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Research Article

Evaluation the Prevalence of Ovine Worms in and Around Injibara

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Abstract

A cross sectional study was carried out from November 2019 to April 2020 with the objective of determining the prevalence and identifying the species of ovine lungworm occured in Injibara, Awi zone. Faecal examinations were carried out in 384 sheep with the Associated factors of age, body condition score and sexes. In the study period 152 male and 232 female were selected. A total prevalence of 35.9% was found by Modified Beremannes technique examinations. These animals were infected by different types of species namely *D. filaria* (17.18%), *P. rufescens* (7.27%), *M. capillaries* (5.46%) and Mixed infection was observed in 4.42% of the cases. *D. filaria* (17.18) was the highest predominant species in the study area. In the study period Females have higher prevalence (39.2%) than males (30.9) and younger sheep are highly infected (44.3%) than adult sheep (30.5). Even if high prevalence was observed in females and younger animals, there was no significant difference between the age and sex variables ($P > 0.05$). A significance difference was observed in body conditions (poor, 71.4%, medium, 33.4%, good, 28.2%) i.e. $p < 0.05$ for body condition variable. This research indicated that the ovine lungworm is an important disease in farmers those participated in livestock production in the area. High infestation of ovine lungworm in the area needs high engrossment to reduce the impact of the problems and due to its side effect on livestock production; concentration should be provided for the control and prevention of lung worm infection in the study area.

Keywords: Ethiopia; Injibara; Lung Worm; Prevalence; Ovine

Introduction

Sheep are the highest multitudinous of human being's familial livestock and are particularly significant in the more outermost climates. In the world 1.614 million sheep (65%) are dredged up in underdeveloped [39]. Ethiopia is the country which has the highest number of livestock population in Africa composed of more than 38,749,320 cattle, 18,075,580 sheep, 14, 858,650 goats, 456,910 camels 5,765,170 equines and 30,868,540 chickens with livestock ownership that have a vital role in socio economic value of the livelihoods of an average of more than 80% of the country side community [10].

In Ethiopia, sheep are the foremost livestock contributing up to 63% of financial income and 23% of food substitute value generated from livestock production. Sheep contributes a crucial role as root of products like meat, milk and wool for smallholder farmers in different production systems and agro-ecologcal areas of the country [17]. They also plays a role in obtaining of foreign currency [4]. Sheep contribute 25% of the domestic meat consumption; about 50% of the domestic wool requirement 40% of fresh skins and 92% of the value of semi- processed skin and hide exports trade. It is assumed that 1,078,000 sheep are used in Ethiopia for household use for year. There is also an improving export market for sheep meat in the Middle Eastern Gulf States and some African countries. At favorable off take rates, Ethiopia can export 700,000 sheep's meat in a year, and at the same time supply, 1.078,000 sheep's meat for the household market. Unlike the highest amount of population and use of sheep in the country their profitability is low. This low profitability is an indication of diseases, poor nutrition, poor animal production system and general lack of veterinary care [31]. Animal disease itself minimizes productivity by 50% to 60%. The current decrease in productivity and profit is often due to parasite infestations; which are common and main obstacle for small ruminant productivity and profitability [14].

Respiratory diseases obtained from internal worms and helminths are of a great economic importance in sheep production in the cold climate of Ethiopia where sheep crucial livestock units. *Dictyocaulidae* and certain *Metastrongylidae* are commonly found in East Africa including Ethiopia [35]. In highland area including Arsi, Asella, respiratory helimenths are the most common cause of high mortality and morbidity rates of sheep [17]**.** lungworm infection Investigations in Ethiopia [2,3,20] showed that high prevalence and importance of the infection in certain area of the country. Lung worm infection is one of the infestation of lower respiratory tract, resulting in inflammation of bronchia or pneumonia or both. Among many parasitic nematode, some cuase infection in lung including; *Dictyocaulus viviparous* in cattle; *Dictyocaulus arnifield* in donkeys and horses; *Dicyocaulus filaria*, *Protostrongylus rufescen*, and *Mullerius capillaris* in sheep and goats; *Metastroylus apri* in pigs; *filriodes (oslerus) osleri* in dogs and *Aelurostrongylus abstrusus* in cats; other lung worm infection occur but less common. These lungworms particularly *Dictyocaulus filaria* can reduce the immunity of the respiratory tract and causes death, emaciation and affects the potential productivity of sheep in the areas where it is prevalent [19].

