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Prevalence of Small Ruminant Ectoparasites and Associated Risk Factors in Selected Districts of Tigray Region, Ethiopia

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Abstract: A cross-sectional study was conducted from October 2009 to May 2010 with the objective of estimating the prevalence of ectoparasites in small ruminants and identifying the potential risk factors in selected areas of Tigray region. A total of 991 small ruminants (600 sheep and 391 goats) were examined for presence of ectoparasites. Accordingly, a total of 310 (51.7 %) sheep and 233 (59.6%) goats were found infested with one or more ectoparasites. The overall prevalence for both host species was 54.8% (n=543). The major identified ectoparasites in sheep were ticks (48%), sheep ked (6.7%) and lice (1.3%) and in goats were ticks (58.8%), lice (6.1%) and fleas (3.1%). Among the risk factors, agro-climatic zone, body condition score, flock size and flock type were found to be significantly associated with the prevalence of ectoparasites in the study area. The prevalence of ectoparasites infestation was significantly higher in small ruminants of the lowland and midland, small ruminants with poor body condition score, large flocks and mixed flocks than in their contemporaries within the same comparison category ($P < 0.001$). To reduce the high prevalence and impact of ectoparasites on small ruminants appropriate and strategic control measure; extension service aiming at creation of awareness about the importance and control of ectoparasites for smallholder farmers is needed.

Key words: Ectoparasites · Prevalence · Risk factors · Small ruminants

INTRODUCTION

Small ruminants represent the most important part of the Ethiopian livestock system. The sheep and goats population of the country is estimated to be 25.5 and 23.4 million respectively. From these small ruminant populations, Tigray region possesses about 687,212 sheep and 1.759,126 goats in the country [1]. Small ruminants are exploited in the country for diverse purposes including meat, milk and skin production, breeding and as means of cash income. Skins and hides of livestock have the largest share of exports in Ethiopia [1, 2]. Annually 16.2 million pieces of skins are produced in the country, based on the off take rates of 33% and 32.5% for sheep and goats respectively [3, 4]. According to the FAO statistical yearbook [4] report about $1.56x10^5$ tones meat were produced by small ruminants in Ethiopia. Although large number of sheep and goats are slaughtered per annum, quality skins production remains very low due the effect of ectoparasites. In Ethiopian tanneries, 35% of sheep and 56% of goat skins have been downgraded and rejected due to defects caused by external parasites [5]. The study done for assessment of major factors that cause skin rejection at Modjo export tannery, Ethiopia, revealed that ectoparasites play key role in the rejection of skin [6]. All ectoparasites cause intense irritation to the skin, the extent depending on the parasite involved. Infested animals scratch, rub and bite the affected areas and this end up with skin damage [7, 8]. Ectoparasites of small ruminants cause blood loss and very heavy infestations result with severe anaemia. Moreover, they are the most important vectors of protozoan, bacterial, viral and rickettsial diseases [8]. All these contributed towards the extreme reduction of small ruminant productivity. In Ethiopia there is limited information regarding the prevalence and distribution of small ruminant ectoparasites.

Therefore, the objective of the present study is to estimate the prevalence and to identify the prevailing species of sheep and goat ectoparasites in the different agro- ecological zones inTigray region.

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MATERIALS AND METHODS

Study Area and Animals: The study was carried out in three districts selected from Tigray region, northern Ethiopia, namely: Alamata, Mekelle and Saesi-Tsaedamba. Agro-climatically, these areas are lowland, midland and highland respectively. Alamata has an altitude less than 1500 m.a.s.l. The annual rain fall of the area ranges from 500-600mm and the minimum and maximum temperatures are18°C and 27°C respectively. The altitude of Mekelle ranges from 2000-2270 m.a.s.l. and receives an average annual rain fall of 579 to 650mm. The maximum and minimum annual temperatures of the area are 24.1°C and 11°C respectively. Saesi-Tsaedamba has an altitude greater than 2500 m.a.s.l. The mean annual rain fall of the area was 520-672 mm and average maximum and minimum temperatures are 18.3°C and 5.8°C, respectively [9]. The study animals were sheep and goat population in the three districts, which were owned by smallholder farmers under traditional management system.

Study Design and Sampling: A cross-sectional study was employed to address the objective of the study. The study animals were selected by systematic random sampling technique and the required sample size was determined based on expected prevalence of 50% and the formula given by Thrusfield [10]. The study considered 95% confidence interval and 5% precision level. Accordingly a total of 991 sheep and goats were selected and studied. The considered risk factors were agro-climate, study animal (species, sex, age, coat type and body condition score), flock size and flock type.

