

Research Article

Bovine Lungworm: Prevalence and Risk Factor in Asella Town, Oromia Region in Ethiopia

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Abstract

Bovine lungworm, also known as *Dictyocaulus viviparus*, is a parasitic worm that infects cattle, particularly calves. It's a lungworm from the Strongylidae family. Between May and June 2024, a cross-sectional study was undertaken in and around Asella town, Ethiopia, to establish the current prevalence of bovine lungworm and its associated risk factors. A total of 384 cattle fecal samples were collected at random and brought to the Arsi University Veterinary Laboratory for larval identification. Of the 384 fecal samples analyzed microscopically, 20 were positive for lungworm infection, indicating an overall prevalence of 5.21%. The results were presented using descriptive statistics, and the chi-square test was used to investigate the relationship between categorical variables and the presence of bovine lungworm. The study found a substantial correlation ($P < 0.05$) between age, breed, and body condition score. However, the sex connection was not statistically significant ($P > 0.05$). The incidence was 6.6% in animals aged 1 to 5 years and 3.45% in those older than 5 years. The highest prevalence was seen in animals with poor body condition (8.6%), followed by those with medium (5.3%) and good (2.2%) body states. Crossbreeds have a higher prevalence (6.98%) than native breeds. Furthermore, infection rates varied by body condition score, with rates of 8.6%, 5.3%, and 2.2% for poor, medium, and good conditions, respectively. The findings of this study indicate that bovine lungworm prevalence is a substantial issue in the area. Furthermore, our data suggest the need for additional research into the occurrence and prevalence of bovine lungworm in and around Arsi town, which can aid in identifying cost-effective ways to reduce cow mortality.

Keywords

Lungworm, Bearman Technique, Prevalence, *Dictyocaulus Viviparus*, Larvae

1. Introduction

Throughout the world, the human population relies heavily on domestic animals for a variety of purposes, including the production of meat, fat, milk, and other dairy products; eggs; and fibers such as wool or cashmere, as well as transportation, draught work, and fertilizer, particularly in developing countries [24]. Livestock play a crucial role in the agricultural sectors of developing countries, accounting for approximately 40% of total agricultural GDP. The global demand for ani-

mal-derived meals is increasing, and the livestock sector will need to expand [1].

Most African rural populations rely on livestock as their primary source of income [7]. Ethiopia is noted for its abundant and diverse cattle resources. Ethiopia has the largest livestock population in Africa, comprising approximately 70 million cattle, 95.4 million small ruminants (42.9 million sheep and 52.5 million goats), 8.1 million camels, 13.33 mil-

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lion equines, and 57 million poultry [5, 6]. However, the economic benefits of these animals are negligible when contrasted to the sheer volume of cattle. Disease, reduced genetic potential, and husbandry techniques all contribute to low output. Infections with parasitic nematodes are a significant problem in animal husbandry [15]. Parasites cause subtle economic losses and are the primary cause of decreased productivity levels in tropical and subtropical regions; helminth infections are among the most common and widely dispersed [25].

The nematode parasite *D. viviparus* causes lungworm infection in cattle, resulting in bronchitis and pneumonia [9, 18]. Infections with this parasite can occur in cattle of any age, but the sickness is most commonly seen in calves during their first season at grass. However, lungworm illness has lately emerged as a disease affecting the second grazing season and older animals [10, 19]. It occurs throughout the world, but is most problematic in moist temperate regions with warm weather and average to high rainfall. While the literature on bovine lungworm is extensive in the temperate zone, it is sparse and limited in the tropics. *D. viviparus* is a trichostrongylidae nematode that lives in cattle's major stem bronchi and tracheae as adults. These species cause economic losses through low productivity, inability to flourish, and death, particularly in first-grazing pasture calves [13].

