Study On The Prevalence Of Bovine Lungworm In Gondar Town, North Ethiopia

Awake Menzir, Debeb Dessie

Jimma University, College of Agriculture and Veterinary Medicine School of Veterinary Medicine
Jimma, Ethiopia; phone: +251 910 961 811
menzirawake@yahoo.com

University of Gondar, Faculty of Veterinary Medicine
Gondar, Ethiopia; phone +251 928 504 167,
dessievet@gmail.com

Abstract: A cross-sectional study was conducted in Gondar town, North Ethiopia, from October 2011 to March 2012 with the objectives of determining the prevalence and assessing the possible risk factors of lungworm infection in cattle. In this study a total of 400 cattle were used. Out of these 386 animals were examined coprologically including 86 animals that were later examined under post mortem and 14 animals were examined only with postmortem examination. The overall prevalence of lungworm infection in the study was 3.1% and 0% in coprological and postmortem findings respectively. Age, sex, breed 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 different age groups and management systems ($P<0.05$) but not between breeds and sexes ($P>0.05$). The prevalence of lungworm was 4.2 % and 2.5% in coprological examination results of females and males respectively and 0% in postmortem in males. Prevalence of 5.6% and 0% 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 (9%) as compared with semi-intensive (3%) and intensive (0%) management systems. In assesing the prevalenc between breeds, it was found to be higher in cross breeds (4.8%) than local breeds (2.8%). It is concluded that prevalence of bovine lungworm in the study area is more associated with young stock in extensive and semi-intensive manegmnt systems. Therefore, grazing management and regular strategic deworming of the whole herd with anthelimenthics rather than treating infested individuals is recommended.

Keywords: Caattle, Coproscopic, D. viviparous, Gondar, Lungworm, North Ethiopia, Postmortem, Prevalence

INTRODUCTION

The livestock sector plays a vital role in the national economy of developing countries. It plays a great role in food supply, a source of income and foreign currency. Ethiopia has a population of about 44 million cattle, 23 million sheep and 23 million goats. 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 70kg for cattle and 6kg for sheep and goat.[16] 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.[10] 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.[18] 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.[11] D. viviparous is a trichostrongylid nematode whose adult stages inhabit the main stem bronchi and tracheae of cattle.[15] 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 faeces.[13] 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.[24] 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.[2] 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 reinfestation.[24] Although lungworm disease most commonly occurs from July to November, outbreaks have been recorded in every month of the year.[17] This parasite causes a severe sometimes fatal bronchopneumonia; the most common clinical manifestations being coughing, respiratory distress and weight loss.[15] Diagnosis is based on clinical signs, postmortem findings and laboratory testing (detecting lungworm larvae in faeces).[14] 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. Antihelminthic 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. viviparus infection, including Macrocyclic Lactones (MLs), Levamisole and Benzimidazols.[10] So far the prevalence of bovine lung worm and associated risk factors were not studied in the study area. Therefore, this study was targeted with the following objectives.

- To estimate the prevalence of bovine lung worm in and around Gondar town and
- To assess the possible risk factors associated with this problem.

MATERIALS AND METHODS

Study Area

This study was conducted in Gondar town which is found in north Gondar zone of Amhara regional state, North Ethiopia. The town is located at 742km from Addis Ababa at an elevation of 2220 meters above sea level (m.a.s.l). Rain fall of the area varies from 880 mm to1172 mm with the maximum temperature of 29.70C and an average annual temperature of 19.70C. The area is characterized by two seasons, the wet season from June to September and dry season from October to May.[3] The livestock population of the area comprises of 2,407,544 cattle, 31,456 horses, 272,655 donkeys, 13,612 mules, 979,800 sheep, 1,382,655 goats, 3,286,769 poultry and 223,690 beehives.[4]

Study Population

Animals for this study were cattle in and around Gondar town. These animals were from three kinds of management systems; intensive, semi-intensive and extensive type of management. All cattle in the area were considered in the study.

Study Design

The study was of cross sectional type involving 400 cattle of which 386 animals (242 males and 144 females) were examined coproscopically. Among these 386 animals examined through coprological method, 86 were coming to Gondar Elfora abattoir for slaughter. The explanatory variables were age, breed sex 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. In addition to these 100 animals were examined through postmortem examination including those 86 animals examined coprologically.

