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Prevalence and Identification of Ectoparasites of Small Ruminants in Angacha District, Southern Ethiopia

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Abstract: To determine the prevalence and associated risk factors; identify species and gross lesion of ectoparasites of small ruminants, cross-sectional study design was implemented in and around Angacha district, southern Ethiopia. A total of 384 small ruminants (241 sheep and 143 goats) were included by simple random sampling method from all extensively managed animals. Every selected small ruminant was thoroughly examined clinically; samples were collected and transported to Sodo regional veterinary laboratory for further detailed investigation of external parasite identification. While clinical examination was performing relevant information was recorded from all animals considered in the study including age, sex, species, origin and body condition score by data collection sheet. From the total studied animals, 105 (27.3%) were infested by different ectoparasites. A total of 241 sheep and 143 goats examined, 31.9% and 19.6% were infested with various types of ectoparasites, respectively. The identified ectoparasites include ticks; 33(13.7%) in sheep and 20 (14%) in goats, lice; 8 (10.4%) in sheep and 4 (2.8%) in goats, mites; 4(1.6%) in sheep and 2(1.4%) in goats, flea; 19 (7.9%) in sheep and 2 (1.4%) in goats and sheep, ked; 13 (16.9%) in sheep. Three genus of tick were recorded in the study which include *Amblyoma*, *Hayaloma* and *Rhipicephalus* (*Boophilus*). Among the variables considered species, age and body condition score had significant association with overall prevalence of ectoparasites ($p<0.05$). It is important to implement different control strategies with further detail study to contract impact of ectoparisites on animals' welfare and economic impact on skins foreign currency to the country.

Key words: Angacha · Ectoparsites · Prevalence · Tick · Small Ruminants · Ethiopia

INTRODUCTION

Ethiopia has been exporting hides and skins in the past 100 years. The country has big potential to develop the sub-sector [1]. Ethiopian small ruminant skins especially sheep skins have good reputation for quality in the world leather market due to their fine grain and compact structure [2, 3]. In Ethiopia, skin from sheep and goat are valuable animal by products for local which has a large contribution to the leather industry use as well for export market. The trend in the country shows that there is deterioration of the quality of leather raw material with an increasing number of reject grades mainly due to skin diseases [4].

Ectoparasites of small ruminants also 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. 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 [5]. Their end result may be mortality, decreased productivity and reproduction, downgrading and rejection of skins [6].

Ectopararasites such as ticks, mange mites, lice, fleas and keds are important parasites because of their disease transmission, blood feeding habit and skin damage in most of the live stock population [7]. They are widely distributed in all agro-ecological zones in Ethiopia, causing serious economic loss in small holder farms [8]. They are also one of the most important causes of loss in production and mortality of animals in various part of the country through decrease in production and reproduction, down grading and rejection of skins [9, 10].

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It was reported that 35% of sheep and 56% of goat skin rejections in Ethiopia are attributed to ectoparasites [11]. All these established facts imply that ectoparasites pose serious economic losses to the farmer, the tanning industry and the country as a whole [12].

The problem created by ectoparasites is believed to be high. Hence, it would be essential to have up to date information on the importance of the prevalence of ectoparasites in various areas to provide an option to develop and implement a cost effective and ecologically important control strategies in the country. However several researches have been conducted in regions of Ethiopia on prevalence and species identification in different agro ecological zones [8,13-16]. But, are no reports of study in the study area, even though huge clinical case reports from the government district clinics and the community. Hence, it is essential to estimate the prevalence of ectoparasites of small ruminants and species involved in the study area. Therefore, the objectives of this study were to identify major ectoparasites, estimate prevalence and quantify associated risk factors of ectoparasites of small ruminants in and around Angacha district, southern Ethiopia.

MATERIALS AND METHODS

Study Area and Animals: The study was conducted from October, 2016 to May, 2017 on sheep and goats in Angacha district, Kembata Tembaro Zone, southern Ethipiopia. The district is located 360km south from the capital city, Addis Ababa. It is situated between 36°60'00'N 83°50'00'E at an altitude of about 2464 meters above sea level. The area is characterized by an average annual temperature of 14°C and an average annual rainfall of 1,201 mm and also total area of 17,754.31 hectare and has total animal population of 202,732 of which 54369 cattle, 9009 equine, 111064 are poultry, 7,340 goats and 20,954 sheep [17].

The study animals were sheep and goat population in the district that are owned by smallholder farmers under traditional management system. Small ruminants of various age, both sex, different body conditions were considered in the study. Animals were selected from the animals visiting district veterinary clinic for different cases and partly by home to home smallholders' visit of the researcher. Immediately before examination, each animal selected was categorized based on its sex, age and species. The ages of animals were determined by the method described by ESGPIP [18]. When lambs and kids were less than one year of age, they were considered as young and animals more than one year old were included in the adult age group.

Study Design, sampling and Sample Size Determination: A cross sectional survey was conducted in order to assess the prevalence and species identification of external parasite of small ruminants. Random sampling method was used for sampling animals owned by smallholder farmers under traditional management system in the study area. Animals included in the study were clinically examined for any ectoparasties and whenever external parsite was found on the animal, the sample of the parasite was collected. After collected the samples were stored in 10% formalin and transported to Sodo regional veterinary laboratory for further examination. Relevant information was recorded from all animals considered in the study including age, sex, species, origin, body condition score (BCS) by data collection sheet.