Prevention and control of these parasites is therefore vital for gaining of the potential of sheep production. Knowledge of parasitic diseases and their seasonal and temporal dynamics must be understood to accomplish rigid rules for their control and prevention which are applicable to all areas. For this reason, a study of epidemiology of each parasitic disease should be limited to small areas [27]. However, in order to discover a lungworm control strategy and policy at local and regional level, further and detailed knowledge on epidemiology and importance of lungworm infections with respect to associated risk factors is necessary but there is no sufficient research carried out so far in the study area. Therefore, the objective of this research is:

- To determine the prevalence of lungworm infestation in sheep through baermann technique.
- To distinguish the prevalent species of the respiratory helminthes circulating in and around Injibara.
- To assess some abiotic and biotic risk factors associated with the disease in the area.

Material and Methods

Study area

The study was carried out in sheep farming highland kebeles in Injibara. The study area is found in North West Ethiopia, in Amhara region, Awi zone at a Distance 420 Km from Addis Ababa, and 118 Km from Bahirdar the regional capital. Its geographical location is 10º 53' North Latitude and 36º 56' East Longitude. The altitude of Injibara ranges from 700 - 2920m above sea level. In Injibara 800 - 2700 mm range of rainfall is recorded. The average lowest and highest temperature of Injibara ranges between 15ºc to 24ºc. The area is dega and has cold climatic condition. In Injibara there are about 74722 cattle, 62213 sheep, 5984 goats, 23955 horses, 1597 mules, 1217 donkeys, 47927 hens [9].

Study population

The study population recruit for this study were sheep owned by subsistence farmers reared in extensive grazing management system. The study of animals included breeds of local, both sex, body condition and age of sheep. 384 sheep were randomly selected for study in and around Injibara.

Study design

A cross-sectional study with simple random sampling technique was performed from November 2019 to April 2020 in Injibara to investigate the prevalence of lung worm infection in sheep and associated risk factors selected for study. The study of animals include breeds, both sex and age of sheep. From these individuals of sheep were determined for the prevalence of lung worm at the time of examination through clinical or coproscopic.

Sample size determination

The required sample size for this study was done using the formula given by Thriesfold [34]:

$$n = \frac{1.96^2 p_{ex}(1 - P_{ex})}{d^2}$$

Where

n=required sample size

P_{exp}= expected prevalence

d= desired absolute precision

1.96^2 = z-value for the 95% confidence level.

Since there was no any research carried out on previously in Injibara, 50% expected prevalence was used. Therefore, using 50% expected prevalence and 5% absolute precision at 95% confidence interval, the number of animals needed in this study were calculated to be 384.

Sampling method

The study was cross-sectional design with simple random sampling method to calculate the prevalence of ovine lung worm infection in and around Injibara. A total of 384 sheep were randomly selected from each Kebeles, peasant associations and households that are found in and around Injibara. Barmann technique of coprological examinations of fecal samples was used to calculate the prevalence of lung worn infestation in the study area.

Study methodology

Coprological examination

- **Sample Collection:** 384 fecal samples were collected directly from the rectum by two fingers after wearing disposable gloves of selected animals in a universal bottle and then was transported to Injibara veterinary clinic Laboratory rapidly and all the sample collected was processed by modified Bearmann technique [11]. All samples will be clearly labeled with the date of sampling, sex, age, breed, body condition score, altitude, anthelmintic usage, season, soil type and the management system that was used (annex 2). The age of animals was collected from the sheep owners and dentations (annex 3).

