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Small Ruminants Lungworms Infection in Highlands of Bale and Arsi Zone, Southeastern Ethiopia

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Abstract: A cross-sectional study was conducted from September 2014- October 2015 to determine the prevalence, identify the species involved and determine associated risk factors of lungworm infection in small ruminant in selected highland areas of Bale and Arsi zone, Southeast Ethiopia. Faecal samples were collected from randomly selected 739 small ruminants (731 sheep and 8 goats) and examined for the presence of the first stage larvae (L1) using modified Baerman technique. The overall prevalence recorded by faecal examination was 426(57.6%). Higher infection rate was recorded in young (80.2%) and poor body condition (88.6%) animal than adult (49.2%) and good body condition 44.6%) animals. The difference was statistically significant. Significantly lower prevalence of lungworms was recorded in those animal treated (14%) with an anthelmintic than non-treated animals (76.3%). *Dictyocaulus filarial, Protostrongylus rufescens* and *Muellerius capillaris* were identified by faecal examination with total prevalence of 35.5, 11.2 and 41.4%, respectively. Of the total 180 (24.4%) small ruminants were infected with multiple species of lungworms. In conclusion, this study revealed the importance of lungworm infection in the study area and integrated efforts towards good animal husbandry and animal health care through control of the intermediate host population and strategic deworming are very important for control of lungworms infection in small ruminants.

Key words: Goat · Highland · Lungworms · Sheep

INTRODUCTION

The livestock subsector has an enormous contribution to Ethiopia's national economy and livelihoods of many Ethiopians. The subsector contributes about 16.5% of the national Gross Domestic Product (GDP) and 35.6% of the agricultural GDP [1]. It also contributes 15% of export earnings and 30% of agricultural employment. The livestock subsector currently support and sustain livelihoods for 80% of all rural population [2]. Small ruminants are important component of livestock sector of Ethiopia and valued for a variety of important contributions in lives of pastoral and farmers' households. Thus, they reared by farming community with several objectives to meet the socio-economic and cultural need. Small ruminants play an important role in financial security, women's empowerment and insurance. They are also important in a diversification strategy that aims to reduce market and climatic risks and optimize the use of available resources. However, their potential contribution is constrained by animal health problems such endoparasitic infections.

Endoparasites, including lungworms, are the major cause of death and morbidity in the Ethiopian highlands. *Dictyocaulus filaria, Protostrongylus rufescens* and *Muellerius capillaris* are the most common lungworms species identified in small ruminants in Ethiopia [3-8]. These lungworms particularly *D. filaria* can suppress the immunity of the respiratory tract [9] and causes death, poor weight gain or loss of body weight as well as greatly affects the potential productivity of sheep and goat industry in the areas where it is prevalent. Highland of Bale and Arsi Zone have favorable climatic and agro-ecological conditions for the development of *D. filaria* and survival and availability of intermediate hosts for *M. capillaris* and *P. rufescens*. Information on prevalence of lungworms on small ruminates and associated risk factors

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on study areas are prerequisite for proper implementation of control measures. Therefore, the objectives this study was to determine prevalence of lungworm infection, identify the species involved and assess associated risk factors in the highlands of Bale and Arsi zone, Southeast Ethiopia.

MATERIALS AND METHODS

Study Areas: The study was conducted in two zone of Oromia regional state namely Bale and Arsi zone. Goba and Dinsho districts were selected from Bale zone. Goba and Dinsho districts are located southeastern part of Ethiopia 430 km and 400km far from Addis Ababa at elevation of 2503 and 3106 meters above sea levels respectively. From Arsi zone Lemu-Bilbilo district were selected for study. Lemu-Bilbilo district is located southeastern part of Ethiopia 231 km far from Addis Ababa and at altitude ranging 2755 to 2878 meters above sea levels.

Study Animals and Sampling Methods: Carpological examination was conducted on 739 small ruminants (731 sheep and 8 goat) selected from Goba, Dinsho and Lemu-Bilbilo districts from September 2014- October 2015. The study animals were kept under extensive traditional management system by rural households in which animals were allowed to graze on natural pasture freely during daytime and kept in open enclosure or house during the night. All animal from randomly selected households were used for study. Both sex and age groups of small ruminants were considered for faecal sample collection.

