

## Prevalence and Potential Risk Factors of Lungworms in Sheep in Gena Bossa Woreda, Dawro Zone, Ethiopia

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**Abstract:** Across-sectional study on prevalence of lungworm infection was carried out with the aims of determining the prevalence rate and identifying the species circulating in sheep in and around Gena Bossa woreda, Dawro zone. The fecal samples were collected from the total of 384 sheep selected randomly by following the right procedures and laboratory examination was conducted. The results of this study indicated the overall prevalence of 49.22% in the three agro-ecological zones of the area. Sheep are invariably infected with different study sites. The prevalence of 62.2%, 55.47%, 30.23% were recorded in highland, midland and lowland respectively. Statistically significant difference ( $P < 0.05$ ) was recorded in different age groups, agro-ecology and body conditions of the study animals. Animals with poor body condition were highly infected with significant difference ( $P < 0.001$ ) than moderate and good. The infection rate between male and female sheep showed no significant difference ( $P < 0.05$  %) with prevalence rate 44.90% and 53.72% respectively. The overall results obtained during this investigation showed that lungworm infection is the most common not only in its high prevalence, 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 of this study.

**Key words:** Epidemiology • Gena Bossa • Lungworms • Risk Factors • Sheep

### INTRODUCTION

Lungworms are parasitic nematodes known for infection of lower respiratory tract characterized by respiratory distress, trachitis, bronchitis and pneumonia [1]. In the high land areas respiratory lungworm parasites were the most common causes of high mortality and morbidity rates [2]. Small ruminants compromise large proportion of livestock resource in Ethiopia product. They provide 12% of the value of livestock products consumed at the farm level and 48.5% of the cash income generated. Ethiopia is rank second in Africa and six in the world in terms of sheep population. Ethiopia with its estimated 24 million sheep together with its variation in agro-climatic zone represents a good reservoir of small ruminant genotypes [3]. Reports from Genna Bossa woreda covers only 0.08% of total land area in the country and has an estimated

29,690 sheep population. It has high land escapement and low land areas. The high land areas are dominated centrally and the low lands dominate the periphery of the area.

Helminthosis is of considerable significance in a wide range of agro climatic zone in sub Saharan African and constitute one of the most important constraints to small ruminants' production. The production loss in a direct result of clinical and sub clinical helminth infections resulting in low productivity due to stunted growth, in sufficient weight gain, poor feed utilization and mortality, in direct losses associated with treatment and control measures costs [4, 5]. Disease alone accounts for 30% mortality in lambs and 20% in adults. A loss US \$ 81.8 million is reported annually due to helminth parasite infection. In a country confronted with such enormous losses caused by helminthes parasites, it is in tolerable to the country [6].

In spite of large population and importance of sheep, however, morbidity and mortality are high in the traditional agro pastoral production system. In the high land areas including Dawro Zone infection with lungworm parasites in the common cause of high mortality and morbidity rates in sheep population [2]. Some of the pioneer finding of lungworm infection in sheep in the country indicated its high prevalence and economic importance of the infection in certain area of the country [7-12].

Few studies conducted in certain areas of Dawro Zone indicated high prevalence lungworm infection in sheep population [9, 13-15]. Knowledge of the current Epidemiological situation of lungworm infection in sheep population in the present area contributes its part to design a control strategy at local and regional level. Therefore, the objective of this study is to determine the prevalence of lungworm, identifying the major lungworm species circulating and associated risk factors in Gena Bossa province, Dawro Zone, Ethiopia.