Sampling Techniques and Sample Size Determination

Cattle were sampled using simple random sampling technique from those animals coming to University of Gondar open air Veterinary Clinic and those coming to Gondar town Elfora abattoir from in and around Gondar town so as to determine the prevalence of bovine lung worm and associated risk factors that contribute to the occurrence of Dictyocaulosis. 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 was determined based on the formula given by Thrusfield.[20]

$$n = \frac{1.962(p)(1-p)}{d2}$$

Where, n = sample size
p = expected prevalence (50%)
1.96= the value of Z of 95% confidence level

$$n = \frac{1.962\ (p)\ (1\text{-}P)}{d2}$$

$$n = \frac{1.962\ (0.5)\ (1\text{-}0.5)}{0.052}$$

n = 384 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 386 fecal samples were taken randomly from extensive, semi-intensive and intensively managed animals found in and around Gondar town of which 86 animals were coming to Gondar Elfora abattoir to be slaughtered. 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, 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 lung worm larvae, 25gm 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 under stereo microscope by putting it on to the petridish.[6][21][8]

Postmortem examination

A total of 100 lungs were examined in Gondar Elfora private abattoir using postmortem examination for the presence of adult lung worm. Lung was examined immediately after animals were slaughtere. The date, age and sex of slaughtered animals were properly recorded. The air passages were opened starting from the trachea down to the bronchi with a fine blunt pointed scissors and sharp knife to detect the adult parasite from each sampled lung.[19][6]

Postmortem and Coproscopic examinations

A total of 86 both fecal and lung samples were collected randomly from the same animals coming to Gondar town Elfora abattoir for slaughter and was examined for the presence of larvae and/or adult bovine lung worm respectively.

Data Management and Analysis

The prevalence of bovine lungworm infection was determined based on coprological and postmortem diagnosis and calculated by dividing the number of positive cases to the total number of cattle sampled. Statistical analysis was performed using SPSS ver. 16. The relationships between the prevalence of lungworm

infection with age, sex, breed and grazing practice (manegment systems) 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 386 cattle (242 males and 144 females) were examined by modified Baerman technique and the investigation results showed 3.1% (12/386) overall prevalence of lungworm infection (Table 1).

Table 1: *The overall prevalence of lungworm in cattle:*

Species	Examined	Positive	Prevalence (%)
Bovine	386	12	3.1

The specific prevalence was found to be 5.6% (12 of 214) and 0% (0 of 172) in animals of 1-5 years of age and in animals above 5 years of age respectively (Table 2). In this study the prevalence of lung worm infection was found to be higher and exclusively confined to young animals (Table 3) and this difference was statistically significant ($p<0.05$). Comparison of the prevalence of lung worm infections in different age groups showed relatively higher prevalence in age group of 1-5 years (3.1%) and no prevalence was observed in animals in the age of above 5 years (prevalence of 0%) (Table 2).

Table 2: *Prevalence of lungworm in different age groups of cattle*

Age	Examined	Positive	Prevalence (%)	χ^2-value	P-value
1-5 years	214	12	5.6	9.954	0.002
Above 5 years	172	0	0	_	_
Total	**386**	**12**	**3.1**	_	_

The investigation result revealed higher prevalence of lung worm in female animals, 4.2% (6 of 144) than male animals and 2.5% (6 of 242). However, this difference was not statistically significant ($p>0.05$) (Table 3).

Table 3: *The prevalence of cattle lungworm on the basis of sex*

Sex	Examined	Positive	Prevalence (%)	χ^2value	P value
Male	242	6	2.5	0.826	0.363_
Female	144	6	4.2	_	
Total	**386**	**12**	**3.1**	_	_

The prevalence of lung worm infection in different management systems was 7.2, 2.4, and 0% in the extensive, semi intensive and intensive management systems respectively (Table 4) 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 (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	Examined	Positive	Prevalence (%)	χ^2-value	P-value
Extensive	125	9	7.2	13.876	0.001
Semi-intensive	126	3	2.4	_	_
Intensive	135	0	0	_	_
Total	**386**	**12**	**3.1**	_	_

The prevalence of bovine lungworm among cross breeds was higher, 4.8% (3 of 63) than local breeds, 2.8% (9 of 323) of cattle. Comparison of the prevalence of lungworm infections in cattle showed no significant difference ($p>0.05$) among breeds (Table 5).

Table 5: Prevalence of lung worm among different breeds of cattle

Breed	Examined	Positive	Prevalence (%)	χ^2-value	P-value
Cross	63	3	4.8	0.609	0.435
Local	323	9	2.8	-	-
Total	**386**	**12**	**3.1**	-	-

Postmortem Examination

A total of 100 cattle (only males) were examined through post mortem examination and no positive result was found (observed). The overall prevalence of lung worm of cattle was found to be 0% in this study.

