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Prevalence of ovine lung worm in and around Assela

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Abstract

A cross-sectional study was conducted on 381 sheep randomly sampled to determined prevalence of lungworm infection and identifying the species of respiratory helminthes circulating in and around Assela, from November 2014 to March 2015. In this study, the overall lung worm infection prevalence was found to be 55.10% (95% CI=49.1-61. 1%).Out of this, *Dictyocaulus filaria* was the dominant lung worm species with prevalence of 27.80% (95% CI=49.1-61.1%), followed by *Protostrongylus rufescens* ,13.9% (95% CI=10.4-17.37%), *Mulliries capillaries*, 6.6 % (95% CI=4.1-9.1%) and Mixed infection, with two or more of the common sheep lung worm infection, 6.80%. The lungworm infection prevalence in different age groups was detected to be 74% (95% CI=66.5-81.5%) in young, and 45.2 % (95% CI=39.1-51.3%) in adult; there was statistical significant difference in susceptibility between this age goups (Chi square = 28.898, 1df, P<0.05), the young s being more affected. Analysis of the result also indicated that there are statistically significant differences in sheep showing clinical respiratory signs(Chi square 11.461, 1df, P<0.05) with prevalence of 64.60% (95% CI =56.8-72.4%). Significant difference (P< 0.05) was found between areas of different altitude with an infection rate of 46.4%, 52.7% and 66.1% at low, medium and higher altitude areas, respectively. An animal with poor body condition was shown higher infection prevalence rate than moderate and good body condition. The overall results obtained during this investigation showed that *Diciyocaulous filaria* is the most common lungworm species not only in its high prevalence rate, but also in its high degree of association with occurrence of clinical respiratory signs, poor body condition, young age and high altitude. Due to its impact on production, emphasis should be given for the control and prevention of lungworm infection in highland areas.

Keywords: Lungworm, prevalence, sheep, Assela.

1. Introduction

Ethiopia has the largest livestock population in Africa. An estimate indicates that the country is a home for about 54 million cattle, 25.5 million sheep and 24.06 million goats. From the total cattle population 98.95% are local breeds and the remaining are hybrid and exotic breeds. 99.8% of the sheep and nearly all goat population of the country are local breeds (CSA, 2013). Sheep and goats 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 (Ibrahim and Godefa, 2012). Small ruminants are especially important in the more extreme climates, and they are noted for their ability to convert low opportunity cost feed in to high value products including meat, milk, fiber, manure and hides (Wilsmore, 2006).

Respiratory diseases resulting from helminth parasites are of a great economic concern in sheep production in the highlands of Ethiopia where sheep are important livestock units. Dictyocaulidae and certain Metastrongylidae are known to exist in East Africa including Ethiopia (Tony, 2006).

The three economically important species of lungworms in sheep and goats are the nematode Dictyocaulus filarial Muelleriu scapillaris and Protostrongylus rufescens. D. filarial is one of the most pathogenic lungworm of sheep and goats which lives in the lumen of the bronchial tree and commonly associated with chronic bronchitis and localized occlusion of the bronchial tree with atelectasis (Taylor *et al.*, 2007). The major problems that greatly affect the economy of sheep and goat production in Ethiopia were diseases (Bekele *et al*; 1992). 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 parasite infection (Demelash *et al*; 1999).

Prevention and control of these parasites are, therefore, critical to enhance the economic benefit from these species of livestock. However, the incidence of parasitic diseases including respiratory helminthosis varies greatly from place to place depending on the relative importance of factors (Alemu 2006). Some of the pioneer finding of lung worm infection in sheep in the country indicated its high prevalence and economic importance of the infection in certain area of the country (Muka *et al*., 2000 Gelagay *et al* 2005; Radostitis et *al*; 2007).

To determine the prevalence of lung worm infection of sheep and identifying the major lung worm species circulating in and around.

2. Materials and Methods

2.1 Study population

This study was conducted in Asella town which is the capital of the Arsi zone of the Oromia region, Ethiopia. Asella town is located 175 km southeast of Addis Ababa. The town is characterized by mild sub-tropical weather with the maximum and minimum temperature of 18 and 5 °C, respectively. The annual rainfall ranges from 1300 to 1500 mm (KARC 2008). Asella is situated at 6 59 to 8 49 N latitudes and 38 41 to 40 44 E longitude in Central Ethiopia. The area covers 23674.72km^2 presenting only 2% of the total land surface of the country. Topographically, Asella province has high land escarpment and low land areas. Vegetation of the area changes with altitude and rainfall ranging from scattered trees and bushes to dense shrubs and bushes. Livestock are the major agricultural resources in the area and has livestock population of 74,141 cattle, 43,306 sheep, 11,864 goats, 2, 849 horses, 13,262 donkey, 160 mules and 63,265 poultry (CSA, 2013).