## MATERIALS AND METHODS

**Description of the Study Area:** Gena Bossa is located in the Dawro zone of Southern Nation Nationalities and people region, Ethiopia. The study area share boundaries with Oromiya Region (Jimma) and Hadiya in the North, Kambata Tembaro zone in the North east, Wolaita zone in the east, Loma woreda in the south and Mareka woreda in the west. Distance of the Woreda is 285 km from west of Hawasa and 512 km South east of Addis Ababa. According to Gena Bossa woreda Agricultural Statistics information, the area has about 98, 262 cattle, 21, 614 sheep, 24, 212 goats, 588 donkeys, 521 horse, 885 calves and 43, 074 poultry. The production system of the area is mixed type. Topographically, it is situated at altitude of 1400 m above sea level with the 15.1-27.5°C mean annual temperature, 1201-1600mm mean Annual rain fall, sandy, loam and clay soil type, 65% high land and 35% low land and the total area cover 90, 122 hectare and geographically it is situated at 37°C 12'-37°C 53'E longitude, 6°C 96'-7°C 35N latitude and 735-2567m altitude. The total human population of Gena Bossa is 100, 022 from which 50, 167 are male and 49, 855 are females. The area is covered with dense mixed type of vegetation. In this area sheep graze with another species of animal, which are mentioned in past. Most of the time the species of farm animals' small holder farmer with different age group grazing together.

Table 1: Livestock population in the study site.

Livestock population	Study sites		
	Bossa	Wozo	Mela
Sheep	1185	760	287
Goat	145	485	488
Cattle	3591	2540	3517
Equine	223	118	101
Poultry	2240	780	927

**Description of the Study Sites:** The present study area was conducted in three different agro Ecological areas of Gena Bossa woreda/province under the same population system (extensive management).

Bossa is located outside the woredas' main town at a distance of 22 km and represented by altitude of 2236 m, longitude of 0310850 m and latitude of 0777662 m, temperature of 10°C minimum and 14°C maximum and rain fall off 1100mm. The total human population of Bossa is 2668 from which 1379 are male and 1289 are females. The dominant species of animal in this area are cattle, poultry and sheep (Table 1). The area is covered with dense mixed type of vegetation. In this area sheep graze with other species of animals, which are mentioned before.

Wozo is located inside Gena Bossa woreda at distance of 18km which is represented by altitude of 1805m, longitude of 0311976m and latitude of 0798825m, temperature of 18°C minimum and 20°C maximum and rain fall off 1000 mm. The total human population of Wozo is 1931 from which 938 are male and 993 are females. The sheep in this area are adapted to graze with another animal species such as cattle, horse, mules and donkey. Infact the area is mostly dominated by forest plantation and grass land.

Mela is located in Gena Bossa woreda town about 28 km far apart. The altitude of the area is 1440 m, longitude 0305556 m, latitude 0795917 m, Temperature of 20°C minimum and 24°C maximum and rain fall of 900 mm. The total human population of Mela is 2017 from which 1001 are male and 1016 are females. Most of the time an species of farm animals small holder farmer with different age group graze together. The dominant species of animal are cattle, Poultry and sheep.

**Study Design and Sampling Method:** Across sectional study was used to determine the prevalence of lungworm infection and simple random sampling technique was used to collect the data out of 36 peasant associations of Gena Bossa woreda, three were selected by considering the difference in altitude and households randomly selected. Sheep from each selected house hold of peasant associations was examined with equal sample size from each peasant association.

**Study Population:** The Study population includes all sheep selected randomly in three peasant associations of Gena Bossa woreda, 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.

**Sample Size Determination:** The Sample size was determined by considering with no previous study in the area and by taking 50%. The sample size for the study was calculated using [20] formula accordingly, a sample size of 384 small ruminants was considered for the study.

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

where,

n = required sample size

P<sub>exp</sub> = recorded previous prevalence = 50%

d = desired absolute precision = 5%

**Sample Collection and Parasitological Examination:**

The sex, body condition (poor, medium and good), age (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 transported to Gena Bossa Woreda clinical veterinary laboratory and processed by using modified Burmann techniques. All larvae were identified morphologically as described by previous workers [16, 17, 19].

**Data Management and Statistical Analysis:** The Microsoft MS excel spread sheet program was employed to create data base and Statistical Package for Social Science statistical software version 13.0 was used to analyze the data. Chi-square statics were used to test the association between variable and descriptive statics.