- **Laboratory Technique:** Using Modified Baerman technique (annex 1) five grams of fresh faces were weighed from each sample for processing. The larvae and enclosed gauze was fixed on to astringe rode was half inserted in a clean glass tube which were filled with warm water left for 24 hours and the sediment was examined under lower power of microscope after siphoning off the supernatant. If the worm is not distinguished under microscopes, the tested samples were recorded as negative for lung worm infection. In both cases, the result that was tested for each sample was registered to their corresponding specific animal [15,38]. Then after the wrapped faeces were removed and the supernatant discarded from the beaker, the sediment was transferred to the Petridish for examination of L_1under microscope. All larvae $_{L1}$ were distinguished morphologically as expressed by previous researchers [1].

Data analysis

The collected data was inserted and managed in MS –Excel spread sheet automatically. After that all the data analysis was processed by Statistical Package for Social Science (SPSS) software version 20. Descriptive statistics such as percentages and frequency distributions were used to investigate the nature and the characteristics of data. The prevalence of lung worm infection was calculated using percentages. The associations of different risk factors with the disease were calculated by Chi - square (x^2) test.

Results

Overall prevalence

Of the total 384 sheep tested, 35.93% (confidence interval ((CI) =95%) were investigated to be infected with either one or more of the lungworm species. The lungworm species identified found during the study period were *Dictyocaulus filaria*, *Protostrongylus rufescens, Muellerius capillaries* and mixed infection which amounted for a prevalence of 17.18%, 7.27%, 5.46%, and 4.42% respectively (Table 1).

Prevalence of lungworm infestation by age and sex

The lungworm infestation prevalence in sex was investigated to be 47(30.9%) in the male and 91(39.2%) in the female animals. No statistically significant difference was observed with in sex. ($p>0.05$) as presented in table 1. The lung worm infestation in various age groups was infected to be 67(44.3%) in the young age group and 71(30.5%) in the adult animals. No statistical significant difference was also observed ($P>0.05$) between young and adult age groups as presented in table 1.

Prevalence of lung worm infestation by body condition

The lungworm infection in relation to the physical body condition score was recorded to be 71.4% in the animals with poor body condition, 33.4% in those with medium body condition and 28.2% in the animals with good body condition. Statistically significant difference was observed ($P < 0.05$) in lungworm infection rate among the physical body conditions in *D. filaria* and *P. rufescens* infestations (p-value=0.001 and 0.009 respectively) (Table 1).

Discussion

In this study, various trials were performed to determine the prevalence of lung worm infection in and around Injibara. Coprological test of faecal samples was used to determine the overall

Variable	No of sheep examined	No of sheep infected				
		D. filari (%)	*p. rufesense*	*M. capillary*	Mixed (%)	Total (%)
Age	Young 151	31(20.5%)	17(11.3)	12(7.9%)	7(4.6%)	67(44.3%)
	Adult 233	35(15%)	17(7.3%)	9(3.9%)	10(4.3%)	71(30.5%)
	X^2	1.953	1.782	2.957	0.026	
	p-value	0.162	0.182	0.086	0.873	
	95% confidence Interval	0.401_1.167	0.306_1.257	0.191_1.133	0.343_2.479	
Sex	Male 152	22(14.5%)	11(7.2%)	8(5.3%)	6(3.9%)	47(30.9%)
	Female 232	44(19.0%)	23(9.9%)	13(5.6%)	11(4.7%)	91(39.2%)
	X^2	1.302	0.815	0.021	0.137	
	95% confidence Interval	0.791_2.417	0.667_2.985	0.432_2.643	0.438_3.347	
Body condition	Poor 49	17(34.7%)	10(20.4%)	5(10.2%)	3(6.1%)	35(71.4%)
	Medium 162	27(16.7%)	12(7.4%)	9(5.6%)	6(3.7%)	54(33.4%)
	Good 173	22(12.7%)	12(6.9%)	7(4.0%)	8(4.6%)	49(28.2%)
	X^2	13.011	9.314	2.805	0.760	
	p-value	0.001	0.009	0.246	0.549	

