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Prevalence of Lungworm Infection in Sheep Around Bahir-Dar Town, Northern Ethiopia

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Abstract: A cross-sectional study was carried out from October 2009 to May 2010 in and around Bahir-Dar town with the objective of identifying the species of lungworm in sheep and assessing the associated risk factors. The number of investigated animals was 384 sheep for coprology and 100 for postmortem examination. Overall prevalence rates of 17.5% and 60% found by coprology and postmortem examination, respectively. The study revealed three species of sheep lungworms in the study area: *Dictyocaulus filaria* (*D. filaria*) (76.1%), *Muellerius capillaris* (*M. Capillaris*) (61.2%) and *Protostrongylus rufescens (P. rufescens).* (11.9%). *D. filaria* was the predominant species recovered from 76.1% of the positive animals. The prevalence of *M. capillaris* and *P. rufescens* was significantly (P <0.05) higher in adult animals, greater than 24 months of age, while infection with *D. filaria* did not show significant variation with age (P >0.05). There was no significant (P >0.05) difference in the prevalence of lugworm infection between male and female animals. Lungworm infection was significantly (P <0.05) associated with the management system of sheep in the area, which is higher in traditional management system. In conclusion, this study showed that lungworm was an important parasite in sheep in the study area and traditional management system was a risk factor for its infection.

Key words: Bahir Dar · Ethiopia · Lungworm · Management System · Prevalence · Sheep

INTRODUCTION

Sheep are important contributors to food production in Ethiopia, providing 25% of the total annual meat production [1]. Despite this, sheep production and productivity is constrained by many factors of which diseases and parasites are the major ones. Lungworms are among the endoparasites frequently found in sheep and affect the production of these animals in Ethiopia and worldwide. Lungworm infection in sheep is caused by the nematode parasites *Dictyocaulus filaria*, *Muellerius capillaris* and *Protostrongylus rufescens*. *D. filaria* infection is acquired by ingestion of infective larvae with herbages but *M. capillaris* and *P. rufescens* are transmitted when Molluscan intermediate hosts are accidentally ingested by grazing animals. *D. filaria* is the most important lungworm of sheep and goats and commonly associated with a chronic syndrome of coughing and unthriftiness, which usually affects lambs and kids. *M. capillaris* and *P. rufescens* are more common but less pathogenic when compared to *D. filaria* [2, 3].

The importance of these parasites in Ethiopia has been reported by [4-7] and many undergraduate Veterinary Medicine students from various Universities in the country. However, there no information is available about the situation of this parasite in and around Bahir-Dar town. In order to implement a sound lungworm control strategy at national level, it is important that complete data should be available on the epidemiology of the parasite in different parts of the country as Ethiopia is a country with diverse agro-ecological conditions. The objective of the study was therefore, to estimate the prevalence of lungworm infection and the prevailing species of the parasite in sheep population kept under traditional and semi-intensive production system in and around Bahir-Dar town.

MATERIALS AND METHODS

Study Area and Animals: The study was conducted from October 2009 to May 2010 in and around Bahir-Dar town, which is located at 11°29'N latitude and 37°29` E longitude, at about 570 km from Addis Ababa, the capital

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of Ethiopia. The study area is situated at an altitude ranging from 1500-2300 meter above sea level and the average annual rainfall of 1200-1600 mm and the mean annual temperature of 23°C.

The study animals were selected from indigenous sheep breed population found in and around Bahir-Dar town. There are two major types of sheep production system in the area: traditional (Kept on communal grazing pasture land) and semi-intensive. Hence, the study sheep include the traditionally and semi-intensively managed sheep. All age groups of sheep were selected and grouped into three age groups: less than 6 months, 6 to 24 months and above 24 months of ages.

Study Design and Sampling: A total of 384 sheep, 236 from traditional and 148 from semi-intensive were selected randomly from the target population and included in the study (8). Moreover, lungs of 100 sheep slaughtered in various restaurants in Bahir-Dar were collected.