**RESULTS**

**Prevalence of Lungworm Infection:** From the total of 384 sheep examined, 189 animals (49.22%) were found invariably infected within different study sites. Agro-ecologically, the total of 79 animals (62.2%) in Bossa (highland), 71 animals (55.47%) in Wozo (midland) and 39 animals (30.23%) in Mela (lowland) were infected with two or three species of lungworms. There is statistically significant relationship between the infections of lungworm species to the disease occurrence in animal to disease epidemiology of the overall infection prevalence.

Table 2: The overall prevalence of lungworms in studied animals

	No of animal examined	No of positive animals	Prevalence
Total	384	189	49.22

Table 3: Prevalence of lungworm infection in sheep by agro-ecology

Study sites	No of animal examined	No of positive	Prevalence
Bosa	127	79	62.2%
Wozo	128	71	55.47%
Mela	129	39	30.23%
Total	384	189	49.22%

Table 4: Prevalence of lungworm infection indifferent age groups

Age	No of animal examined	No of positive	Prevalence	Chi square	P-value
Lamb	113	82	72.57		
Adult	271	107	39.48		
Total	384	189	49.22	4.9	<0.001

Table 5: Prevalence of lungworm infection in sex groups

Sex	No of animal examined	No of positive	Prevalence	Chi square	P-value
Male	198	88	44.90		
Female	188	101	53.72		
Total	384	189	49.22	0.084	2.990

Table 6: Prevalence of lungworm in different body condition

Body conditions	Total examined	No of positive	Prevalence	Chi square	P-value
Poor	142	90	63.38		
Medium	134	55	41.04		
Good	108	44	40.74		
Total	384	189	49.22	18.08	<0.001

The lungworm infection rate in different agro-ecological Zone was found to be 62.22% (95%ci = 57.7% - 67.3 %), 55.47% (95% ci = 50.5-60.5%) and 30.2% (95%ci = 26.7-36.9%) in Bossa (high land), Wozo (mid high land) and Mela (low land) area respectively as summarized in Table 3. The overall lung worm infection rate was observed to be 49.22% (95% ci = 44.7-54.7%). There is statically significance difference among the various agro-ecological zones in lungworm infection (chi square = 9.143.df, p<0.05).

The lungworm infection in different age groups was detected to be 72.57 % (95% ci=76.5-84.5%) in the Lamb age group and 39.48% (95% ci=32.1-41.7%) in the adult animals has presented in table-4. There is statistically significant difference in age susceptibility the lamb age group being more affected (chi square = 34.9214, P<0.000). It was also observed that lungworm species tends to infect predominantly the lamb age group with statistically significant difference (chi square =4.9, p<0.00).

The lungworm infection prevalence in sex was recorded to be 44.90 % (95% CI = 39.9-49.9%) in the male animals and 53.72% (95% CI = 49.8-59.8%) in females as shown in Table 5. There is no statistically significant variation infection rate between both sexes (chi- square 0.290, P > 0.05).

The lungworm infection rate according to the physical boy condition was recorded to be 63.38% (95% CI = 60.7-70.3%) in the animals with poor physical body condition, 41.04% (95% CI=36.1-45.9%) in those with medium body condition and 40.74% (95% CI = 34.9-44.7%) in the Animals with good body condition as shown in Table 6. There is statistically significant difference in the lungworm infection rate among the different physical body condition ( $\chi^2 = 18.0819$ , P < 0.001).

## DISCUSSION

The results of current study unequivocally proved that lungworm is one of the major respiratory diseases of sheep in and around Gena Bossa. Especially the study results indicated that the prevalence was ranked first level from Gena Bossa woreda in Bossa kebeles, being dominantly existing in sheep with respiratory signs, poor body condition and young age groups.

