Prevalence of Caprine Lungworm in Tiyo District, Arsi Zone, Central Ethiopia

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Abstract: Cross-sectional study design was conducted from November, 2016 to April, 2017, in Tiyo district, Oromia region, Ethiopia aiming to determine the prevalence of Caprine lungworm infection, identify species of lungworm and assess associated risk factors for its occurrence. Faecal samples were collected from 384 goats of different age groups, body condition and sex. The first larvae were extracted by Modified Baermann technique. Accordingly, 42.7% of goats were infected with different species of lungworm; namely, Dictyocaulus filaria (19%), Protostrongylus rufescens (3.1%), Muellerius capillaries (11.7%) and mixed infection (8.9%). The prevalence of lungworm infection with regard to age and body condition was statistically significant. However, the prevalence of lungworm infection with regard to sex was insignificant. Questionnaire surveys on antihelmintics treatment history and manifestation of respiratory clinical signs showed that the rate of lungworm infection was 48.0% and 36.7% in none-dewormed and dewormed; and 65.3% and 18.4% in those with signs and without signs, respectively. Statistically, all considered factors for questionnaire survey were highly significant. In conclusion, the study revealed that lungworm belongs to the major respiratory helminthes among respiratory disease complex that affect the health and productivity of goats in the study area requiring effective control and prevention measures.

Key words: Caprine - Lungworm - Prevalence

INTRODUCTION

Ethiopia has the largest livestock population in Africa. An estimate indicates that the country is a home for about 103.7 million livestock population from which the goats’ population was estimated to be 24.6 million [1]. In country, directly or indirectly disease is one of the major barriers for the improvement of livestock production, reproduction and marketing. Diseases of various origins (bacterial, viral, parasitic, etc.) are among the numerous factors responsible for poor production and productivity [2, 3]. Small ruminants, especially goats are among the livestock species that are densely populated in Ethiopia and mostly their productivity is hampered by prevalence of different diseases. The country holds 13.5% of the African goats’ population [4]. However, the country is not making use of this huge potential attributed to different constraints among which disease stands in the front line [2, 5].

Accordingly, parasitic diseases are among those, which play a detrimental role in hampering small ruminant production leading to serious economic loss [6]. The annual economic loss due to disease, mortality, reduced reproductive and productive performance was estimated by 150 million USD [7]. In Ethiopia, 5-7 million sheep and goats die each year due to disease and the overall economic loss from meat industry due to parasitic diseases is estimated at 400 million annually [8].

Helminthes parasites of small ruminants are ubiquitous, with many tropical and subtropical environments of the world providing nearly perfect conditions for their survival and development. Although these parasites are widely prevalent, they can be less obvious than signs of other livestock diseases. Partly for this reason, infection with helminthes parasites are among the most established that high prevalence rates of the infection with less obvious signs are associated with poor production and unthriftness [9].

The three respiratory parasites that cause a significant damage in small ruminant production are Dictyocaulus filaria, Protostrongylus rufescens and Muellerius capillaries. These lungworms particularly Dictyocaulus filaria can suppress the immunity of the respiratory tract and causes death, poor weight gain or
loss of body weight as well as greatly affects the potential productivity of goat’s industry in the areas where it is prevalent [10].

Despite such production challenges in Ethiopia; farmers prefer to rear goats for their low cost of production, prolificacy, for the adaptive capacity of goats to various environmental factors through dynamic feeding behavior and fast reproduction cycle and growth rate. The degree to which goats survive to marketable age is one of the key indicators of the efficiency of goat’s production. But, goat’s survivability in the village condition is one of the main factors that cause favorable condition for the development of parasitism among various diseases and causes low production performance in goats, unless there is an intervention to curb the problems.

Tiyo district is among central highland of Ethiopia with favorable climatic and agroecological conditions for the of development lungworms. So, there is a need to do sufficient studies by assessing the prevalence and major risk factors associated with the disease under village condition to recommend disease control practices to study area. But there is paucity of information so far pertaining to respiratory helminthes of goats in the study area [11]. Therefore objectives of this study were:

- To determine the prevalence of lungworm infection in goats through coproscopic and questionnaire survey in Tiyo district.
- To identify the species of lungworm at study area and to assess associated risk factors for its occurrence in Tiyo district.

