank College of Veterinary Medicine of Haramaya University for the research fund.

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