Sample Collection and Laboratory Examination: Faecal samples were collected directly from the rectum of the selected animals in a screw-capped glass bottles and packed in an icebox. The sex, age, production system and date of sampling were recorded while taking the sample. In the laboratory, the faecal samples were examined for the first stage larvae (L_1) by using the modified Baerman technique [3]. For the postmortem examination, the lungs of 100 sheep were collected from sheep slaughtered at different restaurants in Bahir-Dar town and transported to the laboratory in an icebox for extraction of adult lungworms following the procedures given by Urquhart *et al.* [3].

Statistical Analysis: The results from faecal and postmortem examinations were properly recorded and entered into Microsoft Excel spreadsheet and summarized by descriptive statistics. The association between the prevalence of lungworm infection and different risk factors: sex, age and management system was evaluated by using Chi-square (χ^2) test. A P value < 0.05 was considered for presence of significance. STATA version 11.0 (Stata Corp College Station, TX) was used for all types of analyses.

RESULTS

The prevalence of lungworm infection observed through coprological and postmortem examination was 17.5% and 60%, respectively (Table 1).

The lungworm species encountered during the study period were *D. filaria*, *M. capillaris* and *P. rufescens*. Infection with a single species was observed in 39 (58.2%) whereas mixed infection with two or three species was recorded in 28 (41.8%) of the 67 positive animals by coprological examination. Overall, *D. filaria* was the most prevalent species observed in 51(76.1%) of the positive animals. *M. capillaris* was the second most prevalent recorded in 41 (61.2%) animals whereas *P. rufescens* was the least dominant recovered from only 8 (11.9%) of the infected sheep. Of the mixed infections, *D. filaria* and *M. capillaris* accounted for 71.4% (Table 2).

The result of coprological prevalence of lungworm in male and female sheep was shown below (Table 4).

The prevalence of lungworm on the basis of management system was shown in Table 5.

DISCUSSION

The overall prevalence of lungworm infection in sheep was 17.5%, which is comparable to the report of Boji *et al.* [9] and Fentahun *et al*. [10]. Higher prevalence was reported from various parts of Ethiopia and different investigators [4-7, 11-13]. Apart from geographical variations, the lower prevalence observed in the current study may be attributed to increasing farmers' awareness to deworm their animals against parasitic infections. The result of postmortem examination was significantly (P < 0.001) higher when compared to coprological examination. This finding is consistent with previous observations in Ethiopia [6, 7] and Turkey [14, 15]. This difference could be due to the stage of parasite; in the prepatent (L_1) or post patent phases (L_5), it is impossible to detect these parasites by faecal examination [16] while this could be possible during postmortem inspection. Another possible explanation would be that egg production might be inhibited by immune reaction of host [17]. Also it is well known that the postmortem examination is the golden standard test and hence, should be higher as observed.

The overall prevalence of lungworm infection did not show significant association with the ages of the animals (P > 0.05). This finding is in line with the report of Addis *et al*. [4], Beyene *et al*. [18] and Weldesenbet and Mohammed [19]. But evaluation on the species level showed a significant association with ages. The prevalence of *M. capillaris* (P < 0.05) and *P. rufescens* (P < 0.001) was significantly higher sheep greater than 24 months old (Table 3).

Table 1: Prevalence of lungworm infection by coprological and post mortem examinations

Type of examination	Number examined	Total positive	Prevalence (%)	χ^2	*P*
Coprology	384	67	17.5		
Postmortem	100	60	60	73.97	0.000

Table 2: Lungworm species identified in the 67 infected sheep

Lungworm species	Observation	Proportion (%)
D. filaria	23	34.3
M. capillaris	16	23.9
D. filaria and *M. capillaris*	20	29.8
D. filaria and *P. rufescens*	3	4.5
D. filaria and *M. capillaris* and *P. rufescens*	5	7.5
Single infection	39	58.2
Mixed infection	28	41.8
Overall	67	100