MATERIALS AND METHODS

Study Area: The study was conducted from November, 2016 to April 2017 in Tiyo district, Arsi zone, Oromia Regional State, central Ethiopia. Tiyo is located 175 km southeast of Addis Ababa. It is located at 6°79’ and 8°49’ N latitude and 38°41’ and 40°44’ E longitude. It has an area of 2,118,675 hectares, of which 39.7% is highland, 29.1% is lowland and 27.5% has mid-altitude. The altitude of the area is ranging between 500 (Awash and Wabe valley) and 4245 (Mount Kaka) meters above sea level. The annual temperature varies between 10°C and 25°C. The average annual rainfall ranges between 901mm and 1200mm, with some spatial and temporal variability in quantities and distribution. Its pattern is of a bimodal type with 60% occurring in the long rainy season extending from June to September and the short rainy season from December to February. The other two seasons are the cool dry season extending from October to November and the major dry season from March to May [12].

The Study Animals: The study population comprises of indigenous goats raised in Tiyo district kept under extensive management system; young or adult; all body conditions (poor, medium and good); dewormed or non-dewormed by anthelmintics; apparently health or with respiratory clinical signs were included.

Study Design: Cross-sectional study design was carried out to determine the prevalence of lungworm infection in goats in Tiyo district, Arsi zone, Oromia region, Central Ethiopia. A convenient sampling procedure was used. During sampling age, sex, body conditions, treatment history with anthelmintics usage and appearance of respiratory clinical signs of the animals were recorded.

Sample Size Determination: The sample size was determined according to Thursfield [13] taking in to account an expected previous prevalence of 50% [14, 15], 5% absolute precision and 95% confidence level.

\[
N = \frac{1.96^2 \cdot P_{esp} \cdot (1-P_{esp})}{d^2}
\]

where, N = required sample size
P_{esp} = expected prevalence
d= desired level of precision (5%)

Accordingly, the sample size required for the study was 384.

Questionnaire Survey: Questionnaire survey was carried out to interview individual owners of 384 goats taken for coproscopic examination in order to obtain information regarding to previous medication (anthelmintics) and respiratory clinical signs by structured questionnaire.

Sample Collection and Transportation: Animals was restrained by manual by owner and after wearing plastic disposable gloves, fecal samples were collected directly from the rectum of animals; put in screw capped glass bottles, packed in an ice box and transported to Addis Ababa University, College of Veterinary Medicine Agriculture, Pathology and Parasitology laboratory for further coprological examination. At the time of collection, necessary information were recorded including type of sample, species, sex, age, date of sampling and the body conditions of animals.
Faecal Examination: In laboratory, recovery of lungworm larvae from feces was performed. Approximately ten grams of fresh feces was weighed from each sample for the recovery of L1 larvae using Modified Baermann technique. Feacal sample was fully enclosed in double layered gauze fixed on string rode rest on the edges of the funnel glass. The glass was filled with clean and slightly hot water (approximately 37-45°C) until the sample became submerged making sure that the corners of double layered gauze did not hang over the edge of the funnel. Then, the whole apparatus was left for 24 hours.

Larvae Recovery and Identification: Fluid recovered from the Baermann technique [16] was examined under stereomicroscope for motility of the Larvae. When positive, a drop of fluid containing the larvae was taken by pippete to microscopic slide and drop of 1% iodine solution was used to immobilize the larvae and examined under low magnification power. Then, Larvae were identified morphologically as described by Anne and Gray (17). Otherwise, it was registered negative for lungworm infection.

Data Entry and Analysis: Collected data were recorded in the format developed for this purpose and later on entered into the Microsoft excel 2010 program and analyzed using STATA 13 software (StataCorp 4905 Lakeway Drive, College Station, Texas 77845 USA). It was summarized by descriptive statistics and then displayed by tables to illustrate the relationships between the dependent variables (each lungworm species and their total) and independent variables (age, sex, body condition score, treatment history with antihelminthics or medication and manifestation of respiratory clinical signs). Chi-square ($\chi^2$) and logistic regression will be utilized to test relationship between dependent variable (lungworm species) and environmental factors. Association of host risk factors with larve positives was calculated. A difference should be taken as significant at a p-value less than 0.05 and the confidence level was held at 95%.

