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Study on the Prevalence of Lungworm Infection in Small Ruminants in Gondar Town, Ethiopia

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Abstract: The study was conducted in Gondar town from November-March 2010 with the objectives of determining the prevalence, identifying the species involved and assessing possible risk factors of lung worm infection in small ruminants. The overall prevalence of lung worm infection in the study was 33.83 and 32.6% in coproscopic and postmortem findings, respectively. Age, sex, management system, month and species of animal were taken as risk factor for the occurrence of lung worm infection. There were no significant difference ($p>0.05$) between age, sex, management system, month and species of animal. The prevalence of lung worm infection was 30.43 and 36.22% in coproscopic examination and 31.74 and 34.92% in postmortem findings in sheep and goats, respectively. The prevalence o f lung worm was 36.22 and 30.43% in coproscopic and 27.27 and 35.91% in postmortem in female and male, respectively. Prevalence of 42.85, 32.93, 28.57 and 37.75% were observed in animals of age groups <6 months, 6 month to 2 years, 2-4 years and >4 years, respectively. Prevalence of 39.47, 30.08, 33.33, 34.88 and 31.57% were observed in November, December, January, February and March, respectively. The prevalence between management systems was higher in extensive (34.40%) than semi-intensive (30.90%). *Dictyocaulus filaria* has the highest prevalence (15.86%) than *Muellerius capillaries* and *Protostrongylus refescens*.

Key words: *Dictyocaulus filaria*, gondar, lungworm, *Muellerius capillaries*, prevalence, *Protostrongylus refescens*, small ruminants

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. In Ethiopia, small ruminants contribute 35% of meat and 14% of milk consumption, 12-16% of the total export earnings (Asfaw, 1997).

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 it is 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 per annum, respectively with average live weight loss of 70 kg for cattle and 6 kg for sheep and goat.

The national value of this direct loss estimated to be of 550 million Ethiopian birr (FAO, 1993). Verminous pneumonia due to various lung worm species has been reported to exist in sheep and goats particularly in the high land areas of Ethiopia (Alemu *et al*., 2006). Therefore to increase the potential of small ruminant production and to get the maximum benefit from them prevention and control of lung worms is very important.

Therefore, this study was designed with the objectives of determining the prevalence, identifying the species involved and assessing possible risk factors of lung worm infection in small ruminants in small ruminants in the study area.

MATERIALS AND METHODS

Study design: The study was cross-sectional survey involving 564 small ruminants (423 ovine 141 caprine) of which 235 male and 329 female in. The explanatory variables considered were age, sex and species of animal and management system.

Each individual of the sampled sheep and goat were determined for the presence of lungworm at the time of examination or data collection through clinical or post mortem examination.

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Sampling method and determination of sampling size: Simple random sampling technique was used. To calculate the total sample size, the following parameters were used: 95% level of Confidence (CL), 5% desired level of precision and with the assumption of 50% expected prevalence of lung worm in sheep and goats the sample sizes were determined using the formula given by Thrusfield (2005).

$$n = \frac{1.96^2 * Pexp\ (1\text{-}Pexp)}{d^2}$$

Where:

n = Required sample size
Pexp = Expected prevalence
d = Desired absolute precision

Sample collection and study methodology

Coproscopic examination: About 334 samples were taken randomly from extensive and semi intensive farms found in Gondar town. Fecal samples were collected directly from rectum of all selected animals using disposable gloves and stored in universal bottle until examination. During sample collection the date, species, sex, age and management system were properly recorded. Each bottle was properly labeled corresponding to the animal identity.

The techniques recommended by Fraser and Urquhart were employed for identification of lung worm species from the collected samples. In the laboratory, following conventional method of Baerman technique for detection of lungworm larvae, 25 g of fresh faces was weighed from each sample for the excretion of L_1 larvae. Samples were enclosed with gauze fixed on to a string rod and submersed in a clean glass tube filed with warm water a Baerman apparatus.

