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Prevalence of Bovine Lung Worm and Associated Risk Factors at Bedele Veterinary Clinic, Oromia, South West Ethiopia

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Abstract: A cross-sectional study was conducted at Bedele veterinary clinic, south west Ethiopia, from April, 2018 to December, 2018 with the objectives of determining the prevalence of bovine lung worm at Bedele veterinary clinic and to assess the possible risk factors associated with this problem in the study area. Out of a total 384 cattle, the overall prevalence of lungworm infection in the study was 4.68% in coprological finding. Age, sex, breed, body condition and management systems were taken as risk factors for the occurrence of lungworm infection. There were a significant difference in the prevalence of lung worm between management systems ($P<0.05$) but not between breeds, age groups and sexes ($P>0.05$). The prevalence of lungworm was 6.4% and 2.76% in coprological examination results of females and males respectively. Prevalence of 4.96% and 4.1% were observed in young and adult animals, respectively. Highest prevalence was observed in extensive management system (6.06%) as compared with semi-intensive (2.86%) and intensive (0%) management systems. In assessing the prevalence between breeds, it was found to be slightly lower in cross breeds (4.62%) than local breeds (4.7%). It is concluded that prevalence of bovine lungworm in the study area is more associated with young stock in extensive and semi-intensive management systems. Therefore, grazing management and regular strategic deworming of the whole herd with anthelmintics rather than treating infested individuals is recommended.

Key words: Bedele · Cattle · Coproscopic · *Dictoyclaus viviparous* · Lungworm

INTRODUCTION

Ethiopia is one of developing countries in Africa, which is predominantly an agricultural country with over 85% of its populations engaged in agricultural activity [1]. According to recent estimates, Ethiopia has 56.71 million cattle, 29.33 million sheep, 29.11 million goats, 1.16 million camels and 56.87 million poultry [2]. An increase in large ruminant could contribute to the attainment of food self-sufficiency in the country especially in requirement for the growing human population and to increase export earnings [3].

However, the economic gains from these animals remain insignificant when compared to their huge number. This low productivity is a reflection of disease, limited genetic potential and husbandry standard. The morbidity of animals generally estimated to be in the range of 8-10 % of national cattle herd per annum and 14-16 % and 11-13 % of national sheep and goat flock respectively with average live weight loss of 70 kg for cattle and 6 kg for sheep and goat [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].

As Ploeger [6] stated, lungworm infection in cattle is caused by the nematode parasite *Dictyocaulus viviparous*; the only lungworm found in cattle and is characterized by bronchitis and pneumonia. It occurs worldwide but causes problems mainly in moist temperate regions with mild climates and average to high rainfall.

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While the documentation on bovine lungworm is vast in the temperate, it is very sporadic and limited in the tropics [7].

Dictyocaulus 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 a lack of re-infestation [10].

Although lungworm disease most commonly occurs from July to November, outbreaks have been recorded in every month of the year. This parasite causes a severe sometimes fatal bronchopneumonia; the most common clinical manifestations being coughing, respiratory distress and weight loss [8]. Diagnosis is based on clinical signs, postmortem findings and laboratory testing (Detecting lungworm larvae in feces) [12].

Although control measures to prevent infestation of the animals are difficult due to the continuous exposure of the animals to contaminated pasture, there are two strategies for controlling lungworm; vaccination and suppression with regular deworming. Anthelminthic drugs are used to combat nematode infections but resistance of the worms to the drugs is increasing and limits the efficacy of this approach. Several drugs are available for the treatment of *D. viviparous* infection, including Macro-cyclic lactones, Levamisole and Benzimidazols [5].

However, there has not been any study done about the prevalence of bovine lung worm and its associated risk factors in the study area. Therefore, the objectives of this study were:

- To determine the prevalence of bovine lung worm in the study area
- To assess the possible risk factors associated with this problem.

MATERIALS AND METHODS

Study Area: The study was conducted from April, 2018 to December, 2018 to determine the prevalence of bovine lung worm at Bedele veterinary clinic and to assess the possible risk factors associated with this problem in the study area, western Ethiopia. Bedele town is located in Oromia region, at a distance of about 483 km west of Addis Ababa. Geographically, Bedele is located at 8° 26"80' N Latitudes and 36° 20" 97' E Longitudes and with an altitude of ranging between 1400 to 2010 meter above sea level. The annual mean temperature ranges from about 12.5°C to 27.5°C and the area receives annual rainfall greater than 1400 mm. Agriculture is the main stay of livelihood of people with a mixed farming system and livestock plays an integral role for agriculture. The major livestock kept in the study area are cattle, goats, sheep and equines with estimated population has been to be 59, 233 cattle, 40, 543 sheep, 9, 786 goats, 38, 364 poultry and 1, 878 equine [13].