Postmortem and Coproscopic Examinations

Among the 100 animals examined under postmortem, 86 animals were examined antemortem using Baerman thcnique to investigate lungworm larvae from freshly collected fecal sample but no animal was found to be infested with lungworm in either of the examinations.

DISCUSSIONS

Coproscopic Examination: From the results, it is evident that the prevalence of lung worm infection was higher and entirely confined in young stock than adults. Generally, in relation to the age of animals, the higher prevalence (5.6%) was observed in animals of 1-5 years old with 0% prevalence observed in animals within the age group of above 5 years that was statistically significant. 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.[22] 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[5] 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. In this study between the sexes of animals lungworm prevalence was higher in females, 4.2% (6 of 144) than male animals, 2.5% (6 of 144) although it was not statistically significant. This could be due both sexes of animals do have similar environmental exposure. The prevalence of lungworm infection in extensive management system was 7.2% which is highest in

comparision with the prevalence observed in semi-intensive (2.4%) 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 faecal transmission,[7] 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 scumb to the disease provided the right environmental conditions are made available.[9] In the current study higher level of prevalence was observed in cross breeds (4.8%) as compared to local breeds (2.8%) of cattle; but it showed no significant difference ($p>0.05$). This indifference in prevalence between cross and local breeds of cattle might be due to the reason that although 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. Postmortem Examination: In the current study post mortem examination results showed that no (0%) prevalence was found. This result is not in agreement with the study results obtained in Malaysia by Lat-Lat,[12] in which among the total of 260 lungs of cattle, lungworm was found in three cattle (1.1%). In addition to this it is not agreed with necropsy records of Bateman et al.[1] at the Ontario Veterinary College yielded eight cases of D. viviparous infection over the period 1969 to 1984. Other than this a seven year old cow and a 30 month old heifer all other cases occurred in calves under eight months of age. This variation might be due to the reason that young animals which are susceptible to lungworm infection were not slaughtered in the study area and as explaind by Beggs[2] on most organic farms, a gradual infection occurs in young animals resulting in development of a natural immunity. As van-Dijk[23] explaind natural infection of calves with D.viviparus elicits humoral immune responses that provide protection against re-infection as they become an adult. Therefore this study result is in agreement with these interesting facts. Postmortem and Coproscopic Examinations: Among the 100 adult animals examined using postmortem, 86 animals were also examined in coproscopic examination but they were found to be negative in either of these examinations. This result was in agreement with results of Yildiz,[25] in Turkey; Kirikkale province in which D. viviparous was not detected either in coproscopic examination or during postmortem in cattle; but as Yildiz[25] explaind, D. viviparous was detected as 0.3-2 % during postmortem and fecal examinations respectively in previous studies in turkey.

CONCLUSIONS AND RECOMMONDATIONS

Comparison of the prevalences revealed that young animals are the solely affected groups of cattle. This variation could be explained by the fact that young animals are susceptible to this parasite during their first grazing season and when they became an adult they can develop immunity against it. In the present study the infection prevalence of lungworm has no significant association with breed and sex of cattle; other epidemiological risk factors such as age and management systems have great contribution to the prevalence of lungworm infection in the study area. Overall in the present study it was found that prevalence of lung worm infections was only investigated from coproscopic examination of young animals, 3.1% (12 of 386) and no prevalence was seen at post mortem investigations, 0% (0 of 100). This might be due to the fact that young animals were not slaughtered and adults could develop immunity once they are infested as a result of the first exposure during their first grazing season when they are calves. 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.

REFERANCES

[1] Bateman, K.G., Baird, J. D., Slocombe, J. O., Leslie, K.E., Curtis, R.A. and Menzies, P.1. (1986): Case Report: Verminous Pneumonia in Adult Dairy Cows in Southern Ontario due to Dictyocaulus viviparous. Department of Clinical Studies and Department of Pathology, Ontario Veterinary College, University of Guelph, Can Vet J, (27): 233-236.

[2] Beggs, N. (2011): Lungworm Infection in Organic Cattle. Disease Surveillance and Investigation Branch, Veterinary Sciences Division, Department of Agriculture and Rural Development, Beltany Road, Coneywarren, Omagh, Co., Tyrone, Northern Ireland.

[3] CSA, (Central statistical authority) (2003): Federal Democratic Republic of Ethiopia Static Research. Addis Ababa, Ethiopia.

[4] CSA, (2008): Federal Democratic Republic of Ethiopia, Central Statistical Agency, Agricultural sample servey 2008. Report on Livestock and Characteristics, statisticall bulletin, 446:39.

[5] Floron, C. and Faries, J. (2006): Common cattle parasites.