2.2 The study sites

The present study was conducted from November 2014 up to March 2015 in three different agro ecological Areas of Tiyo Woreda under the same production system (extensive management).

2.3 Study population

The study population includes all sheep are selected which are rearing under extensive management system. During sampling, sex, age, body condition, and sheep those have clinical respiratory sign and apparently health are recorded.

3. Study design and sampling method

A cross-sectional study was used to determine the prevalence of lung worm infection, and simple random sampling technique was used to collect the data. Woreda, three were selected by considering the difference in altitude, and households randomly selected. Sheep from each selected house hold of PA was examined with equal sample size from each PA (127)

3.1 Sampling methodology

3.1.1. 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 have 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 barman technique (Urquhart *et al.*, 1996).

3.2.2. Modified Berman technique

Barman 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). The sample size for the study

was calculated using the following formula (Thrusfield, 1995). As estimated by the formula, a sample size of 381 sheep was considered for the study.

3.2 Sample Collection and Parasitological Examination

The sex, body condition (poor, medium, and good), age group (Lamb and adult) and the clinical respiratory sign as shown by coughing and nasal discharge and apparently healthy animals were considered during the present study. Fresh faecal samples were collected per rectum from individual sheep and immediately and processed by using Modified Burman techniques (Anne and Gary, 2006; and Hansen *et al*, 1994). All larvae were identified morphologically as described by previous workers (Anne and Gary, 2006; and Urquhart *et al.* 1996).

Definition of measured parameters considered during the study

Body condition: **-** Every sampled sheep was recorded and any fall in any of the three scores (Poor, medium and good) were the criteria for scores (Cooper and Thomas, 1985).

*Poor***:** When individual spinous process was sharp to touch and easily distinguished, in addition, the bonny structure of the sheep was easily noticeable. The eye muscles are of moderate depth.

*Medium***:** When the spinous process was examined with very firm pressure and they were round rather than sharp. The eye muscle areas are full with moderate fat cover.

Good: When the top and side of the backbone in lion area immediately behind the last rib and above the kidney were covered with muscles. Their eye muscles were full and have a thick fat cover.

Age: The age was categorized in to two groups as young below six months and as adultabove six months by following description.

3.3 Data Management and Statistical Analysis

The MS excel spreadsheet programmer was employed to create database and SPSS statistical software version 13.0 was used to analyze the data. Chi square statistics were used to test the association between variables and descriptive statistics to summarize the data in Tables.

4. Results

4.1 prevalence of lungworm infection

A total 381 sheep examined, and 55.1% were found invariably infected with different species of lungworm. Of the total, 27.8% were infected with *D.filaria*, while the remaining, 3.9%, 6.8%and 6.6% were infected with *P.rufescens*, Mixed infection (Either with two or three species) and *M.capilleries*, respectively. Statistically significance between each lungworm species in overall infection prevalence.

4.1.1 Prevalence of lungworm infection in different age groups

The lungworm infection in different age groups was detected to be 74.0% (95% CI =66.5-81.5%) in the Lamb age group and 45.20% (95% CI =39.1-51.3%) in the adult animals as presented in Table 3. There is statistically significant difference in age susceptibility the Lamb age group being more affected (Chi square = 28.898, 1df, P<0.05). It was also observed that *Dictyocaulus filaria* tends to infect predominantly the Lamb age group with statistically significant difference (Chi square = 37.83, 1df, P<0.05)

Table: 1 Prevalence of lungworm infection in different age groups

Lungworm Species	Lamb		Adult		Overall Infection	
	Animals examined = 131	Animals infected & Prevalence (%)	Animals examined = 250	Animals infected & prevalence (%)	Animals examined = 381	Animals infected & Prevalence (%)
D. filarial		62(47.30)		44(17.60)		106(27.80)
P.rufescens		19 (4.5)		34 (13.60)		53 (13.90)
M. capil.		6 (4.60)		19 (7.60)		25(6.60)
Mixed inf.		10(7.60)		16 (6.40)		26 (6.80)
Total		97 (74.0)		113(45.20)		210(55.10)

4.1.3 Prevalence of Lung Worm Infection in Both Sexes

The lungworm infection prevalence in sex was recorded to be 53.30% (95% CI =45.9-61%) in the male animals and 56.40% (95% CI =49.7-63.1%) in the females as shown in Table 2. There is no statistically significant variation in infection rate between both sexes (Chi square = 0.290, 1df, P>0.05)