Table 1: Prevalence of lungworm infection in ovine hosts in relation to hypothesized risk factors (variables).

prevalence of lung worm infestation in the study area. Coprological examination of faecal samples indicated that 35.9% of overall prevalence of lung worm infestation in the study area. The total lung worm infection prevalence outcome almost agree with the previous parasitologist researchers 34.9% at Ambo District, Oromia, Ethiopia [13], 40.4% in Dessie and Kombolcha areas, Northern part of Ethopia [28]. These coincidment/similarity in the prevalence might be associated with the similarity in agro-ecology of study areas which favor the survival of parasites larvae in general and/or the snail intermediate host in case of *P. rufescens* and *M. capillaries* in particular, nutritional condition, management type of the animal, rain fall, humidity and temperature similarity and similar season of study on the respective study areas. But, it was lower than 70.7% prevalence in Debre Tabor district, 73.75% in Debre Birhan [3,8,20,26] and 71.3% in six places of Wollo district at high geographical altitude [29]. The best description for such infection rate difference might be affection difference in agro-ecology, various climatic conditions difference and season of examination on the corresponding study areas, which help or suppress the survival of lung worm larvae [5]. The study analysis observed is higher than with the research carried out in different districts of Ethiopia, 13.4% in Mekele town [21]. This difference could be contributed to the variations in infestation amount of the study areas and the previous studies might carried out in the dry season, hot climatic areas, well managed, feed quality and treated animals.

Three species of lungworm helminth parasites were distinguished: *D. filaria (*17.8%), *P. rufescence* (7.27%) *M. capillaries* (5.46%). Prevalence of lungworm infection caused by *D. filaria (17.18%)* was found to be the highest. Correspondent outcomes were reported in some districts of Ethiopia as 15.09% in Dessie and Kombolcha, South Wollo and 13% in and around Bahir Dar District [31]. Even if, evident variation were also famed with some works, 32.20% in Gayint Awraja [32], 39.79% in and around Assela [42], 30.74% in Chilalo adistrict [26], 73% in and around Debra Berhan town [42]. But it disagrees with the report of Sefinew., *et al.* [29] *Mullrius capillaries* was found to be the highest (49.7%). The variation in mean worm burden might be due to the unfavorable condition for the intermediate host of *Protostrongylus rufescens* in Injibara district and the presence of direct life cycle in *D. filaria*, which did not need intimidate host.

P. rufescens was the second highest abundant species, as the present finding showed with prevalence of 7.27%. This result coincides with the work of Teffera (1993) [32] in Dessie and Kombolcha areas (10.57%) and in and around Debre Birhan 12.6% and Yekitie (2009%) [40] in and around Debre Birhan 9.11% and lowers than

the previous study reported by (Wondwesson, 1992) in and around Assela (36.13%) and Paulos (2000) [26] in Chilalo area (23.71%). Sisay (1996) [30] in Bahir Dar 39.3%. Because, *P. refescens* has indirect life cycle that needs longer time and colder season to finish their complex life cycle in the presence of favorable intermediate hosts that helps for suitable states for sporadic distribution.

As for *M. capillaries*, this study indicated that it is the lowest abundant in the present study, 5.46% This report was dissimilar with the work of Teffera (1993) in Dessie and Kombolcha district (15.48%), (Wondwesson, 2000) in Bahir Dar and its surrounding (39.3%), (Paulos, 2000) [26] in Chilalo district (26.61%) and in Debra Berhan [43] and its surrounding (12.6%) in Hamasien Awraja (20.5%). The low prevalence rate of *M. capillaris* in the place where the study conducted could be contributed to the fact that the study of the season (for example automn/belg - which was short rainy season) which does not aggravate the development of the snail intermediate hosts [22].

The prevalence of mixed infection (4.42%) investigated in the present study, this study coincides with Sisay (1996) [30] who reported 7.6% in Bahir Dar and its surrounding. The present study was dissimilar with the prevalence studied by Teffera (1993) [32] in Dessie and Kombolcha (58.86%). These differences could be due to the variations in altitude, season of the study time and highly presence of the mollusc, and intermediate hosts in the area [42].