[6] Fraser, C.M. (1991): The veterinary manual: A handbook of Diagnosis, therapy and Disease prevention and control for the veterinarians. 7th ed. USA, Merck and co; Inc. Pp. 714-717.

[7] Glundj, H.O., Morrison, D. A., Mattsson, J. G and Engstro, A.M (2006): Population genetics of the bovine/cattle lungworm (Dictyocaulus viviparus) based on mtDNA and AFLP marker techniques. Department of Parasitology (SWEPAR), National Veterinary Institute and Swedish University of Agricultural Sciences, Uppsala, Sweden.

[8] Hendrix, C. M., (2006): Diagnostic veterinary parasitology for Vet. Technicians, 2nd edn. St. Louis, London, Philadelphia, Pp. 262-264.

[9] Kimberling, C.V. (1988): Jensen and swift's Disease of sheep 3rd edn., Lea and Febiger, Philadelphia.

[10] Kooijman, F. (2008): Immunodominant glycoproteins of the bovine lungworm Dictyocaulus viviparous.

[11] Lat-Lat, H., Hassan, L., Sani, R.A., Sheikh-Omar, A.R. , Hishamfariz, M. and Ng, V. (2007): First report of bovine lungworm disease in South-East Asia. Faculty of Veterinary Medicine, Universiti Putra Malaysia, Department of Veterinary Services Malaysia, Production Division, Putrajaya, Malaysia. Tropical Biomedicine, 24(1): 77–81.

[12] Lat-Lat, H. (2010): Lungworm of cattle in Malaysia. Department of Pathology and Microbilogy, Faculty of Veterinary Medicine, University Putra Malaysia. Tropical Biomedicine, 22(1): 236-240.

[13] Laven, R. (2005): Lungworm (Husk or Parasitic Bronchitis).

[14] Love, S. (2008): Lungworm (Husk or Parasitic Bronchitis).

[15] McKeand, J.B. (2000): Department of Veterinary Clinical Science and Animal Husbandry, Faculty of Veterinary Science. Vaccine development and diagnostics of Dictyocaulus viviparus. University of Liverpool, Leahurst, SouthWirral, UK.

[16] Mekonnen, A., Abebe, F., and Yohannes, E. (2011): Study on the Prevalence of Lungworm Infection in Small Ruminants in Gondar Town, Ethiopia. Veterinary Research, 4 (3):85-89.

[17] NADIS (2010): National Animal Disease Information Service: Cattle Disease Focus for N Ireland.

[18] Ploeger, H.W. (2002): Dictyocaulus viviparus: Re-emerging or never been away? Trends in Parasitology, 18(8): 392-332.

[19] Radostits, O.M., Gay, C.C., Blood, D.C. and Hinchclift, K.W. (1994): Diseases associated with helminthe parasites in veterinary medicine: A textbook of the Disease of cattle, sheep, pigs, goats and horses. 9th edn. Harcourt publishers, Ltd. London, Pp. 1564-1569.

[20] Thrusfield, M. (2005): Surveys in veterinary epidemiology.3rd ed. UK, Black well science, Ltd. Pp. 626.

[21] Urquhart, G.M., Armour, J., Duncan, A.M. and Jennings, F.W. (1994): Veterinary Parasitology, 1st ed. London, Blackwell Publishing, Pp. 270-290.

[22] Urquhart, G.M., Armour, J., Duncan, A.M. and Jennings, F.W. (1996): Veterinary Parasitology, 2nd ed. Blackwell Science, Scotland, Pp. 39–58.

[23] VanDijk, J. (2004): The epidemiology and control of dictyocaulsis in cattle. Cattle Practice. British Cattle Veterinary Association, Frampton-on-Severn, UK, 12(2):133-145.

[24] Vermunt, J. (2000): Infectious diseases of cattle in New Zealand. Surveillance, 27(3): p. 7.

[25] Yildiz, K. (2006): Prevalence of Lungworm Infection in Sheep and Cattlein the Kirikkale province. Department of Parasitology, Faculty of Veterinary Medicine, Kirikkale University, Turkish Society for Parasitology, 30(3): 190-193.

Author Profile

Menzir, A., received Doctor of Veterinary Medicine from Jimma university, College of agriculture and Veterinary Medicine in 2012. Sicnce July 2013 to January 2016, worked in Benishangul Gumuz regional state as Animal health care and quality control core work process coordinator and since February 2016 to September 2016, worked in Amhara Regional state as animal health service expansion, disease surveliance and control expert. Beginning from October 2016 still now working in Ethiopian veterinary drug and animal feed administration and control Authority, at Amhara National Regional state branch office, as veterinary drug inspector.