Table: 2 Prevalence of Lung Worm Infection in Both Sexes

Lungworm Species	Male		Female		Overall Infection	
	Animals examined = 168	Animals infected & Prevalence (%)	Animals examined = 213	Animals infected & prevalence (%)	Animals examined = 381	Animals infected & Prevalence (%)
D. filarial		39 (23.2)		67 (31.5)		106 (27.8)
P.rufescens		27 (16.1)		26 (12.2)		53 (13.9
M. capil.		11 (6.5)		26 (12.2)		25 (6.6)
Mixed inf.		13 (7.7)		13 (6.1)		26 (6.8)
Total		168(53.3)		213 (56.4)		210(55.1)

4.1.3 Prevalence of lungworm infection in relation to body condition scores

The lungworm infection rate according to the physical body condition was recorded to be 79.10% (95% CI =72.3-85.8%) in the animals with poor physical body condition, 52.10% (95% CI = 43.2-61%) in those with medium body condition and 30.90% (95% CI =22.7-39.1%) in the animals with good body condition as shown in Table 3. There is statistically significant difference in the lungworm infection rate among the different physical body conditions (Chi square = 61.586, 1df, P<0.05)

Table 5. Prevalence of Lungworm Infection in Animals with different Body conditions

Lungworm Species	Poor Condition		Medium Condition		Good Condition		Overall Infection	
	Animals examined = 139	Animals infected & Prevalence (%)	Animals examined = 119	Animals Infected & prevalence (%)	Animals examined = 123	Animals infected & Prevalence (%)	Animals examined = 381	Animals infected & Prevalence (%)
D. filarial		60(43.20)		28(23.50)		18(14.60)		106(27.80)
P.rufescens		28 (20.10)		13(10.90)		12(9.80)		53(13.90)
M. capil.		10 (97.20)		12(10.10)		3 (2.40)		25 (6.60)
Mixed inf.		12 (8.60)		9 (7.60)		15 (4.10)		26 (6.80)
Total		110(79.10)		62(52.10)		38(30.90)		210(55.10)

4.1.4 Prevalence of Lung Worm Infection in Relation to Clinical Respiratory Signs

Among the animals with clinical respiratory signs, 64.60% (95% CI =56.8-72.4%) were found infected with lungworms whilst 49.00 (95% CI =45.7-52.4%) of the clinically healthy animals were detected to harbor lungworm as summarized in Table 5. The statistical analysis showed that, there is significant difference in lungworm infection rate between animals with respiratory signs and the apparently healthy animals (Chi square 11.461, 1df, P<0.05). The infection prevalence of *D.filaria* and *P.rufescens* was significantly higher (Chi square 34.95, 1df, P<0.05) and (Chi square 7.16, 2df, P<0.05), respectively, in sheep with clinical respiratory signs.

Table 5. Prevalence of Lung Worm Infection in Relation to Respiratory Signs

Lungworm Species	Animals with respiratory sign		Clinical healthy animals		Overall Infection	
	Animals examined = 150	Animals infected & Prevalence (%)	Animals examined = 231	Animals infected & prevalence (%)	Animals examined = 381	Animals infected & Prevalence (%)
D. filarial		67(44.70)		39 (16.90)		105 (27.80)
P.rufescens		14 (9.30)		39 (16.90)		53 (13.90)
M. capil.		4 (2.70)		21 (9.10)		25 (6.60)
Mixed inf.		12 (8.0)		14 (6.10)		26 (6.80)
Total		97(64.60)		113(49.0)		210 (55.10)

5. Discussion

The result of current study unequivocally proved that lungworm is one of the major respiratory diseases of sheep in and around Assela areas. In addition, it was disclosed that *D.filaria* was the lungworm species that ranks first in prevalence of infections, being dominantly existing in sheep with clinical respiratory signs poor body condition and young age groups.

