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Prevalence of Bovine Lungworm and Its Associated Risk Factor in and Around Mendi Town

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ABSTRACT

A cross-sectional study was conducted in and around Mendi Town, Oromia regional state, west Ethiopia, from September to January, 2019 intended to determine the current status of bovine lungworm prevalence and its associated risk factor. A total of 384 cattle fecal samples were collected randomly and transported to Mendi Type B Veterinary Clinic Parasitology laboratory for larvae identification. Out of 384 fecal samples examined coprologyically, 18 showed positivity for lungworm infection with an overall 4.7% prevalence applying chi-square(x2) descriptive statistics. Age, sex, breed and management systems were considered as risk factors for the occurrence of the disease. Chi-square analysis indicated statistically significant association between age groups, body condition score and management systems and the disease ($P<0.05$) and non-significant association between breed, sex and the disease ($P>0.05$). The prevalence of lungworm by sex was found to be 6.3% and 3.7% in coprological examination of females and males, respectively. Prevalence of 7.0% and 1.8% were observed in animals of 1-5 years of age and animals of above 5 years, respectively. Highest prevalence was observed in extensive management system (8.6%) as compared with semi-intensive (4.5%) and intensive (0%) management systems. Analysis of lungworm infection by breed showed a higher prevalence in cross breeds (6.3%) than local breeds (4.4%). Moreover, the degree of infection by body condition score was assessed indicating 9.0%, 5% and 0.8% for poor, medium and good body conditioned animals, respectively. The study concluded that the prevalence of bovine lungworm in the study area was more associated with young stock in extensive and semi-intensive management systems.

Keywords: Cattle, Coprology, Mendi, Lungworm, Prevalence.

INTRODUCTION

Throughout the world, human population largely depend on domestic animals for a multitude of purposes, essentially for the production of meat,

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fat, milk, and other dairy products, eggs and fibers like wool or cashmere as well as other purposes such as transport, draft, and provision of fertilizers, especially in developing countries [1]. The livestock sector is highly dynamic contributing 40% of the global value of agricultural output and supports the livelihoods and food security of almost a billion people [2]. Ethiopia has large livestock population in Africa with an estimation of 57.8 million heads of cattle, 28.89 million sheep, 29.7 million goats [3].

However, the economic gains from these animals remain insignificant when compared to the huge number of livestock. This low productivity is a reflection of disease, limited genetic potential and husbandry practices [4]. Parasitic nematode infections are a burden for animal husbandry. In general, the infections do not cause a high mortality but morbidity can be high with concomitant loss of production [5].

Lungworm infection in cattle is caused by the nematode parasite *Dictyocaulus viviparous* (*D. viviparous*), the only lungworm found in cattle and is characterized by bronchitis and pneumonia [6]. It occurs worldwide but causes problems mainly in moist temperate regions with mild climates and average to high rainfall. While the documentation on bovine lungworm is vast in the temperate, it is very sporadic and limited in the tropics [7].

D. viviparous is a trichostrongylid nematode whose adult stages inhabit the main stem bronchi and tracheae of cattle [8]. During coughing the eggs are swallowed by the host. Hatching of eggs takes place in air passages or the digestive tract. Larvae are passed in the feces [9]. Infections with this parasite may occur in all ages of cattle, but the disease is mainly seen in calves during their first season at grass. Lungworm infestation has been associated with severe respiratory disease in adult cows [10].

On most organic farms, a gradual infection occurs in young animals resulting in development of a natural immunity. However, on some farms this gradual infection does not take place and large numbers of infective larvae may build up on pasture. The challenge may be sufficient to cause clinical disease in cattle which have not developed adequate immunity [11]. Outbreaks in adult dairy cattle nearly always occur because either cattle have not been exposed to sufficient parasitic challenge in earlier life to provide adequate immunity or immunity has been lost as a result of lack of reinfestation [10].

Although lungworm disease most commonly occurs from July to November, outbreaks have been recorded in every month of the year [12]. This parasite causes a severe sometimes fatal bronchopneumonia; the most common clinical manifestations being coughing, respiratory distress and weight loss [8]. However, there has not been any study done about the prevalence of bovine lungworm and its associated risk factors in the study area. Therefore, the objectives of this study were to determine the prevalence of bovine lungworm in the selected area and to assess risk factors associated with the disease.

MATERIALS AND METHODS

Study area

The study was conducted from September 2018 to January 2019 to determine the prevalence and associated risk factors of lungworm in cattle in and around Mendi town, which is located in the western welega zone of the oromia region, this town has a latitude and longitude of 9048'N and 35o6'E and an elevation of 1583 meters above sea level. It is the administrative center of Manasibu Woreda. Manasibu is bordered on the south by Jarso, on the South West by Begi on the North by the Benishangul Gumuz Region and on the southwest by Nedjo which is 596 km west of Addis Ababa (2007, Housing census of Ethiopia).