On most organic farms, young animals become infected gradually, resulting in the development of natural immunity. However, on other farms, this slow infection may not occur, and vast numbers of infective larvae may accumulate on the pasture. The challenge may be enough to trigger clinical illness in cattle that have not developed appropriate immunity. Dictyocaulosis's clinical picture ranged from moderate respiratory symptoms, such as loss of appetite, increased respiratory rate, and coughing, to emphysema and pneumonia. In badly infected animals, the infection may be fatal. Preventing and controlling these parasites is therefore crucial to maximizing economic gain from these livestock species [20].

Bovine lungworm infections are a global problem for both small- and large-scale farmers, although they are more widespread in temperate regions and the highlands of tropical and subtropical countries, as well as in Ethiopia [3]. Lungworm parasites produce economic losses in a variety of ways, including reduced fertility, decreased labor ability, involuntary culling, decreased food intake and weight gain, poorer milk output, higher treatment expenses, and mortality in extensively parasitized animals. Several researchers in Ethiopia have documented the incidence of lungworms in ruminants as well as the parasite species [14, 22, 11]. However, there is less research on bovine lungworms than there is on small ruminant lungworms.

Some investigations found that the overall prevalence of lungworm infection in sheep and goats based on coprological and postmortem exams was 60.8% and 55.2%, respectively [5]. According to Nageso et al. [17], 23 (8.5%) sheep and 13 (11.4%) goats were positive for lungworms. Merkinet al. [16]

found that the overall morbidity rates for sheep and goats were 22.27% and 13.2%, respectively. The mortality rate for sheep and goats was 7.04% and 10.4%, respectively. Endoparasites, such as lungworms, account for over half of all small ruminant mortality and morbidity in Ethiopia's highlands. The majority of research undertaken so far has focused on the prevalence and related variables of lungworm in small ruminants. However, lungworm can afflict both small ruminants and cattle. As a result, precise information is required to establish effective control and prevention strategies for bovine lungworm infection in the region. Therefore, the objectives of this study are to assess the prevalence and risk factors of bovine lungworm in and around Asella town.

2. Materials and Methods

2.1. Study Area and Population

The study was conducted between May 2024 and June 2024 to estimate the prevalence of bovine lungworm and related risk factors, as well as to examine community awareness and socioeconomic implications of the disease in and around Asella. Asella is located in the East Arsi Zone of the Oromia National Regional State in eastern Ethiopia, some 125 km from the capital, Addis Abeba. Its geographical coordinates are 5° 00' N, 36° E, and it is located at an altitude of 1490 meters above sea level with the average lowest and maximum yearly temperatures of 10.01 °C and 27.50 °C, respectively, with pleasant subtropical weather. It has a bimodal rainfall pattern, with the long rainy season running from March to May and the short wet season extending from June to September, with an average of 1144 mm of rainfall per year [6]. The study animals were housed under the customary wide management system of indigenous breeds of various ages, genders, and bodily states prevalent in and around Arsi town.

2.2. Study Design, Sample Size Determination, and Sampling Method

A cross-sectional study design was adopted, and the overall prevalence and potential risk factors for the disease were evaluated based on their association with bovine lungworm, with sampling taking place from April to June 2024. The study animals were recruited through simple random sampling from the population of bovines located in and around Arsi Town, including both sexes, all age groups, breeds, and typical elaborate management techniques. A total of 384 extensively handled bovines were randomly chosen. In this example, each cow is chosen fully at random, and every member of the cattle population has an equal chance, or probability, of being chosen. To determine the total sample size, a 95% level of confidence (LC), a 5% desired level of precision, and a 50% predicted prevalence of lungworm in cattle were used. The sample size for this study was computed

using the Thrusfield formula [21].

$$N = \frac{1.96^2 P_{exp} (1 - P_{exp})}{d_2}$$

Where:

N = required sample size

P_{exp} = expected prevalence

d = desired absolute precision

Accordingly, the calculated sample size will be 384.