Faecal Sample Collection and Examination: Approximately 10gm of faecal samples were collected directly from the rectum of selected animal and kept in screw capped universal bottles. The bottles were then labeled with unique identification number of animals and transported to nearby veterinary clinics in each selected districts in icebox for carpological examination. During faecal sample collection, information regarding the sex, age, species, body condition and treatment status with anthelmintic of individual animal was recorded using recording formats. Age of each animal was determined by dentition as described by Girma and Alemu[10] and categorized as young (less than 1 year old) and adult (greater than 1year old). Body condition of each sampled animal was carried out according to the method described by Girma and Alemu [10] and categorized in to two scores as poor and good. Faecal samples were examined for presence of larvae 1using modified Baerman technique. Briefly, about 10 grams of fresh faeces was taken and wrapped with gauzes, fixed on a string-rod on the conical flask and submerged in a conical flask filled with warm water of about 45°C which covers about ¾ of the faecal samples. Then the sample was kept overnight undisturbed for about 24 hours. Then supernatant was discarded and a sample left at the bottom was examined for moving lungworms larvae under the stereomicroscope. The positive sample subjected to further examination for species identification following methods described by Van Wyk and Mayhew [11].

Data Management and Analysis: The collected datawerefirst entered and managed on Microsoft (Ms) excel spread sheet. All the process of data handling, coding, cleaning and validation was carried out on this spread sheet, were transferred and analyzed using SPSS package version 20. Descriptive statistics was used to compute frequency and animal level prevalence. Ch-square test were used to assess the association between the disease and exposures of the potential risk factors. In all analysis, confidence level was held at 95 % and P=0.05 was set for significance.

RESULTS

Of total 739 small ruminants examined for lungworms, 426(57.6%) animal were infected by one or more lungworms species (Table 1). Highest prevalence of lungworm infection was observed at Dinsho (67.7%) followed by Goba district (64.6%). Statistically significant differences were observed between districts. The infection rate was higher in sheep (57.7%) and male (61.8%) than goat (50%) and female (56.8%), respectively, however the difference was statistically insignificant. In this study, higher infection rate was recorded in young (80.2%) than adult (49.2%) and the difference was statistically significant. Higher prevalence of lungworms infection was recorded in animal with poor body condition (88.6%) than with good body condition (44.6%) animals. Lower prevalence of lungworms was recorded in those animal treated (14%) with an anthelmintic than non-treated animals (76.3%). The difference was statistically significant.

Table 1: Overall prevalence lungworms in small ruminants in highlands of Bale and Arsi zone

Risk factors		No. tested	No. positive (%)	X^2	P-value
Districts	Dinsho	192	130(67.7)	24.04	0.000
	Goba	192	124(64.6)		
	Lemu	355	172(48.5)		
Species	Ovine	731	422(57.7)	0.194	0.660
	Caprine	8	4(50)		
Sex	Female	616	350(56.8)	1.037	0.308
	Male	123	76(61.8)		
Age group	Young	202	162(80.2)	57.90	0.000
	Adult	537	264(49.2)		
Body condition	Poor	219	194(88.6)	122.021	0.000
	Good	520	232(44.6)		
Treatment status	De-wormed	221	31(14)	245.68	0.000
	Non-dewormed	518	395(76.3)		
Total		739	426(57.6)		

Table 2: Identified lungworms species and associated risk factors in small ruminant in highlands of Bale and Arsi zone

			D. filaria		*P. rufescens*		*M. capillaris*	
Risk factors		No. tested	No positive (%)	X^2 (P-value)	No positive (%)	X^2 (P-value)	No positive (%)	X^2 (P-value)
Districts	Dinsho	192	79(41.1)	8.52(0.014)	21(10.9)	4.239(0.12)	94(49)	6.317(0.042)
	Goba	192	76(39.6)		29(15.1)		77(40.1)	
	Lemu-Bilbilo	355	107(30.1)		33(9.3)		135(38)	
Species	Ovine	731	260(35.6)	0.38(0.534)	83(11.4)	1.023(0.31)	303(41.5)	0.05(0.82)
	Caprine	8	2(25)		0(0.00)		3(37.5)	
sex	Female	616	216(35.1)	0.24(0.621)	63(10.2)	3.743(0.05)	256(41.6)	0.04(0.85)
	Male	123	46(37.4)		20(16.3)		50(40.7)	
Age category	Young	202	103(51.0)	29.32(.000)	32(15.8)	5.926(0.01)	123(60.9)	43.5(0.00)
	Adult	537	159(29.6)		51(9.5)		183(34.1)	
Body condition	Poor	219	131(59.8)	80.733(0.000)	37(16.9)	5.926(.015)	14(164.4)	67.72(0.00)
	Good	520	131(25.2)		46(8.8)		165(31.7)	
Treatment status	De-wormed	221	21(9.5)	92.78(0.00)	6(2.7)	22.9(0.00)	21(9.5)	132.2(0.00)
	Non-dewormed	518	241(46.5)		77(14.9)		285(55)	
Total	739	262(35.5)		83(11.2)		306(41.4)		