On the attempt to know the influence of area on the overall prevalence, the study clearly indicated that in area about 2004 m.a.s.l. showed 66.1% (95% CL = 57.9-74.35%); in 2000 m.a.s.l showed 52.7% (95% CI = 44-61.4%) and in area about 2250 m.a.s.l revealed 46.6% (95% CI = 37.7-55%). The results indicate that infection with lungworm increase with altitude. This result in agreement with the study reported by Alemu *et al.* [21] who found 70%, 47% and 43%; in high , midland and low altitude, respectively; Abebe [22] reported that 50.9%, 52.2% and 70.9% in low (1800 m.a.s.l), medium (2000 a.m.a.s.l) and high (2500 m.a.s.l) altitudes, respectively. This finding is not in harmony with study report by Wondewosen [13] 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.

As the influence of age on over all infection prevalence concerned 72.57% (95% IC = 76.5-84.5%) of lamb examined was infected lungworm while 39.48% (95% CI = 32.1-41.7%), of examined adult found to be infected with lungworm. This indicated that lamb are more susceptible than adult. Prevalence of lungworm was higher in lamb than adult sheep. Study conducted by Abebe [22], Uqbazghi [23], Tefera [24] and Wondewosen [13] were found that lamb are more susceptible to lungworm 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 [13, 14, 19, 25].

In the present findings, both sexes showed different susceptibility to infection with lungworm, hence sex dependent variation was encountered. This was coinciding with study reported by Alemu *et al.* [21], by Abebe [22] and Yohannes [26], but disagrees with reports of Eyob [27] and Paulos [28]. These may be due to the fact that improper distribution of sample selection between the two sexes [28]; or else most of the samples sampled are not preparturient period during the study time. Sheep with poor body condition scores manifested the highest prevalence of lungworm 63.38 (95% CI = 25.9-34.7%), while sheep that have good body condition manifests the lowest prevalence, 40.74 (95%). This is partly due to the fact that poorly nourished sheep appear to less computation in getting rid of lung worm infection [1].

The study indicated overall lungworm infection prevalence of, 49.22% (95% CI = 49.1-61.1%) in Gena Bossa Woreda. The overall infection prevalence result almost coincides with previous report by Paulos [28] with infection prevalence of 52.54% in Chilalo area; 50% infection prevalence in Dessie and Kombolcha [24]; 58.8% infection prevalence in and around Assela [14] and 58.8% infection prevalence in Assela Awraja [13]. But it was inharmony with the Yohannes [26] in Debretabor Awraja with prevalence of 70.7%; by Eyob [27] in Assela town with prevalence of 74.44%. 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, rain fall, humidity and temperature in different area of the country [17, 29, 30].

As the result revealed, lungworm infection in Bossa kebeles that ranks first from the overall prevalence of study site 62.25 (95%). Comparable finding were reported by Eyob [27] with prevalence of 71.3% in Assela town. From the total examined sheep in Gena Bossa woreda Wozo kebeles was ranked in the prevalence of sheep lungworm infection which is 55.47% from the overall examined sheep.

The result almost coincides with previous report by Paulos [28] with infection prevalence 44.7% (52.54%) in Chilalo area; with 58.8% infection prevalence in and around Assela town [14] and 58.8% prevalence in Assela Awraja [13]. The variation might be due to the difference in area, season of the study time [13, 28].

### CONCLUSION

The result of present study indicated that lungworm is one of the major helminthosis of sheep. The prevalence of infection in lamb is higher than adults and lungworm is the dominant parasite that is responsible for outstanding clinical manifestation of respiratory signs. Higher prevalence rate of lung worm infection was observed in animals 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. Treating sheep with broad-spectrum anthelmintic at the beginning of rain season would appear to be most effective. These treatment regimens could reduce the burden and minimize pasture contamination with larvae. Prohibition of sheep to graze early in the morning and evening at swampy areas to protect from infection with lungworm parasites. Isolation of most susceptible age groups at the season when the carried have potential source of pasture contamination.

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