2.3. Study Methodology

2.3.1. Sample Collection and Transportation

Following suitable restraint, disposable gloves were used to collect faecal samples straight from the rectum and freshly deposited faeces. During sample collection, the date, age, gender, breed, management system, body condition, and species will all be recorded correctly. Each bottle carrying the samples is carefully labelled with the animal's identity. The samples were sent to the Arsi University Veterinary Laboratory for lungworm parasite detection.

2.3.2. Laboratory Examination

In the laboratory, following the conventional method of the modified Baermann technique for the detection of lungworm larvae, a minimum of 15gm of fresh fecal will be weighed from each sample for the extraction of L3 larvae from bovine. Each sample was enclosed with double-layered gauze fixed onto a string rod and submerged in a clean glass beaker filled with warm water. The whole apparatus was left in place for 24 hours, during which time larvae actively moved out of fecal and ultimately collected by gravitation in the glass beaker, and then after discarding the supernatant, the sediment was examined under a microscope by putting it onto the Petri dish, and the sediment was examined under the lower power of the microscope [2, 3].

2.4. Data Management and Analysis

All collected data were entered and coded into the Microsoft Office Excel software program and analyzed using SPSS version 20. Descriptive statistics were used to summarize the data. Chi-square statistics were used to test the association between variables. Statistically significant at $P < 0.05$ is taken to determine whether there were significant differences between the parameters.

3. Results

3.1. Coprological Examination Findings

Coproscopic examination conducted from May 2024 to June 2024 showed that from a total of 384 cattle managed

extensively examined for the presence of lungworm by using the Baermann technique, 20 cattle revealed *bovine lungworm larvae* (*D. viviparous*) in their fecal with an overall prevalence of 5.21% (20/384*100).

3.2. Prevalence of Bovine Lungworm Based on Risk Factor

There was a statistically significant difference ($P < 0.05$) in the prevalence of bovine lungworm in animals of different ages. Of 212 (55.2%) randomly selected animals less than 5 years old, 14 were positive for bovine lungworm with a prevalence of 6.6%, and out of 172 randomly selected animals above 5 years old, 6 were found positive for bovine lungworm with a prevalence of 3.45%. Hence, the highest bovine lungworm occurs in animals less than 5 years old than in animals over 5 years old, according to this study (Table 2). Statistical analysis revealed that there was no significant difference ($P > 0.05$) in the prevalence of bovine lungworm among different sex groups. Of 240 (62.5%) randomly selected males, 12 were randomly selected and were positive, with 5% prevalence. Out of 144 (37.5%) selected females, 8 were positive with a 5.56% prevalence.

The prevalence of bovine lungworm among crossbreeds was higher (6.98%) than in local breeds (4.98%). Comparison of the prevalence of lungworm infections in cattle showed significant differences ($p < 0.05$) among breeds (Table 2). The prevalence of lungworm infection in different body condition scores was 8.6%, 5.3% and 2.2% in the poor, medium, and good body condition scores, respectively (Table 2), and the difference was statistically significant ($p < 0.05$). In this study, the prevalence of lungworm was found to be higher in animals with poor body condition (8.6%) as compared to animals with a medium body condition score (5.3%), and a 2.2% prevalence was found in good body condition.

Table 1. Frequency distribution of bovine lungworm.

Risk factors	Categories	Frequency	percent
Age	<5 year	212	55.2%
	>5 year	172	44.8%
Sex	Male	240	62.5%
	female	144	37.5%
Breed	local	341	88.8%
	Cross	43	11.2%
	Poor	116	30.2%
BCS	Medium	133	34.6%
	Good	135	35.2%

Table 2. Prevalence of bovine lungworm among different risk factors.