Sample Collection: A total of 991 animals (600 sheep and 391 goats) were randomly selected from the three agro-climatic zones and examined for presence of ectoparasites. Before clinical examination, the age and body condition of each selected animals were recorded. The age and body condition score (BCS) of sheep and goats were determined based on the description given by Gatenby [11] and Steele [12] respectively. The clinical examination was performed by multiple fleeces parting in the direction opposite to that in which hair or wool normally rests and visual inspection and palpation of the skin for parasites on all parts of the animal including ears and digits. Ectoparasites such as ticks, lice, sheep ked and fleas were collected by hand from their attachment site and put in clean universal bottle with 70% alcohol [13]. The collected samples were transported to the laboratory and examined under stereomicroscope for identification following the identification key given by Urquhart *et al*. [13] and Walker *et al*. [14].

Data Analysis: All collected data were recorded and managed on Microsoft Excel and STATA version 11.0 statistical software (STATA Corp., TX) was used for all descriptive and statistical analysis.

RESULTS

Overall Prevalence of Ectoparasites: From a total of 991 examined small ruminants, 54.8% animals (543/991) were found to be infested with one or more ectoparasites (Table 1). The full list for both sheep and goats is shown in Table 2 below. The major identified ectoparasites in order of predominance in sheep were ticks (48%), sheep ked (6.7%) and lice (1.3%), whereas in goats were ticks (58.8%), lice (6.1%) and fleas (3.1%). The prevalence of tick and lice infestation was significantly ($p < 0.01$) higher in goats than sheep. Similarly, the overall prevalence of ectoparasites infestation was significantly ($p < 0.05$) higher in goats than sheep (Table 1).

Species Identification: Six species of three ticks genera were identified in both sheep and goats. From the six species observed, *Rhipicephalus evertsi evertsi* was the most abundant both in sheep and goats in all the agro-climatic zones. *Hyalomma marginatum rufipes* was found in the midland and lowland. Goats in the lowland were infested with all the six species of identified ticks and *Rh*. *Praetextatus* and *Rh*. *pulchellus* were observed on goats and only in the lowland area. Sheep ked was found from sheep and it was only from highland. The detail of genera and species of identified ectoparasites both in sheep and goats with their respective agro-climatic zones were shown in Table 2.

Risk Factors: The univariate logistic regression analysis of risk factors showed that agro-climate, flock type, BCS, flock size ($P < 0.01$) and animal species ($P < 0.05$) had statistically significant association with the prevalence of ectoparasites. The risk factors analysis outcome is shown in Table 3. Further, all the risk factors with $P < 0.25$ in univariate analysis were subjected to backward stepwise multivariate logistic regression analysis. Accordingly, the final model disclosed four factors: agro-climate, BCS, flock size and flock type for the prevalence ectoparasites in small ruminants in the study districts (Table 4).

Table 1: Overall prevalence of ectoparasites in sheep and goats in all the study area

	Sheep (n=600)		Goats (n=391)		Total (n=991)	
Ectoparasites	Number infested	Prevalence (%)*	Number infested	Prevalence (%)*	Number infested	Prevalence (%)
Ticks	288	48.0[a]	230	58.8[b]	518	52.3
Lice	8	1.3[a]	24	6.1[b]	32	3.2
Fleas	-	-	12	3.1	12	1.2
Sheep ked	40	6.7	-	-	40	4.0
Overall	310	51.7[a]	233	59.6[b]	543	54.8

* Prevalence rates with different superscripts (a and b) within the same row are statistically different ($p < 0.01$)

Table 2: Species and proportion of identified ectoparasites in both sheep and goats

	Sheep			Goats		
Ectoparasite	HL	ML	LL	HL	ML	LL
Ticks						
- *Rh. evertsi evertsi*	96.6	75.0	67.4	-	59.6	20.7
- *Rh. pravus*	-	4.7	32.6	-	-	20.7
- *Rh. praetextatus*	-	-	-	-	-	17.2
- *Rh. pulchellus*	-	-	-	-	-	20.7
- *Hy. m. rufipes*	-	3.1	-	-	-	20.7
- *B. decoloratus*	3.4	17.2	-	-	40.4	20.7
Lice						
- *L. Stenopsis*	-	-	-	-	100	100
- *L. ovillus*	-	100	-	-	-	-
Fleas						
- *Ct. felis*	100	-	-	-	100	100
Sheep ked						
-*M. ovinus*	100	-	-	-	-	-

NB. HL=Highland, ML=Midland and LL=Lowland

Table 3: Univariate regression analysis of risk factors vs. prevalence of ectoparasites