RESULTS

Overall Prevalence of Lungworm Infection: Out of 384 goats faecal samples examined, three species of lungworm larvae was recovered as indicated by (Figure 2) and 164 (42.7%) were infected with different species of lungworm. Out of these 19%, 11.7%, 3.1% and 8.9%, was due to $D$. filaria, $M$. capillaries, $P$. rufescens and mixed infection, respectively. Thus, $D$. filaria was the most dominant species followed by $M$. capillaries; $P$. rufescens was the least and certain investigated animals were infected by mixed infection (Table 1).

Questionnaire Survey and Rate Lungworm Infection: Rate of lungworm infection during questionnaire survey was conducted based on treatment history with antihelminthics and manifestation of respiratory clinical signs.
Fig. 2: Species of lungworm recovered from fecal samples of goats examined.

Keys: A= larvae of *D. filaria*, *Red arrow= Protoplasmic knob, B= larvae of *Muellerius capillaries*, *Purple arrow= Dorsal spine, C= larvae of *Protostronglus rufescens*, *Yellow arrow= pointed tail of larvae of *Protostrongylus rufescens*.

Table 1: Prevalence of different species of lungworm in total examined Goats

<table>
<thead>
<tr>
<th>Species of lungworm</th>
<th>No. Positive</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>D. filaria</em></td>
<td>73</td>
<td>19</td>
</tr>
<tr>
<td><em>M. capillaries</em></td>
<td>45</td>
<td>11.7</td>
</tr>
<tr>
<td><em>P. rufescens</em></td>
<td>12</td>
<td>3.1</td>
</tr>
<tr>
<td>Mixed infection</td>
<td>34</td>
<td>8.9</td>
</tr>
<tr>
<td>Total</td>
<td>164</td>
<td>42.7</td>
</tr>
</tbody>
</table>

Rate of Lungworm Infection in Relation to Treatment History with Antihelminthics in Study Animals:

Out of 180 respondents who practiced deworming, 36.7% and out of 204 respondents who do not practice deworming, 48.0% were found positive to lungworm infection. *D. filaria* was most recovered larvae of lungworm species followed by mixed infection with two or three species and *M. capillaries*, where, as *P. rufescens* least in goats those were dewormed according owners response. However, *M. capillaries* were the second most recovered next to *D. filaria* in non-dewormed goats. Where, as the others were the same to that of dewormed one. There was significantly higher infection rate in non-dewormed goats than dewormed ones and the odds of infection with lungworm in non-dewormed goats is more likely 1.96 times to that of dewormed goats (*p*<0.05), (Table 2).

Rate of Lungworm Infection and Manifestation of Respiratory Clinical Signs in Study Animals:

Rate of lungworm infection in study animals according to manifestation of respiratory clinical signs was 18.4% and 65.3% in apparently health and those that manifest respiratory clinical signs according to owner’s response respectively. *D. filaria* was most recovered larvae of lungworm species followed by mixed infection with two or three species and *M. capillaries*, where, as *P. rufescens* least in both animas with respiratory clinical sign and apparently health goats. There is statistically significant difference between each factors and the odds of infection with lungworm in animals those indicated respiratory clinical signs is 6.28 times more likely to that of animals without clinical signs (*p*<0.05), (Table 3).

Risk Factors and Prevalence of Lungworm Infection

Prevalence of Lungworm Infection with Respect to Sex:

Prevalence of lungworm infection with respect sex of animals was 30.8 % and 47.3 % in male and female respectively. *D. filaria* was most recovered larvae of lungworm species followed by mixed infection with two or three species and *M. capillaries*, where, as *P. rufescens* least in both sexes. Prevalence was higher in female than male; however, statistically there was insignificant difference between each factors and the odds of infection with lungworm in animals those indicated respiratory clinical signs is 1.96 times more likely to that of animals without clinical signs (*p*> 0.05), (Table 4).

Prevalence of Lungworm Infections in Different Age:

The prevalence of lungworm infection according to age of study animals was 67.3% in young and 24.2% in adult animals. All observed lungworm species was higher in young than adult animals. *D. filaria* was most recovered larvae of lungworm species followed by mixed infection with two or three species where, as *P. rufescens* least in both age. The prevalence of lungworm infection between age group of study animals was statistically significant and the odd of infection with lungworm in young is 3.54 times more likely to that of adult animals (*p*< 0.05), (Table 5).