The study indicated an overall lungworm infection prevalence of, 55.1 % (95% CI=49.1-61.1%) in Assela areas. The overall infection prevalence result almost coincides with previous report, 52.54% infection prevalence in chilalo area (Paulos, 2000), 50% infection prevalence in Dessie and Combolcha (Tefera, 1993); 58.8% infection prevalence in and around Assela (Abebe, 2000), and 58.8% infection prevalence in Assela Awraja (Wondowossen, 1992). But it was not in harmony with the observation made by Yohannes (1989) in Debretabor Awraja with prevalence of 70.7%; by Sefinew (1999) in six district of wollo high land with prevalence of 71.3%; by Eyob (2000) in Assela town with prevalence of 74.44 %; by Sisay (1996) in Bahirdar with prevalence of 44.7%, and 83 - 99.5 % prevalence in high land shoa province (Jovanovic *et al*., 1962). The reason behind such variation, either greater than or lower than the present study, in the infection rate could be attributed to the variation in altitude, rainfall, humidity and temperature in different area of the country (Bradford, 2002; Soulby, 1982; Blood *et al*, 1976).

As the result revealed, *D.filaria* was the lungworm species that ranks first from the overall prevalence of infection, 27.8% (95% CI=23.3-33.2%). Comparable finding was reported in different part of Ethiopia as 27.6% in Hamassen Awraja (Uqbazghi, 1990; 26.1% in and around Assela (Abebe, 2000); 30.74% in chilalo area (Paulos, 2000); 32.2% in Gaiynat Awraja (Tsegaye, 1985), 33% in Debretabor Awraja (Yohannes, 1989).

However, apparent difference was also noted with some works, 15% in Debre-Zeit (Fesaha and Gebrenugus, 1977); 64.7% in Debretabor (Brook *et al*., 1986); 73% in Debrebrhan (Netsanet, 1992); and 50.7% in Dessie and Combolcha (Teffera, 1993). *Protostrongylus rufscens* was the second important lungworm species, as the present study indicated, 13.9% (95% CI=10.4-17.37%) of total examined sheep. This result agrees with the earlier report of Abebe (2000). He reported that *P.rufescens* was rank second (16%) among the three species of sheep lungworm in ad around assela; but the result higher than the report of Tsegaye (1995) in Gaynat (3.6%), and lower than previous study reported by Wondwosen (1992) in Assela Awraja (36%), and Paulos (2000) in chilalo area (23.7%). As for *Mulliries capillaries*, this study shows that it is the lowest prevalence of lungworm species in and around Assela, 6.6 % (95% CI=4.1-9.1%). Similar result reported by Eyob (2000) in Assela town (5.4%). Different workers (Fesaha and Gebrenugus, 1977; Uqbazghi, 1990; Paulos, 2000) reported the infection prevalence of 12.6%, 27.6%, and 26.6% in sheep found in Mojo Governmental farm, Hamanse awraja, and Chilalo areas, respectively. Mixed infection (6.8%) in the present study area, almost, in harmony with report reported by Abebe (2000) in and around Aseela, and lower than the report of Wondowossen (1992) and Paulos (2000) 24.02% and 80%, respectively.

The variation might be due to the difference in area, season of the study time (Paulos, 2000; Wondowossen, 1992).

The higher infection prevalence was recorded in sheep those showing clinical respiratory signs rather than those were healthy; 49% (95% CI=57-72.3%) of those apparently healthy sheep and 64.6% (95% CI=42.4%-55.4%) of those showing clinical respiratory signs were infected with lung worm, with higher statistical significant variation (x^2=34.96, df=1, P<0.05%) of *D. flaria* from the other species. The result coincides with observation recorded by, Eyob (2000), 59%, and Abebe (2000), 65%. They reported that high prevalence of infection in those showing clinical respiratory sign than clinically healthy sheep.

The reason for those showing clinical respiratory sign (64.6%) was: during the end of prepatent phase bronchitis, which is responsible for clinical respiratory sign, developed and characterized by immature lung worm in the air ways and by cellular infiltration of the epithelium (Bradford, 2000). About 25% of heavily infected and then recovered there is a flare-up of clinical signs during the post patent phase and termed post patent parasitic bronchitis (Bradford ,2002; Urquhart *et al*.,1996). The other obvious fact is that lungworm is not the only cause of clinical respiratory signs. On the other hand, for those apparent health is the result of immunity development as exposures to a few lung worm larvae, it is not associated with clinical signs, but they shade larvae (Radostats *et al.*, 2000).