Risk factors	Number examined	Number positive	Prevalence % (95%CI)	OR (95% CI)	P-values
-Agro-climate					
Highlands	200	74	37 (12.0-62.0)	1	
Midlands	391	241	61.6 (40.7-82.5)	2.7 (1.9-3.9)	0.000
Lowlands	400	228	57 (35.5-78.5)	2.3 (1.6-3.2)	0.000
-Animal Species					
Sheep	600	310	51.7 (45.7-57.9)	1.0	
Goats	391	233	59.6 (39.1-73.0)	0.7 (0.6-0.9)	0.014
-Sex					
Female	580	307	52.9 (33.0-72.8)	1	
Male	411	236	57.6 (36.7-78.5)	0.83 (0.6-1.1)	0.162
-Age					
Young	479	258	53.9 (33.1-74.7)	1	
Adult	512	285	55.7 (35.4-76.0)	1.1 (0.8-1.4)	0.569
-Coat type					
Hairy	921	503	54.6 (45.6-6.36)	1	
Wooly	70	40	57.1 (25.1-64.8)	0.9 (0.6-1.5)	0.682
-BCS					
Good	767	377	49.1 (30.6-67.6)	1	
Poor	224	166	74.1 (53.3.-94.4)	2.0 (2.12-4.12)	0.000
-Flock size					
Small size	706	345	48.4 (29.6-67.2)	1	
Large size	277	198	71.5 (69.2-73.8)	2.6 (1.9-3.5)	0.000
-Flock type					
Single	738	357	48.4 (29.6-67.2)	1	
Mixed	253	186	73.5 (71.2-75.8)	3.0 (2.2-4.1)	0.000

Table 4: Multivariate logistic analysis of risk factors vs. the prevalence of ectoparasites

Risk factors	ß	SE	OR (95%CI)	*P* -values
Agro-climate				
Highlands			1	
Midlands	0.905	0.222	2.5 (1.6-3.8)	0.000
Lowlands	0.732	0.202	2.1 (1.4-3.1)	0.000
Body condition score				
Good			1	
Poor	1.408	0.195	4.1 (2.8-6.0)	0.000
Flock size				
Small			1	
Large	0.750	0.167	2.1(1.5-2.9)	0.000
Flock type				
Single			1	
Mixed	0.697	0.178	2.0 (1.4-2.8)	0.000
Constant	-1.099	0.179	-	0.000

DISCUSSION

The overall prevalence of ectoparasites in small ruminants was 51.7% in sheep and 59.6% in goats. The present result is comparable to the report of Mulugeta *et al*. [15] and Sertse and Wossene [16] who reported 55.2% in sheep and 58.0% in goats and 50.5% in sheep and 56.4% in goats in Tigray and the eastern Amhara regions, northern Ethiopia respectively. In the current study, the overall prevalence of ectoparasites was significantly ($P < 0.01$) higher in goats than in sheep. This is in line with the report of Sertse and Wossene [16]. Ticks were found to be the most frequently recorded ectoparasites in both sheep and goats throughout all the three agro-climates. This finding is in a general agreement with those of Yacob *et al*. [17] in Ethiopia and Yakhchali and Hosseine [18] in Iran. Three tick genera, Rhipicephalus, Boophilus and Hyalomma, were observed in the study areas. These ticks were reported from different parts of the country from various domestic animals [1, 2]. Two species of sucking lice were identified in midland and lowland areas of this study: *Linognathus ovillus* in sheep and *Linognathus stenopsis* in goats. This finding is in line with Sertse and Wossene [16] and Bekele *et al*. [19] who reported the same species of lice infest sheep and goats respectively. It is distributed in most parts of the country. During the present study, sheep ked was identified from sheep only in highland. Mulugeta *et al*. [15], Sertse and Wossene [16] and Bekele *et al*. [19] reported this parasite from sheep and majorly from highland and very rarely from midland. As stated in Radosstits *et al*. [8], *M. ovinus* is mainly the parasite of sheep in colder and wetter areas.

Risk Factors: The prevalence of ectoparasites was found to be significantly affected ($P < 0.01$) by risk factors like animal species, agro-climate, animals' body condition, flock size and flock type. Overall significantly ($P < 0.01$) higher prevalence of ectoparasites was recorded in goat than in sheep. Also significantly higher ectoparasites prevalence was seen in midland and lowland agro-climate and animals with poor body condition. This finding is in line with Mulugeta *et al*. [15], Sertse and Wossene [16] and Madeira *et al*. [20]. The prevalence of small ruminant ectoparasites in the midland and lowland were 2.5 and 2.1 times more than that of highland respectively.

During the current study, significantly higher prevalence of ectoparasites was recorded in mixed flock of sheep and goats than in the single flock ($P < 0.01$). Also flock size had significant effect on the prevalence of ectoparasites ($P < 0.01$). The infestation rate of large flock was 2.1 times more than that of the small flock size. This finding is in a general agreement with report of Madeira *et al*. [20] from Sao Paulo, Brazil. In large flocks there is crowding of the animals, which increases the chance of contact between animals and results in the transmission of ectoparasites between infected and susceptible animals.

Collectively, it can be concluded that more than half of sheep and goats (54.8%) were found infested with ectoparasites. Ticks were the major ectoparasites encountered in both sheep and goats. Hence, this has great impact on small ruminant productivity and the country economy. To reduce the impact of ectoparasites on sheep and goats the appropriate and strategic control measure should be applied by animal health service. Moreover, extension services and training programs aiming at creation of awareness about the importance and prevention of ectoparasites among smallholder animal producing farmers is recommended.

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