Prevalence of Lungworm Infection in Different Body Conditions:

Prevalence of lungworm infection according to body condition of study animals was 82.5%, 59.0% and 12.1% in poor, medium and good, respectively. Thus, prevalence of lungworm was highest in poor followed by
Table 2: Rate of lungworm infection in relation to treatment history with antihelminthics in study animals with response of respondents

<table>
<thead>
<tr>
<th>Did you deworm your goat?</th>
<th>No. examined with rr</th>
<th>No. positive</th>
<th>Df (%)</th>
<th>Mc (%)</th>
<th>Pr (%)</th>
<th>Mi (%)</th>
<th>Total P (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>180</td>
<td>66</td>
<td>30(16.7)</td>
<td>13(7.2)</td>
<td>6(3.3)</td>
<td>17(9.1)</td>
<td>36.7</td>
</tr>
<tr>
<td>No</td>
<td>204</td>
<td>98</td>
<td>43(21.1)</td>
<td>32(15.7)</td>
<td>6(2.9)</td>
<td>17(8.3)</td>
<td>48.0</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>164</td>
<td>73(19)</td>
<td>45(11.7)</td>
<td>12(3.1)</td>
<td>34(8.9)</td>
<td>42.7</td>
</tr>
</tbody>
</table>

Keys: ($\chi^2 = 4.6225$; $p= 0.032$; OR=1.96), $Df= D. filaria$, $Mc= M. capillaries$, $Pr= P. rufescens$, *OR= odd ratio, *p= p-value, *$\chi^2$= chi square, *No.exmd with rr = number of examined animals with response of respondents

Table 3: Rate of lungworm infection and respiratory signs with response of respondents

<table>
<thead>
<tr>
<th>Did your goat cough?</th>
<th>No. examined with rr</th>
<th>No. positive</th>
<th>Df (%)</th>
<th>Mc (%)</th>
<th>Pr (%)</th>
<th>Mi (%)</th>
<th>Total P (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>199</td>
<td>130</td>
<td>59(29.6)</td>
<td>37(18.6)</td>
<td>9(4.5)</td>
<td>25(12.6)</td>
<td>65.3</td>
</tr>
<tr>
<td>No</td>
<td>185</td>
<td>34</td>
<td>14(7.6)</td>
<td>8(4.3)</td>
<td>3(1.6)</td>
<td>9(4.9)</td>
<td>18.4</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>164</td>
<td>73(19)</td>
<td>45(11.7)</td>
<td>12(3.1)</td>
<td>34(8.9)</td>
<td>42.7</td>
</tr>
</tbody>
</table>

Keys: ($\chi^2 = 33.64$; $p= 0.00$; OR=6.28), $Df= D. filaria$, $Mc= M. capillaries$, $Pr= P. rufescens$, *OR= odd ratio, *p= p-value, *$\chi^2$= chi square, *No.exmd with rr = number of examined animals with response of respondents

Table 4: Prevalence of lungworm infection with respect to sex

<table>
<thead>
<tr>
<th>Sex</th>
<th>No. Examined</th>
<th>No. positive</th>
<th>Df (%)</th>
<th>Mc (%)</th>
<th>Pr (%)</th>
<th>Mi (%)</th>
<th>Total P (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>107</td>
<td>33</td>
<td>16(15)</td>
<td>8(7.5)</td>
<td>3(2.8)</td>
<td>6(5.6)</td>
<td>30.8</td>
</tr>
<tr>
<td>Female</td>
<td>277</td>
<td>131</td>
<td>57(20.6)</td>
<td>37(13.4)</td>
<td>9(3.2)</td>
<td>28(10.1)</td>
<td>47.3</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>164</td>
<td>73(19)</td>
<td>45(11.7)</td>
<td>12(3.1)</td>
<td>34(8.9)</td>
<td>42.7</td>
</tr>
</tbody>
</table>

Keys: ($\chi^2 = 2.3104$; $p= 0.128$; OR=0.59), $Df= D. filaria$, $Mc= M. capillaries$, $Pr= P. rufescens$, *OR= odd ratio, *p= p-value, *$\chi^2$= chi square