Generally, these differences in the prevalence might be associated with the variations in agro-ecology of the study areas which favor the survival of parasites larvae 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 and requires shorter time to develop to an infective stage [41]. Compared with *D. filaria,* the transmission of infection of lungworm than *P. rufescens* and *M. capillaris* is epidemiologically complex condition including epidemiological triads like host, parasite and intermediate host. In addition to this, the low prevalence of both *M. capilaris* and *P. rufescens* in the study area might be attributed to the fact that the study was done in dry season which does not favor the development of the snail intermediate hosts. *M. capillaris* and *P. rufescens* in sheep require slugs or snails as intermediate hosts, which must be eaten for infection to occur [41].

A trial was furthermore made to distinguish the effect of age and sex on the overall prevalence of lungworm infection and statistical difference was not observed ($P > 0.05$) in the infestation rate of all lungworm species in sex and age factors. However, a high infection prevalence of overall lungworm was recorded in youngest (44.3%) than adults (30.5%) which is in agreement with the observations of Blood (1979) [6]. This might be associated with the apparent inability of the host to develop acquired immunity so that young animals have the heaviest infections and the highest prevalence [38]. This has been partly explained by the analysis given as though, infection with *M. capilleries* and *P. rufescens* did not indicate progression of acquired immunity. The acquired immunity improved older sheep due to previous exposure of *D. filaria* and that recovered from the infection have better immunity against reinfection [12].

In the present study females are highly affected (39.2%) than in male animals (30.9%). The result is in agreement with previous work done in and around Bahirdar [42]. In North and South Gondar, Female 28.9%, Male 13.4% and Female 43.3% and Male 33.57% respectively. This variation in prevalence between female and male animals might be due to the reason that resistance to infection is increased at the time of parturition and during early lactation [12]. This also was agree with research study reported by Dawit and Abdu (2012) [13] and Hasen., *et al*. (2013) [20]. These may be due to the fact that improper distribution of sample selection between the two sexes [26]; or else most of the sampled females are not in periparturient period during the study time [37].

While assessing the influence of body condition score on the prevalence of lungworm infection, the result of the study indicated that the prevalence of rate of 71.4%, 33.4% and 28.2% in poor, medium and good body condition scores, respectively. The prevalence was significantly the highest ($P < 0.05$) in those sheep with loss of body weight or emaciated than in those with medium or good body conditions. This is in accord with the report of Thomson and Orita (1988) [33]. The possible explanation for this observation could be due to immuno-suppression in sheep with poor body conditions concurrent infection by other parasites including GIT helminthes and/or malnutrition [23]. Poorly managed sheep appear to be less competent in getting rid of Lungworm infection [26]. Evidently, the infestation with a parasite by itself might results in progressive emaciation

Conclusion and Recommendations

The overall prevalence of ovine lungworms recorded in the study area was high. *D. filaria*, *P. rufescens* and *M. capillaries* were the species of respiratory nematodes identified in the study area while, D. filarial being the higher in predominant one, although mixed infections was also observed. Female animals are more susceptible to lungworms infection than males. Younger sheep were found to be more affected by the infection of lungworms than older ones. The lungworm infection was the highest in those sheep with poor body conditions than in those with medium or good body

conditions. Finally, the result of current study revealed that lungworms are major parasites that affect the health and productivity of sheep in the area; the economic implication of the disease seems very huge. In view of these facts the following recommendations are forwarded;

- Regular strategic deworming with broad spectrum ant-helmentics.
- Animals should not be allowed to have access to moist and swampy pastures.
- Prohibitions of sheep to graze early in the morning and evening and in rainy weather when the intermediates host (snail and slug) are prominent.
- Isolation of most susceptible age groups (young) from adult in the first season of grazing.
- Supplementation of additional feed to sheep's to make well nourished and good body condition.

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Annexes

Annex 1: Procedure of Modified baerman technique.