Risk Factors	Categories	No of examined	No of positive	Prevalence (%)	X ²	P-Value
Age	<5 year	212	14	6.6%	1.87	0.0248
	>5 year	172	6	3.45%		
Sex	male	240	12	5%	0.056	0.816
	female	144	8	5.56%		
Breed	local	341	17	4.96%	0.37	0.048
	cross	43	3	6.98%		
	poor	116	10	8.62%		
BCS	medium	133	7	5.26%	5.175	0.023
	good	135	3	2.22%		
Total		384	20	5.21%		

4. Discussion

Lungworm infection (verminous pneumonia) is a chronic parasitic disease that affects the respiratory system of animals. This disease results in substantial economic losses due to the reduction of growth rate, morbidity, and mortality, and predisposes the animal to secondary infection. In the present study, coproscopic results revealed an overall lungworm infection prevalence of 5.21% in cattle in and around Arsi town. This study on the prevalence of bovine lungworm was higher than the previous report in southwest Ethiopia at Bedele, reported by Garoma *et al.* [8], at 4.68% and Awake Menzir and Debeb Dessie [4], who reported a 3.1% prevalence in Gondar town, and Mathewos *et al.* [12], who reported a 4.7% prevalence in Mendi town. Similarly, Ahmed Wodaje and Zemenu Birhan [23] currently reported the prevalence of bovine lungworm in faecal samples to be 3.1% in and around Gondar towns.

However, the present finding is much lower than the finding of Taddie *et al.* [20], who reported a prevalence of 30.1% in Woreta town (the western part of the Amhara region). The variations observed in different studies may be attributed to the agro-ecology of the study area, management, season, and sample size. The present study indicated that the prevalence of lungworm infection in animals less than 5 years old is higher (6.6%) than in adults (3.45%). The difference in prevalence by age group was statistically significant ($p < 0.05$). In relation to the age of the animals, younger ones were found to be significantly more affected ($p < 0.05$) by the lungworm infection than adults and older ones. This might be due to the reason that young animals were found to harbour as many lungworms as adult and older animals; this might be the acquired immunity developed in adult and older animals due to previous exposure, and animals that recovered from the in-

fection have better immunity against reinfection.

The statistical analysis of the present study showed that there was no significant variation ($P > 0.05$) between sexes. This signifies that sex seems to have no impact on infection rate, and both sexes are equally susceptible to bovine lungworm infection. This might be due to grazing of both females and males in the field, and both sexes of animals do have similar environmental exposure. In the present study, a higher level of prevalence was observed in crossbreeds (6.98%) as compared to local breeds (4.98%) of cattle, with a significant difference ($p < 0.05$). This difference in prevalence between cross and local breeds of cattle might be because local breeds have innate resistance to infection or infestation. They can be affected similarly to crossbreeds if exposed to the parasite when they are young or after a long period of their first exposure.

Body condition scores were found to be a major risk factor ($p < 0.05$) in the prevalence of bovine lungworm infection, which is in agreement with the finding of Wolde and Mersha [22]. The prevalence based on body condition grade was 40.3%, 34.7% and 35.2% in poor, medium, and good body condition, respectively. The possible reason for this result might be associated with the nutritional management of the animals. Poor body condition occurs as a result of a lack of feed or nutritional management: this may lead to a lack of resistance to infection and contribute to the increased prevalence rate in poorly conditioned animals. Furthermore, considerable weight loss is associated with infection due to *D. viviparus* [10].

5. Conclusion and Recommendations

An updated prevalence of bovine lungworm in the research area has been supplied by the current investigation. Four risk factors were taken into account in this study in order to

evaluate their influence on the incidence of lungworms. While there is no correlation between the disease and sex, there is a statistically significant correlation between the disease with the animal's age, breed, and body score. Lungworm infection is more common in young, malnourished, male, and crossbred animal groups, according to the study. The following suggestions were sent out in light of the aforementioned conclusion: Regular deforming programs need to be put in place; when pasture contamination may occur, young animals should be kept under control; and to create efficient control measures, more thorough epidemiological research needs to be done.

Author Contributions

Fetegn Yohannis Meskele: Conceptualization, Data curation, Formal Analysis, Resources, and Writing – original draft.

Fikru Gizaw: Supervision, Formal Analysis, and Writing – original draft.

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Data Availability Statement

The data supporting the outcome of this research work have been reported in this manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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