Study Population: Animals for this study were cattle at Bedele veterinary clinic. These animals were from three kinds of management systems; intensive, semi-intensive and extensive type of management system. All cattle in the area were considered in the study. The age of cattle were grouped as young (<5year), Adult (Above 5years) [14].

Study Design: A cross-sectional study was carried out from involving 384 cattle of which animals (176 males and 208 females) were coproscopically examined. The explanatory variables were comprised of age, breed, sex, body condition and management systems. Each individual of the sampled animals were determined for the presence or absence of lung worm at the time of examination or data collection through clinical examination.

Sampling Method and Sample Size: Cattle were sampled using simple random sampling technique from those animals coming to Bedele Veterinary Clinic from in and around Bedele town. To calculate the total sample size, the following parameters were used: 95% Level of Confidence (LC), 5% desired level of precision and with an assumption of 50% expected prevalence of lung worm in cattle. The sample size for this study was determined by using Thrusfield formula [15].

$$3\ n = \frac{1.96^2 \times P_{exp}(1 - P_{exp})}{d^2}$$

where: n = required sample size
Pexp = Expected prevalence
d = Desired absolute precision

During collection, animals are inserted into crash or tied with the help of assistant. After restraining, samples were taken randomly from rectum of the cattle. Accordingly, 384 animals were supposed to be sampled from the study area.

Sample Collection and Transportation: Fecal samples were collected directly from rectum of the cattle, after wearing disposable gloves and transported to Bedele Regional veterinary laboratory, parasitology laboratory as soon as possible aseptically. All samples were clearly labeled with the date of sampling, sex, age, breed, body condition score and management system of the cattle.

Laboratory Technique: Using modified Barman technique 5-10 grams of fresh feces were weighted from each sample. The larvae and enclosed gauze fixed on to astringe rode are submerse in a clean glass tube which is filled with warm water left for 24 hours and the sediment are transfer to the microscope slide for examination of L1 under lower power of microscope after siphoning off the supernatant. Finally if the larvae are detect under microscope the result will record as positive, if not, recorded as negative. In both cases, the result that is obtained for each sample is recorded to their corresponding specific animals.

Study Methodology

Visual Examination of the Animals: After randomly selecting animals visual examination for the presence of clinical signs that include coughing, rapid breathing, nasal discharge, loss of appetite and ill thrift and/or reluctant to move, stand with head down and neck extended was assessed although these are not restricted to only for the presence of lung worm.

Coproscopic Examination: A total of 384 fecal samples were taken randomly from extensive, semi-intensive and intensively managed animals found in and around Bedele town. Faecal 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 the inside out until reached to the laboratory. During sample collection the date, breed, age, sex, body condition 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 lung worm larvae, 5-10 gm of fresh faces was weighed from each sample for the extraction of L1 larvae. Each sample was enclosed with double layered guaze fixed on to 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 collect by gravitation in the glass beaker and then after discarding the supernatant, the sediment was examined compound microscope or under stereo microscope by putting it on to the petridish [16-18].

Data Management and Analysis: Statistical analysis was performed using SPSS version 20. The relationships between the prevalence of lungworm infection with age, breed, sex and management system were examined by testing its significance using the Pearson Chi- Square test. The level of significance was tested at p = 0.05.

RESULTS

Coproscopic Examination: A total of 384 cattle (176 males and 208 females) were examined by modified Baerman technique and the investigation results showed 4.68 % (18/384) overall prevalence of lungworm infection. The specific prevalence was found to be 4.96% (13 of 262) and 4.1 % (5 of 122) for young and adult age respectively (Table 1). Comparison of the prevalence of lung worm infections in different age groups showed relatively higher prevalence in young age (4.1 %) and lower prevalence was observed in animals in the adult age (prevalence of 4.96 %) with no statistical significance ($p>0.05$) (Table 1).

The investigation result revealed higher prevalence of lung worm in female animals, 6.4 % (13 of 203) than male animals and 2.76% (5 of 181). However, this difference was not statistically significant ($p>0.05$) (Table 2).

The prevalence of lung worm infection in different management systems was 6.06%, 2.86% and 0% in the extensive, semi intensive and intensive management systems respectively (Table 3) and this difference was statistically significant ($p<0.05$). In this study the prevalence of lung worm was found to be higher in the extensive management system (6.06%) as compared to the semi-intensive management system (2.86%) and 0% prevalence was found in the intensive management systems.