Identified larvae of lungworms during faecal examination were *Dictyocaulus filaria, Protostrongylus rufescens* and *Muellerius capillaris* with total prevalence of 35.5, 11.2 and 41.4%, respectively (Table 2). One hundred eighty (24.4%) small ruminants were infected with multiple species of lungworms. Different infection rate were recorded in all identified species of lungworms. However, statistically significant different infection rate were recorded only between age groups (young and adult), body condition (poor and good) and treatment status (dewormed and non-dewormed).

DISCUSSION

Detection of lungworm infection in small ruminants by faecal examination in the study area revealed prevalence of 57.6% which was in close agreement with previous finding of 57.1% from Tiyo district [12] and North East Ethiopia of 53.6 % [8]. The current finding was relatively higher than those reported in and Around Wukro; 25.69% [3], Gonder town; 33.83% [13], Mekedella district; 28.6% [14], in and around Jimma Town; 29.04% [5] and Ambo District; 34.90% [15]. However, the current finding was relatively lower than reports from Deberehan[16], Assella[17]and Wogera District [6]with prevalence of 73.75, 72.44and 67.69%, respectively. Variation in prevalence of lungworms across the study sites might be attributed from agro-ecology, altitude, rainfall, humidity and temperature difference and season of examination on the respective study areas which favor or disfavor the survival of parasite larvae and harboring the intermediate host [7, 13, 18,19].

The results of current study revealed that infection rate in less than one year was higher than older animals. Similarly, several studies reported that young animals were more susceptible in comparison with adult animals

[7,13, 19]. This might be associated with the naturally acquired immunity against infection in older animals which slowly developed due to the previous exposure and better immunity against reinfection after recovering from the disease [18, 20]. In this study significantly higher prevalence of lungworms infection were observed in poor body condition animals than with good body condition. The significant difference in the occurrence of the lungworm infection between those treated with anthelmintic and non-treated was observed. This could be due to the fact that the drug reduced prevalence of lungworms.

The result of current study indicated that *M. capillaries* (41.4%) was the most predominant lungworm species in study area followed by *D. filaria*(35.5%) and *P. rufescens*(11.2%) was the least predominant. This result was in agreement with the previous reports from different parts of Ethiopia [7, 8, 21]. However the result of this study disagreed with the previous reports by other researchers [3, 4, 5,6]. The observed prevalence difference between reports could be attributed to availability of suitable environmental condition for both intermediate host and the parasite. The highest prevalence of *M. capillaris* in this study could partly be attributed to its indirect life cycle of using intermediate host [22, 20]. Furthermore, L1 larvae of *M. capillaris* are fairly resistant to drying and the stages in snails are well protected during adverse conditions over prolonged durations [20, 22] and can also survive up to a week after the death of the intermediate host [23]. On the other hand, *D. filaria* has direct life cycle [20] and its larvae are generally more susceptible to adverse environmental conditions than that of *M. capillaris* [22]. The lowest prevalence of *P. rufescens* in this study might be observed due to the fact that intermediate host for *P. rufescens* is restricted to certain species of snails. In conclusion, this study revealed the importance of lungworm infection in the study area and integrated efforts towards good animal husbandry and animal health care through control of the intermediate host population and strategic deworming are very important. Molecular, epidemiological, financial analysis and mathematical modeling should be carried for the characterization, mapping and economic impact of the Parasites. Furthermore, potential intermediate host incriminated for transmission of the lungworm should be identified and characterized.

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