Infection with *D.filaria* appeared to produce high infection prevalence as compared to the rest; and followed by *P.rufescens* with statistical significant variation, (x^2=34.96, df=1, P=0.000), and (x^2=7.16, df=2, P=0.037), respectively. This finding agrees with Wondowossen (1992) who found that *D.filaria* was the first lung worm species to show clinical respiratory sign and followed by *P.rufescens.* Also Soulby, (1982) indicated that *D.filaria* was the major species of lung worm which responsible for appearance of clinical respiratory sign. In this study *M.capilleries* didn't show significant variation between these groups. This indicates that *M.capilelries* was not responsible for clinical respiratory sign. These may due to exposure to few numbers of larvae, however, heavy infection can weaken lung, resistance of the hosts and cause respiratory signs (Radostats *et al.*, 2000; Paulos, 2000)

On the attempt to know the influence of area on the overall prevalence rate, the study clearly indicated that in area about 2800 M.a.s.l, showed 66.1% (95% CI=57.9-74.35%); in 2000 M.a.s.l showed 52.7%(95% CI=44-61.4%), and in area about 2650 M.a.s.l revealed 46.6% (95% CI=37.7-55%). These results indicate that infection with lungworm increase with altitude. This result in agreement with the study reported by Alemu *et al.* (1999) who found 70%,47%, and 43%; in high, medium, and low altitude, respectively; Abebe (2000) 50.9%, 52.2% and 70.9%; in low (1800 M.a.s.l), medium (2000 M.a.s.l) and high (2700 M.a.s.l) altitude, respectively. This finding is not in harmony with study report by Wondowossen (1992) who indicated no statistical significant variation between mid and high land in Assela Awraja. The reason may be due to the variation in sample size and study duration. Infection with *D.filaria* (35.4%) was the higher in high land (2800m.a.s.l) than other areas (in 2000 M.a.s.l, 25.2%; in 1650 M.a.s.l, 22.8%). Uqbazghi (1990) indicated the effect of altitude on *D.filaria* with altitude of above 2200 M.a.s.l, 40.4%, and with altitude of about 1800 M.a.s.l , 30.3% of sheep examined found to be infected.

As the influence of age on overall infection prevalence concerned 74%, (95% CI=66.5-81.5%) of lamb examined was infected with different species of worm while 45.2 %, (95% CI=39.1-51.3%), of examined adult found to be infected with different species of lungworm. This indicated that lamb sheep are more susceptible than adult. Prevalence of *D.filaria* was higher in lamb than adult sheep. Study conducted by Abebe (2000), Uqbazghi (1990), Tefera (1993) and Wondowossen (1992) were found that lamb are more susceptible to *D.filaria* than adult. This has been partly explained by the acquired immunity developed in older animal due to previous exposure and therefore, sheep that recover from the infection have better immunity to reinfection (Radoatats *et al*., 2000; Abebe, 2000; Urquhart, 1996; and Wondowossen, 1992).

On the other hand, infection prevalence of *M.capilleries* and *P.rufescens* didn't showed statistical variation between age categories. This statement is corresponds to the report made by Eyob (2000) in assela town which found equal susceptibility of age group to *M.capilleries* and *P.rufescens* infection. This may be due to absence of acquired immunity development to *M.capilleries* and *P.rufescens* species (Urquhart *et al*, 1996).

In the present finding both sexes showed equal susceptibility to infection with lungworm, hence sex dependent variation was not encountered. This was coinciding with study reported by Eyob (2000) and Paulos (2000), but disagrees with report of Alemu *et al* (1989), by Abebe (2000) and Yohanes (1989).

These may be due to the fact that improper distribution of sample selection between the two sex (Paulos, 2000); or else most of the sampled sheep are not in preparturient period during the study time.

Sheep with poor body condition scores manifested the highest prevalence of infection 79.1 (95% CI=72.34-85.7), and *D.flaria* was the dominant species in this group of animals. This is partly due to the fact that poorly nourished sheep appear to less computation in getting ride of lung worm infection.

6. Conclusion and Recommendations

The result of present study indicated that lungworm is one of the major helminthosis of sheep in and around Assela, Arsi Zone. The prevalence of infection in Lamb is higher than adults and *Dictiyocaulous flaria* is the dominant lungworm species responsible for outstanding clinical manifestation of respiratory sign. Higher prevalence rate of lungworm infection was observed in animal with poor body condition and relatively higher altitude areas. Based on the present finding and general knowledge of the disease, the following recommendations are forwarded: -

Treat sheep with broad-spectrum anthelmintic at the beginning of rain season would appear to be most effective. These treatment regimes could reduce the burden and minimize pasture contamination with larvae.

Prohibition of sheep to graze early in the morning and evening, and swampy areas to protect from infection with *Mullerius* and *protostongylus* species.

Isolation of most susceptible age groups at the season when the carried have potential source of pasture contamination.

Immunization of sheep with X-ray, gamma ray eradicated *Dictiyocaulus filaria* has been found to mount protective level of immunity. The application and wide use of such control measure should be encouraged in areas easily accessible by transport means.

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