- Take 5 - 10 gm faeces from the rectum of the animal.
- Wrap it in double layer guaz and suspend in beaker containing warm water using aclip wire.
- Immerse partially the faeces in the water and allow to stand for 24 hours.
- Remove the wrapped faeces.
- Discard the supernatant beaker.
- Transfer the sediment to the petridish.
- Add in slide and cover by cover slip.
- Examine the larvae under a microscope (Charles and Robinson, 2006).

Annex 2: Data collection format.

Date	Owners name	Address	ID no	Sex	Age	Breed	Management system	Body condition	Lab result

Table 2

Annex 3: To determine the age of sheep

Age of every sampled sheep was determined based on dentition. Those which have not erupted permanent incisor teeth, were classified as young, while those with one pair or more permanent incisor teeth were classified as adults (Gatentby, 1991).

Annex 4: Body condition scoring of small ruminant.

Annex 5: Morphology identification of ovine lung worm larvae.

Condition	Score	Lumbar region	Rib cage	Sternum
Starving	0	Extremely emaciated and on the point of death. It is not possible to detect any muscle or fatty tissue between the skin and the bone.	Skin is sunken between visible ribs.	There is no sternal fat.
Very thin	1	The spinous processes are prominent and sharp. The transverse process are also sharp, the fingers pass easily under the ends, and it is possible to feel between each process. The eye muscle areas are shallow with no fat cover.	Ribs are clearly visible.	Sternal fat is easily grasped and moved from side to side.
Thin	2	The spinous processes feel prominent but smooth, and individual processes can be felt only as fine corrugations. The transverse processes are smooth and rounded, and it is possible to pass the fingers under the ends with a little pressure. The eye muscle areas are of moderate depth, but have little fat cover.	Some ribs can be seen. There is a small amount of fat cover. Ribs are still felt.	Sternal fat is wider and thicker but can still be grasped and moved slightly from side to side.
Moderate	3	The spinous processes are detected only as small elevations; they are smooth and rounded and individual bones can be felt only with pressure. The transverse processes are smooth and well covered, and firm pressure is required to feel over the ends. The eye muscle areas are full, and have a moderate degree of fat cover.	Ribs are barely seen; an even layer of fat covers them. Spaces between ribs are felt using pressure.	sternal fat is wide and thick. It can still be grasped but has very little movement.
Fat	4	The spinous processes can just be detected with pressure as a hard line between the fat covered eye muscle areas. The ends of the transverse processes cannot be felt. The eye muscle areas are full, and have a thick covering of fat.	Ribs are not seen.	Sternal fat is difficult to grasp and cannot be moved from side to side.
Very fat	5	The spinous processes can't be detected even with firm pressure, and there is a depression between the layers of fat in the position where the spinous processes would normally be felt. The transverse processes cannot be detected. The eye muscle areas are very full with thick fat cover. There may be large deposits of fat over the rump and tail.	Ribs are not visible and are covered with excessive fat.	Sternal fat extends and covers the sternum. It can not be grasped
No 0, 1 and 2 are classified as poor body condition, no 3 is classified as medium body condition where as No 4 and 5 are classified as good body conditions of sheep. Source: (Thompson and meyer, 2002).				

Table 3

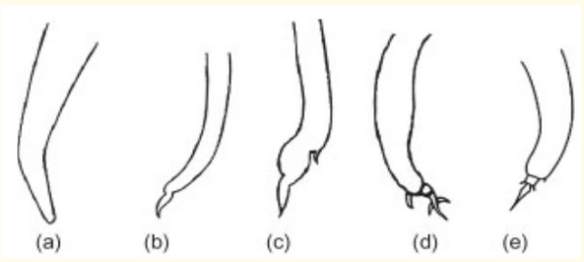

Figure 1: Comparison of the posterior region of the first stage larvae of (a) D. filaria, (b) P. rufescens, (c) M. capillaries(d) Cystocaulus ocreatus and (e) Neostrongylus linearis (Taylor., et al., 2007).

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