Study population

The study was conducted on both local and cross breed cattle in and around Mendi town. These animals were from three kinds of management systems; intensive, semi-intensive and extensive type of management system. The estimation of age was done by the examination of teeth eruption using the approach forwarded by De-Lahunta, et al. [13]. Two age groups were considered; less or equal to five years and above five years. The body condition scoring was classified into three categories as poor (1, 2, 3), medium (4, 5, 6) and good (7, 8, 9) [14]. The study included both sex groups (male and female).

Study design

A cross-sectional study design was carried out from September, 2018 to January, 2019 for coprological study of bovine lungworm. Explanatory variables used included age, breed, sex, and body condition and management systems.

Sampling method and sample size determination

Both purposive and random methods of sampling were

applied. The study site was selected purposively while study units were randomly opted. For determination of total sample size, 95% level of confidence (LC), 5% desired level of precision and 50% expected prevalence of lungworm in cattle was applied. The sample size for this study was determined by using the Thrusfield formula (2005).

$$n = \frac{1.96^2 \times P\exp(1 - P\exp)}{d^2}$$

Where:

n = required sample size

*Pex*p = expected prevalence

d = desired absolute precision

Accordingly, a total 384 animals were taken for the current study.

Study methodology

Sample collection and transportation

Fecal samples were collected directly from anus of the cattle wearing disposable gloves and transported to Mendi Type B Veterinary Clinic for larvae identification. All samples were clearly labeled with the date of sampling, sex, age, and body condition score of animals sampled

Coprological examination

A total of 384 fecal samples were taken randomly from extensive, semi-intensive and intensively managed animals found in and around Mendi town. Fecal samples were collected directly from the rectum of all selected animals using disposable gloves and stored in universal bottles or by the glove itself after it was turned inside out until reached to the laboratory. During sample collection the date, age, sex and management systems were properly recorded.

Each bottle or glove containing the sample was properly labeled corresponding to the animal identity. In the laboratory, following conventional method of Berman technique for detection of lungworm larvae, 25gm of fresh faces was weighed from each sample for the extraction of L1 larvae. Each sample was enclosed with double layered gauze fixed onto a string rod and submersed in a clean glass beaker filled with Luck water. The whole apparatus was left in place for 24 hours during which time larvae actively move out of faces and ultimately collected by gravitation in the glass beaker and then after discarding the supernatant, the sediment was examined by compound microscope by putting it onto the petridish [15].

Data management and analysis

Relevant data were coded and entered in Microsoft excel and made organized further analysis. Organized data were further analyzed using IBM-SPSS version 20. Descriptive statistics was done to determine the rate of bovine lungworm disease. Chi-square ($\chi 2$) statistic was employed to determine the association risk factors.

RESULTS

Coprological examination findings

A total of 384 bovine (241 males and 143 females) fecal samples were microscopically examined and a total of 18 fecal samples were found to harbor bovine lungworm larvae *Dictyocaulus viviparous* (*D. viviparous*) with an overall prevalence of 4.7 % lungworm infection (Table 1).

Table1. The overall prevalence of lungworm in cattle.

Species	No of animals examined	No of positive	Prevalence (%)
Bovine	384	18	4.7%

The prevalence of the parasite by age group of animals showed to be 7.0 % (15/215) and 1.8% (3/169) in animals of 1-5 years of age and in animals with age above 5 years, respectively (Table 2). In this study, the prevalence of lungworm infection was found to be higher in young animals (Table 2) and the difference was statistically significant ($p<0.05$).

Table 2. Prevalence of lungworm in different age groups of cattle.

Age	No of animals examined	No of positive	Prevalence (%)	X^2-value	P-value
<5 Years	215	15	7.0%	5.730	0.017
>5 Years	169	3	1.8%	-------	-------
Total	384	18	4.7%	-------	-------

Moreover, the study has revealed higher prevalence (6.3%) of lungworm infection in female animals than male animals (3.7%) and the difference was not statistically significant ($p>0.05$) (Table 3).

Table 3. The prevalence of bovine lungworm on the basis of sex.

Sex	No of animals examined	No of positive	Prevalence (%)	X^2-value	OR	P-value
Female	143	9	6.3%	1.316		0.251
Male	241	9	3.7%	-------		-------
Total	384	18	4.7%	-------		-------

The prevalence of lungworm infection in different management systems was also calculated to be 8.6, 4.5, and 0% in the extensive, semi-intensive and intensive management systems, respectively (Table 4) and analysis of association indicated existence of statistically significant association ($p < 0.05$)In this study, the prevalence of lungworm was found to be higher in the extensive management system (7.2%) as compared to the semi-intensive management system (2.4%) and no prevalence was found in the intensive management systems.

Table 4. Prevalence of bovine lungworm in relation to management systems.

Management system	No of animals examined	No of positive	Prevalence	X^2-value	OR	P-value
Extensive	139	12	8.6%	10.316		0.006
Semi-Inten	134	6	4.5%	---------		-------
Intensive	111	0	0%	---------		-------
Total	384	18	4.7%	---------		-------

The prevalence of bovine lungworm among cross breeds was higher 6.3% than local breeds 4.4%. Comparison of the prevalence of lungworm infections in cattle showed no significant difference ($p>0.05$) among breeds (Table 5).