The whole apparatus was left for 2-3 h and then the sediment was examined under the low power of microscope after siphoning off the sediment. If the samples were found to be positive a drop of 1% iodine solution was used to immobilize the larvae for species identification.

Postmortem examination: About 230 samples (171 sheep and 59 goats) were collected for post mortem examination of adult lung worms and the identification of the species involved. A sampling frame of different restaurants in Gondar town was prepared and lung was examined immediately after slaughter from the sampling units. The species sex, date of sampling and the origin of slaughtered animals were labeled.

The air passages were opened starting from the trachea down to the bronchi with fine blunt pointed scissors to detect parasites.

Data management and analysis: The data were entered and managed in MS Excel work sheet. The analysis was conducted using Stata version 7. Prevalence of lung worm was expressed as percentage with 95% (CI) by dividing the total number of animals positive to lungworms to the total number of animal examined.

The significant of difference between the prevalence of lung worm was determined using χ^2-test. The explanatory variables which include species, sex, age, management system and type of examination were considered as risk factor to see their association with the level of prevalence. The differences were regarded as significant if p-value is <0.05.

RESULTS AND DISCUSSION

Coproscopic examination: A total of 334 small ruminants (251 sheep and 82 goats) were examined by modified Baerman technique from Gondar town. The identification results showed 33.83% (113/334) prevalence of lung worm infection.

The specific prevalence was found to be 32.67% (82 of 251) and 37.35% (31 of 83) in sheep and goat, respectively (Table 1). In this study the prevalence of lung worm infection was found to be higher in goats than sheep but this difference was not statistically significant (p>0.05) (Table 1).

The investigation result revealed higher prevalence of lung worm in female animals 36.22% (71 of 196) than male animals 30.43% (42 of 138). However, this difference was not statistically significant (p>0.05) (Table 2).

Comparison of the prevalence of lung worm infections in the different age groups showed relatively higher prevalence in age group of <6 months (42.8%) and the lowest prevalence was observed in animals between 2 and 4 years (28.57%). There was no significant difference (p>0.05) among these proportion of lung worm isolates in the different age groups of animals examined during the study (Table 3).

The monthly prevalence of lung worm infection in small ruminants was 39.47, 30.47, 33.33, 34.88 and 31.57% in November, December, January, February and March, respectively. The highest prevalence of lung worm

Table 1: Prevalence of lungworm in sheep and goat

Species	Examined	Positive	Prevalence (%)	χ^2-value	p-value
Ovine	251	82	32.67	1.2126	0.271
Caprine	83	31	37.35	-	-
Total	334	113	33.83	-	-

Table 2: Prevalence of lungworm infection on the basis of sex

Sex	Examined	Positive	Prevalence (%)	χ^2-value	p-value
Male	138	42	30.43	1.2126	0.271
Female	196	71	36.22	-	-
Total	334	113	33.83	-	-

Table 3: Prevalence of lung worms in difference age groups of small ruminants

Age	Examined	Positive	Prevalence (%)	χ^2-value	p-value
<6 months	42	18	42.85	2.8287	0.419
6 months-2 years	167	55	32.93	-	-
2-4 years	77	22	28.57	-	-
>4 years	48	18	37.75	-	-
Total	334	113	33.83	-	-

Table 4: Monthly prevalence of lung worm infection in small ruminant

Month	Examined	Positive	Prevalence (%)	χ^2-value	p-value
November	76	30	39.47	1.6884	0.793
December	133	41	30.08	-	-
January	63	21	33.33	-	-
February	43	15	34.88	-	-
March	19	6	31.57	-	-
Total	334	113	33.83	-	-

Table 5: Identification results of lung worm species

Species	Examined	Positive	Prevalence (%)	χ^2-value	p-value
D. filaria	334	53	15.86	4.3393	0.502
M. capilaris	334	37	11.07	-	-
P.rufescens	334	16	4.79	-	-
Mixed infection	334	5	1.49	-	-
Total	334	113	33.83	-	-

infection in small ruminants was recorded in November (39.47%) where as the lowest was in December (30.08%). Comparison of the prevalence of lung worm infections in small ruminants showed no significant difference ($p>0.05$) among the months (Table 4). Final identification of the lung worm species were done based on the morphology of the larvae by viewing the faecal samples with a light microscope. *Dictyocaulus filaria* was found to be the highest prevalence (15.86%) among the different species identified. The identification result showed that there was no significant difference among the species of lung worms in small ruminants (Table 5).