Table 5: Prevalence of lungworm infections in different age

<table>
<thead>
<tr>
<th>Age</th>
<th>No. Examined</th>
<th>No. positive</th>
<th>Df (%)</th>
<th>Mc (%)</th>
<th>Pr (%)</th>
<th>Mi (%)</th>
<th>Total P (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young</td>
<td>165</td>
<td>111</td>
<td>49(39.3)</td>
<td>31(18.8)</td>
<td>11(6.7)</td>
<td>20(12.1)</td>
<td>67.3</td>
</tr>
<tr>
<td>Adult</td>
<td>219</td>
<td>53</td>
<td>45(23.4)</td>
<td>14(6.4)</td>
<td>1(0.5)</td>
<td>14(6.4)</td>
<td>24.2</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>164</td>
<td>73(28.4)</td>
<td>45(10.7)</td>
<td>12(7.6)</td>
<td>34(9.9)</td>
<td>42.7</td>
</tr>
</tbody>
</table>

Keys: ($\chi^2 = 17.3889$; $p= 0.00$; OR=3.54), $Df= D. filaria$, $Mc= M. capillaries$, $Pr= P. rufescens$, *OR= odd ratio, *p= p-value, *$\chi^2$= chi square

Table 6: Prevalence of lungworm infection in different body condition of study animals

<table>
<thead>
<tr>
<th>Body condition</th>
<th>No. Examined</th>
<th>No. positive</th>
<th>Df (%)</th>
<th>Mc (%)</th>
<th>Pr (%)</th>
<th>Mi (%)</th>
<th>Total P (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>97</td>
<td>80</td>
<td>45(46.4)</td>
<td>20(20.6)</td>
<td>5(5.2)</td>
<td>11(10.3)</td>
<td>82.5</td>
</tr>
<tr>
<td>Medium</td>
<td>105</td>
<td>62</td>
<td>21(20)</td>
<td>21(20)</td>
<td>4(3.8)</td>
<td>18(15.2)</td>
<td>59.0</td>
</tr>
<tr>
<td>Good</td>
<td>182</td>
<td>22</td>
<td>7(3.8)</td>
<td>4(2.2)</td>
<td>3(1.6)</td>
<td>8(4.4)</td>
<td>12.1</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>164</td>
<td>73(19)</td>
<td>45(11.7)</td>
<td>12(3.1)</td>
<td>34(8.9)</td>
<td>42.7</td>
</tr>
</tbody>
</table>

Keys: ($\chi^2 = 63.3616$, 41.6025; $p= 0.00$; OR=24.45, 9.59), $Df= D. filaria$, $Mc= M. capillaries$, $Pr= P. rufescens$, *OR= odd ratio, *p= p-value, *$\chi^2$= chi square

medium and good body condition. Variation among body condition with relative to infection of lungworm was statistically significant and the odds of infection with lungworm in animals with poor and medium body condition is 24.45 and 9.59 times more likely to that of good body condition. Prevalence of lungworm infection according body condition was statistically significant ($p< 0.05$) (Table 6).

**DISCUSSION**

The results of the present study obtained during the period from November, 2016 to April, 2017 from Tiyo district, Oromia region, central highland of Ethiopia, indicated that lungworm infection was one of the most common respiratory diseases complex of goat with an
overall prevalence of 42.7%. This finding agrees with the study findings that were conducted around Gondar town [18], in Dessie and Kombolcha [19], in North and South Gondar [20] and in North Gondar zone [21] with prevalence of 44.64%, 40.40%, 44.70% and 46.70% respectively. However, the current finding was lower than the prevalence reported by Fentahun [22] in and around Jimma town, 49%; Haji [15] in Hitosa district, 50%; Abera [14] in highland of Bale and Arsi zone; 50% and Alemu [23] in six district of northeastern of Ethiopia, 50.7%. The result of current finding disagrees with study conducted by Addis [24] in Gondar, 37.35%, by Abebe [25] in Wolaita sodo town, 19.2%, by Assaye and Alemneh [26] in and around Bahir Dar city, 28.5%, by Kassa [27] in three district of south Wollo, 31.0%, by Weldesenbet and Mohammed [28] in Jimma town, 28.2%. The possible explanation for such prevalence variation could be due to variation in altitude, rainfall, humidity, temperature difference and season of examination on the respective study areas which favor or disfavor the survival of parasite larvae [29, 30] and competence of investigator to detect larvae of parasite in faeces.