Table 5. Prevalence of lungworm among different breeds of cattle.

Breed	No of animals examined	No of positive	Prevalence (%)	X^2-value	OR	P-value
Local	321	14	4.4%	0.466		0.495
Cross	63	4	6.3%	-------		-------
Total	384	18	4.7%	-------		-------

The prevalence of lungworm infection in different body condition score were 9.0%,5.0% and 0.8% in the poor, medium and good body condition scores, respectively (Table 6) 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 (9.0%) as compared to animals with medium body condition score (5.0%) and good body condition score (0.8%).

Table 6. Prevalence of lung in relation to body condition scores of cattle.

Body condition score	No of animals examined	No of positive	Prevalence (%)	X^2-value	P-value
Poor	111	10	9.0%	9.281	0.010
Medium	140	7	5.0%	-------	-------
Good	133	1	0.8%	-------	-------
Total	384	18	4.7%	-------	-------

DISCUSSIONS

The present study has revealed an overall prevalence of *D. viviparous* in the study area to be 4.7%. The current finding of bovine lungworm prevalence is in close agreement with the report of Mahmood et al. [16] who reported 4.76% prevalence in Pakistan Faisalabad city.

Comparatively, the current report of 4.7% is relatively higher than the findings of Yildiz [17], who reported lower prevalence of bovine lungworm in different city of turkey 0.3%, 0.7% and 2% in anon, Samsun and Kars, respectively. Similarly, Menzir and Dessie [18] reported the prevalence of bovine lungworm in fecal samples to be 3.1 % in and around Gondar town.

However, the present finding is much lower than the findings of Schunn et al. [19], who reported prevalence of (17.1%) in Germany. Mohammad et al. [20] reported the prevalence of 47.5% in Iran Tabriz city. In Turkey, Yildiz [17] reported prevalence of 70% in bursa city. The variations observed in different studies may be attributed to agro-ecology of study area, management, and season and sample size.

The present study indicated that the prevalence of lungworm infection in young animals to be higher (7%) than adults. The difference in prevalence by age group was statistically significant ($p<0.05$). Similar finding was reported in different countries [18,21-23]. This might be associated with the apparent ability of the host to develop acquired immunity so that adult animals have the lower infection and the lower prevalence. The variation of lungworm prevalence in the age groups could be explained by the fact that lungworm disease occurs in previously unexposed cattle such as in calves or moved cattle these group of animals are more susceptible to this parasite as they are not immune during their first exposure and or their first grazing season. Accordingly, as the age of animals increase, susceptibility to lungworm infection decreases. This might be associated with the apparent inability of the host to develop acquired immunity so that young animals have the heaviest infection and the highest prevalence while in adult animals after primary infection, rapid solid immunity is developed and cattle continually exposed to infection at low rate; therefore, the accusation of infection decrease.

The statistical analysis of present study showed as there was no significant variation ($P>0.05$) between sexes. This signifies that sex seems to have no impact on infections rate and both sex equally susceptible to bovine lungworm infection. This might be due to grazing of both female and male on the field and both sexes of animals do have similar environmental exposure.

The prevalence of lungworm infection in extensive management system was found to be 8.6% which is higher in comparison with the prevalence observed in semi-intensive (4.5%) and intensive (0%) management systems with statistically significant difference ($p<0.05$). This might be because of the reason that cattle are infected by ingesting grass contaminated with larvae through fecal transmission [24]. The another probable reason could be the fact that poorly nourished animals appear to be less competent in getting ride off lungworm although it is not unusual for well feed animals succumb to the disease provided the right environmental conditions are made available.

In the current study higher level of prevalence was observed

in cross breeds (6.3%) as compared to local breeds (4.4%) of cattle but with no significant difference ($p>0.05$). This difference in prevalence between cross and local breeds of cattle might be due to the reason that local breeds have innate resistance to infection or infestation. They can be affected in similar manner as cross breeds 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 finding of Wolde and Mersha [14]. The prevalence based on body condition grade was 9.0%, 5.0% and 0.8a% 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 lack of feed or nutritional management: this may lead to lack of resistance to infection and contribute for increased prevalence rate in poorly conditioned animals. Furthermore, considerable weight loss is associated with infection due to *D. viviparous* [25].

CONCLUSION AND RECOMMENDATIONS

The current study has provided an updated prevalence of bovine lungworm in the study area. In the present study, five risk factors were considered to assess the impact of the factors on lungworm occurrence no matter how management, age and body score conditions of animals were found to have a statistically significant association with the disease while sex and breed had no association with the disease. The study has also confirmed that lungworm infection is more prevalent in young, poor body condition, extensive management, female and crossbreed animal groups.

- Based on the above conclusive findings, the following recommendations were forwarded:
- Extensive community awareness must be created on the management of bovine lungworm.
- Regular deforming programs must be implemented.
- Young animals should be managed during possible pasture contamination.
- Further and detailed epidemiological studies must be conducted to design effective control measures.

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