In this study the prevalence of lung worm was found to be higher in the extensive management system (34.40%) when compared to the semi-intensive management system (30.90%). However, this difference was not statistically significant ($p>0.05$) (Table 6).

Post mortem examination: A total of 230 sheep and goats were examined through post mortem examination of which 75 (32.6%) were positive for lung worm infection. Out of 230, 167 were sheep and 63 goat with a prevalence of 31.74% (53 of 167) and 34.92% (22 of 63), respectively (Table 7).

On the basis of sex the prevalence was higher in male than female with a prevalence of 35.91% (51 of 142) and 27.27% (24 of 88) in males and females, respectively (Table 8). Comparison of the overall prevalence of lung worm infection was found to be higher in coproscopy (33.83%) than post mortem examination (32.6%) (Table 9).

Table 6: Prevalence of lungworm infection under different management system

Management system	Examined	Positive	Prevalence (%)	χ^2-value	p-value
Semi-intensive	55	17	30.90	0.1885	0.664
Extensive	279	96	34.40	-	-
total	334	113	33.83	-	-

Table 7: Prevalence of lungworm infection in sheep and goat during PM examination

Species animal	Examined	Positive	Prevalence (%)
Sheep	167	53	31.74
Goat	63	22	34.92
Total	230	75	32.60

Table 8: Prevalence of lungworm infection on the basis of sex during PM examination

Sex	Examined	Positive	Prevalence (%)
Male	142	51	35.91
Female	88	24	27.27
Total	230	75	32.60

Table 9: Coproscopic and post mortem examination results of lung worm

Type of examination	Examined	Positive	Prevalence (%)
Coproscopy	334	113	33.83
Post mortem	230	75	32.60

Coproscopic examination: The overall prevalence of lung worms of small ruminants was found to be 33.83% in this study. The specific prevalence of lung worms were 32.67% (82 of 251) and 37.35% (31 of 83) in sheep and goat, respectively. This level of prevalence was in agreement with previous studies conducted by Tsegaye (1985) at Gaint and Uqubazgi (1990) at Hamassien Awraja who reported prevalence rates of 32.2 and 27.6%, respectively. However, the finding was lower than prevalences reported by Netsanet (1992) in Debrebirhan and Alemu *et al.* (2006) in North West Ethiopia who reported prevalence of 73.25 and 53.6%, respectively. The present report was higher than Tefera at Deseie and Komolcha, Frewengel (1995) in Tigray and Sissay (1996) in Bahirdar who report prevalence of 15.47, 11.24 and 13%, respectively.

The differences in the prevalence of lung worms of small ruminants in the above studies might be associated with differences in the methods followed in the detection of larvae of lung worm, the difference in the study areas which favors the survival of the larvae of the lung worm or the snail intermediate host in case of *P. rufescens* and the different sample sizes used by the researchers. It might also be associated with nutritional status, level of immunity, management practice of the animal, rain fall, humidity and temperature differences and season of examination on the respective study area. The reason for low prevalence of the disease in this study could be attributed to the establishment of open air clinic in rural kebeles, increase number of private veterinary pharmacy, increase farm awareness to deworm their sheep and goat.

The reason for the increment of the prevalence in this study could be explained to the fact that Tefera, Sissay (1996) and Frewengel (1995) were conducted their research during dry period the duration of the study was short when compared to the present research.