Table 3: Prevalence of lungworm species in different age groups of sheep

	Prevalence in different age groups, n (%)				
Lungworm species	< 2 months (n = 69)	6 - 24 months (n = 214)	>2-6 months (n = 101)	χ^2	*P*
D. filaria	10 (14.5)	23 (10.8)	18 (17.8)	3.09	0.213
M. capillaris	2 (2.9)	22 (10.3)	17 (16.8)	8.42	0.015
P. rufescens	0	0	8 (7.9)	22.89	0.000
Overall	12 (17.4)	33 (15.4)	22 (21.8)	1.93	0.381

Table 4: Coprological prevalence of lungworm infection in various sex of sheep

Sex	No. examined	No. positive	Prevalence (%)	95% CI	χ^2	*P*
Male	158	21	13.3	8.6, 19.8		
Female	226	46	20.4	15.5, 26.4	3.22	0.073
Total	384	67	17.5			

Table 5: Coprological prevalence of lungworm infection vs. management systems of sheep

Management system	Number examined	Number positive	Prevalence (%)	95% CI	χ^2	*P*
Traditional	236	52	22.0	17.0, 27.9		
Semi-intensive	148	15	10.1	5.95, 16.4	8.94	0.003
Total	384	67	17.5			

In coprological examination, there was no significant ($P > 0.05$) difference in the prevalence of lungworm infection between male and female animals although female animals tend to have higher infection rate (Table 4). This result is in a general agreement with the report of various studies [4-6, 10, 12, 13, 19].

There was a significant difference in lungworm infection ($P < 0.05$) between the two management systems. That is, the prevalence was significantly higher in traditionally managed sheep, on communal grazing pasture (22%) than those kept under semi-intensive management system (10.1%) as shown in Table 5. This finding is in consistent with the report of Terefe *et al.* [20]. The communal grazing pasture highly contaminated by the continuously and/or visiting infected animals. This increased degree of pasture contamination in turn leading to higher prevalence of lungworm and other parasites [21]. On the other hand sheep managed under semi-intensive systems supplemented and this could improve the resistance of the animals. It is well established that poorly nourished animals appear to be less competent in getting ride off lung worm infection, although it is not unusual for well feed animals to succumb of the disease provided that the right environmental conditions are made available [22].

Dictyocaulus filaria was the most prevalent lungworm species identified (76.1%) during the period. This finding in agreement with various reports from different parts of Ethiopia [4, 5, 9, 10, 19, 19, 23, 24] and Turkey [14, 15]. The highest prevalence of *D. filaria* over the other species is most likely associated with its direct lifecycle. In contrast, *M. capillaris* and *P. rufescens* have indirect lifecycles, with land snails and slugs acting as the intermediate hosts. Transmission occurs when infected slugs or snails are accidentally ingested during grazing.

Therefore, their geographical distribution and prevalence is mainly determined by the distribution of the intermediate hosts which in turn is affected by the availability of suitable environmental conditions [2, 3]. *P. rufescens* was the least prevalent in the present study and this is probably due to its intermediate host range being restricted to certain species of snails unlike *M. capillaris,* which has a wide range of intermediate hosts [3].

CONCLUSION AND RECOMMENDATION

The result of the present study revealed higher prevalence of lungworm, which indicates it is one of the most important internal nematodosis of sheep in study area. Moreover, this study indicated sheep kept under traditional management system were at a higher risk of acquiring lungworm infection than those in semi-intensive management system. Three species of lungworms: *D. filaria*, *M. capillaris* and *P. rufescens*, were identified. Hence, due to its impact on sheep health and productivity, emphasis should be given for the control and prevention of lungworm infections. Further, detailed seasonal and other risk factors study should be done to enable the development of appropriate control strategy. Animal health extension work for awareness creation of sheep breeders about the impact of the lungworm may play key role in the reduction of this problem.

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