In the current study, the prevalence of different species of lungworm was 19.0%, 3.1%, 11.7% and 8.9% due to D. filaria, P. rufescens, M. capillaries and mixed infection with two or three species of lungworm, respectively. With regard to the species of lungworms, it was observed that D. filaria was the most predominant species in the area followed by M. capillaries, whereas P. rufescens was the least prevalent. This finding is supported by Assaye and Alemneh [26], Abebe [25], Abera [14] and Kassa [27]. In contrast to this findings, Alemu [21] in six district of northeastern Ethiopia, Regassa [19] in Dessie and Kombolcha, Fentahun [18] in and around Gondar and Terefe [21] in Gondar reported that M. capillaries was the most prevalent. The possible explanation for the predominance of D. filaria in the study area might be attributed to the difference in the life cycles of the parasites. Thus, D. filaria has a direct life cycle which requires shorter time to develop to an infective stage while M. capillaries has an indirect life cycle which needs an intermediate snail for completing its life cycle. Thus, require longer time to develop to infective stage. According to Soulsby [29] after ingestion the larvae D. filaria parasites can be shed with faeces within five weeks.

In my findings, P. rufescens was the least prevalent. This is in coherent with the finding reported by Assaye and Alemneh [26], Abera [14] and Weldesenbet and Mohammed [28], however, disagrees with the finding reported by Addis [24]. Mixed infection was also observed in the current study which is coherent with previous studies reported by Haji [15], Hansen and Perry [9] and Paulos [11].

With regard to know influence of treatment history by anthelmintics on rate of lungworm infection, questionnaire survey findings were tried to associate it with the faecal examination results. Out of 204 goat's owners respondents that said non-dewormed, 98 goats (48.0%) was harbor to lungworm infection and out of 180 goat’s owners respondents that said dewormed, 66 goats (36.7%) was harbor to lungworm infection. This findings, was closely agreed with previous study reported by Abebe [25], Abera [14] and Regassa [19].

With regard to know appearance of respiratory clinical signs with lungworm infection, questionnaire survey findings were tried to associate manifestation of respiratory sign with the faecal examination results. Out 199 goat's owners respondents that said yes (those shows respiratory clinical signs), 130 goats (65.3%) was harbor lungworm infection and Out 185 goat's owners’ respondents that said no (did not show respiratory clinical signs), 34 goats (18.4%) was harbor lungworm infection. This finding agrees with the study reported by Paulos [11].

With respect to know the influence of sex, on variation of prevalence of lungworm infection, the prevalence was higher in female (47.3%) than male (30.8%), but the difference was statistically insignificant ($P=0.128$). This agrees with the findings reported by Addis [24], Abebe [25] and Kebede [31], but disagrees with report of Alemu [23] and Assaye and Alemneh [26]. These differences might be either due to improper distribution of sample selection between the two sexes that makes prevalence higher in female [24] or most of the sampled females are not in preparturient period during the study time that make both sexes equally susceptible to disease.

With regard to the prevalence of lungworms with respect to age groups; young animals were found to be more infected than adult. The higher infection rate was observed in young animals (67.3%) while lower infection rate was observed in adult animals (24.2%). This agrees with the findings reported by Fentahun [18], Assaye and Alemneh [26] and Abera [14]. However, the result of this study disagrees with findings reported by Haji [15]. The difference might be observed due to the fact that intermediate host for P. rufescens is restricted to certain species of snails or might be due to competition of investigator during feacal examination.
With regard to assess the influence of body condition, on variation of prevalence of lungworm infection, it was found that 82.5%, 59.0% and 12.1% in poor, medium and good, respectively. Prevalence was higher in poor, followed by medium and good body condition. Hence, this finding agrees with study reported by Abera [14], Haji [15], Assaye and Alemneh [26].

CONCLUSION

The results of the present study revealed that prevalence of Caprine lungworm was high in Tiyo district, Arsi zone, Oromia, Ethiopia. The major lungworm species identified in the study area were: D. filaria, M. capillaries and P. rufescens. D. filaria was identified as the most dominant lungworm species.

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