The prevalence of lung worm infection was relatively higher in goats (37.35%) than sheep (32.67%). This variation could be explained by the fact that goats are more susceptible to helminthes than sheep due to their grazing behavior. Goats with their browsing behavior consume uncontaminated matter with parasite larvae, so being less exposed to larvae and therefore have lower acquired resistance than sheep (Wilsmore, 2006).

In the current study higher level of prevalence was observed in female (36.22%) animals compared to male animals (30.43%). This difference in prevalence's between female and male animals could be due to the fact that resistance to infection decreases at the time of parturition and during early lactation. This per parturient relaxation of resistance result in the females in ability to expel adult worm's which cause higher level of larvae detection (Craig, 1998).

With regard to age, generally, the highest prevalence (42.85%) was observed in animals of <6 month years old while the lowest prevalence (28.57%) was observed in animals of age groups 2-4 years with no statistically significant difference ($p>0.05$) between the prevalence's of the different age groups. This report agree with (Netsanet, 1992) who report that young sheep and goat were found to be infected more than adults and *D. filaria* infection decrease with increasing age of the animal. This might be associated with the apparent ability of the host to develop acquired immunity so that adult animals have the lowest infection and the lowest prevalence (Urquhart, 1996).

Dictyocaulus filaria was the most prevalent (15.86%) of the total samples examined in the study area. This result agrees with the previous report of Netsanet (1992) around Debre Berhan and Uqubazgi (1990) in Hamase Awraja but it disagree with the report of Sissay (1996) in Bahirdar (39.3%) and Mezgebu (1995) in Addis Ababa who reported as *M. capilaris* is the most prevalence. This could be associated with the difference in the life cycles. *Dictyocaulus filaria* has a direct life cycle and takes less time to reach the infective stage and after ingestion, larvae can appear in the faces within 5 weeks (Soulsby, 1982). Compared with *D. filaria*, transmission of *P. rufescens* and *M. capillaries* is epidemiologically complex event involving host, parasite and intermediate host. In addition to this the low prevalence of both *M. capilaris* and *P. rufescens* in the area is because of sampling was done during dry season which is not suitable to the snails, IH of these species to which larvae (L) develop to infective stage (L3). *P. rufescens* whose intermediate host range is restricted to certain species of snail has lower prevalence of the rest through its geographic range is just wide like.

The monthly dynamics of lung worm infection with in the study periods showed that the prevalence were high in November with remarkable declining during the dry season. The reason for increment of lung worms in the wet season could be associated to the fact that survival and development of lung worm larvae is favored by low moisture content and high humidity (Thomson and Orita, 1988).

The prevalence rate of lung worm infection in extensive management system was (34.40%) which is higher than semi-intensive (30.90%). The results of the present study was in line with Alemu *et al.* (2006) and Sissay (1996) but it disagrees with the result of Muluken who reported prevalence similar prevalence rates in both the management systems. The reason for high prevalence of lung worm infection in extensive farming system could be due to the fact that poorly nourished animals appear to be less competent in getting ride off lung worm although, it is not unusual for well feed animals to succumb to the disease provided the right environmental conditions are made available (Kimberling, 1988).

Post mortem examination: Post mortem examination results showed that the prevalence was higher in goats 34.92% (22 of 63) than sheep 31.74% (53 of 167). This variation is due to the fact that goats are more susceptible to helminthes than sheep as they appear to develop less immunity due to their grazing behavior. Goats with their browsing behavior consume uncontaminated matter with parasite larvae so being less exposed to larvae and therefore have lower acquired resistance than sheep (Wilsmore, 2006).

CONCLUSION

Comparison of the prevalence revealed that males 35.91% (51 of 142) are highly affected than females 27.27% (24 of 88). This variation could be explained by the fact that the sample size was higher in male than female as most of the slaughtered shoats are males. Overall in the present study it was found that prevalence of lung worm infections was higher in coproscopic examination (33.83%) than post mortem investigations (32.6%). One of the probable reasons is that most of sheep and goat brought for slaughter house and restaurants were apparently healthy with good body condition.

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