Table 1: Prevalence of lungworm in different age groups of cattle

Age	No.of examined	No.of positive	Prevalence (%)	χ^2	P-value
Young	262	13	4.96	1.167	0.291
Adult	122	5	4.10		
Total	384	18	4.68		

Table 2: The prevalence of cattle lungworm on the basis of sex

Sex	No.of examined	No.of positive	Prevalence (%)	χ^2	P-value
Male	181	5	2.76	1.167	0.291
Female	203	13	6.4		
Total	384	18	4.68		

Table 3: Prevalence of bovine lungworm in relation to management systems

Mgt	No of examined	No of positive	Prevalence (%)	χ^2	P-value
Extensive	247	14	6.06	6.127	0.043
Semi-intensive	130	4	2.86		
Intensive	170	0	0.00		
Total	384	18	4.68		

Table 4: Prevalence of lung worm among different breeds of cattle

Breed	No. of examined	No. of positive	Prevalence (%)	χ^2	P-value
Local	319	15	4.70	0.231	0.649
Cross	650	3	4.62		
Total	384	18	4.68		

Table 5: Prevalence of lung worm among different body condition of cattle

BCs	No of examined	No of positive	Prevalence (%)	χ^2	P-value
Poor	780	7	5.70	0.472	0.790
Medium	184	8	4.35		
Good	122	3	3.85		
Total	384	18	4.68		

The prevalence of bovine lungworm among local breeds was higher, 4.7% (15 of 319) than cross breeds, 4.62% (3 of 65) of cattle. Comparison of the prevalence of lungworm infections in cattle showed no significant difference ($p>0.05$) among breeds (Table 4).

The prevalence of lung worm infection in different body condition score was 3.85%, 4.35% and 5.7% in the good, medium and poor body condition score respectively and this difference was statistically non-significant ($p>0.05$). In this study the prevalence of lung worm was found to be higher in the poor body condition score (5.7%) as compared to the medium (4.35%) and 3.85% prevalence was found in good body condition scores (Table 5).

DISCUSSION

The overall prevalence of bovine lungworm infection (4.68%) found in this study was low. Similar low prevalence of cattle lungworm infection has been reported by Awake and Debeb [9] who reported 3.1% in Gondar town and Fekadu [19] who reported 0.5 % in Addis Ababa abattoir, Ethiopia. The result agrees with previous studies conducted by Mahmood *et al*. [20] from Faisalabad, in Pakistan (4.76 %). On the contrary Kader [21] reported zero prevalence in the Kirik kale province of Turkey. This variation might be due to climate, altitude, probability of deworming and rainfall of the study area [7].

From the results, it is evident that the prevalence of lung worm infection was slightly higher in young stock than adult. These results are in agreement with the results of other works done from various countries where lungworm infection is endemic. The variation of lungworm prevalence in the age groups could be explained by the fact that lung worm disease occurs in previously unexposed cattle such as in calves or moved cattle [22] because 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.

Generally, in relation to the management systems of animals, the higher prevalence (6.06 %) was observed in extensive system, with 2.86 % prevalence observed in

animals kept under semi-intensive and 0% within intensives 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 [23] and lungworm infection in extensive farming system could be due to 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 [24].

There was also a slight difference of disease rate between poor, medium and good body conditions with 5.7%, 4.35% and 3.85% respectively that indicated statistically no significant difference ($p>0.05$). This might be associated with the lower immunity due to lactation, pregnancy, draft power of the host to protect the infection so that young animals have the lower infection and the lower prevalence [25].

In this study between the sexes of animals lungworm prevalence was higher in females, 6.4% (13 of 203) than male animals, 2.76% (5 of 181) although it was not statistically significant. This could be due to the fact that both sexes of animals do have comparable environmental exposure. In the current study relatively slight difference of prevalence was observed between local breeds (4.7%) as compared to cross breeds (4.62%) of cattle; but it showed no significant difference ($p>0.05$). This difference in prevalence between cross and local breeds of cattle might be due to the reason that although local breeds have low managemental practices than cross breeds.

CONCLUSION AND RECOMMENDATIONS

In general this study revealed that occurrence of higher prevalence of lungworm infection in extensive management system and young animals are observed. In the present study the infection prevalence of lungworm has no significant association with breed, age, body condition and sex, but indicated significant association with management system of the cattle. Overall in the present study it was found that prevalence of lung worm infections was only investigated from coproscopic examination of intensive and semi-intensive management with 0% (0 of 17) and 2.86% (4 of 130) respectively and higher prevalence was seen in animals kept under extensive management system, 6.06% (14 of 247).

Therefore, based on the above conclusion the following recommendations are forwarded:

- Grazing management and Regular strategic deworming of the whole herd (Especially when infected cattle are present) with broad spectrum anthelimenthics rather than treating individuals is recommended.
- Isolation of most susceptible age groups during the season when pasture contamination occurs.

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