The sample size determination was according [19] by using 95% confidence interval and 0.05 desired level of precision, the sample size were determined to be 384 as calculated by the following formula for cross-sectional study design.

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

where:

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

Study Methodology

Clinical Examination: Every selected small ruminant was thoroughly examined clinically through visual inspection followed by physical examination of skin, inspection and palpation of the skin and hair across all parts of the animal for the presence of parasites. Animals found to have one of the ectoparasites were taken as positive.

Sample Collection and Transportation: Ectoparasites including: ticks, lice, keds and fleas were collected by hand from their attachment site and some by skin scraping, put in universal bottle containing 70% methanol to identify types and species of ectoparasites. Samples were then transported to Sodo veterinary regional laboratory for further identification of the parasites.

Body Condition Scoring and Age Estimation: Body condition for sheep and goat range from 1 to 5 were used with average of 3 as neither to fat nor too skinny and score of 1 is very skinny and emaciated whereas a score of 5 is very fat animal or obese [20]. Age determination was based on dentition for sheep and goats with different numbers of erupted permanent incisors as per [21].

Laboratory Examination: Ectoparasites (ticks, sheep keds, lice and fleas) either encountered on the skin surface or attached to the hair were collected manually from their sites of attachment. The ticks were removed from the host skins whilst retaining their mouth parts for identification using thumb forceps. A coat brushing technique was applied to collect lice from host skin.

Data Analysis: Data was entered in to Microsoft Excel spread sheet. The prevalence or frequencies of ectoparasites were compared with variables and expressed in percentage as descriptive statists. Moreover, the association of different risk factors with the prevalence of ectoparsites was analyzed by using SPSS Statistical software version 20. In all analysis the confidence level was held at 95% CI and the desired absolute precision was set 5%.

RESULTS

A total of 384 small ruminants were examined to determine the prevalence of ectoparasites infestation in Angacha district. From the total studied animals, 105 (27.3%) were infested by different ectoparasites as shown in Table 1. The overall prevalence of ectoparasites from a total of 241 sheep and 143 goats were 31.9% and 19.6%, respectively. Identified ectoparasites include ticks; 33(13.7%) in sheep and 20 (14%) in goats, Lice; 8 (10.4)in sheep and 4 (2.8%) in goats, mites;4(1.6%) in sheep and 2(1.4%) in goats, Flea; 19 (7.9%) in sheep and 2 (1.4%) in goats and sheep ked; 13 (16.9%) in sheep. The prevalence of lice and fleas were higher when compared to goats, while the prevalence of tick and mite among the two species of small ruminants are almost the same.

Three genus of tick were recorded in the study include Amblyomma, Hayalomma and *Rhipicephalus* (*Boophilus*). The prevalence of *Rhipicephalus* and *Ambylomma* in sheep and goat were the same which was 5% and 4.2%respestivelly. Whereas, *Hayaloma* shows lower prevalence 3.7% in sheep while higher in goat 5.6%. The identified genera of lice infesting in sheep and goats in common were *Damilina* which is 3.3% and 2.8% respectively. Whereas 5.4% sheep keds were recorded in sheep and no prevalence were detected in goats. Two genera of mange mites were identified; *Demodex* 1.2% and *Sarcoptes* 0.4% in sheep and the same genera of mange mites were encountered with the prevalence of 0.7% *Demodex* and 0.7% *Sarcoptes* in goats as indicated on Table 2.

It is indicated on Table 3 that the percentage of positivity and percentage of each species of ectoparasite in each category of variables. Among the variables considered species, age and body condition score had significant association with overall prevalence of ectoparasites ($p<0.05$); however sex and origin had no statistically significant association ($p>0.05$). Animal species difference was significant with sheep accounting 31.9% was higher than goat 19.6%. Younger age groups

Table 1: Prevalence of ectoparasites among species of small ruminants in Angacha district, southern Ethiopia

Variables	Ectoparasites					
Species	Tick	Lice	Fleas	Mites	Sheep Ked	Total
Sheep	33(13.7%)	8 (10.4)	19 (7.9%)	4(1.6%)	13 (16.9%)	77(31.9%)
Goats	20(14%)	4 (2.8%)	2(1.4%)	2(1.4%)	0 (0)	28(19.6%)
Total	53(13.8%)	12(3.1%)	21(5.5%)	6 (1.6%)	13 (3.4%)	105 (27.3%)

Table 2: Prevalence of ectoparasites based on its types in Angacha district in Southern Ethiopia

Ectoparasites		Sheep (241)	Goat (143)	Total (384)
Tick	*Amblyomma*	12 (5%)	6 (4.2%)	18 (4.7%)
	Hayalomma	9 (3.7%)	8 (5.6%)	17 (4.4%)
	Rhipicephalus (Boophilus)	12 (5%)	6 (4.2%)	18 (4.7%)
Lice	*Damalina*	8 (3.3%)	4 (2.8%)	12 (3.1%)
Mites	*Demodex*	3 (1.2%)	1 (0.7%)	4 (1%)
	Sarcoptes	1 (0.4%)	1 (0.7%)	2 (0.5%)
Ked		13 (16.9%)	0 (0)	13 (3.4%)
Flea		19 (7.9%)	2 (1.4%)	21 (5.5%)

Table 3: Overall and species level small ruminant ectoparasites prevalence among species, age, sex, body condition and its origin in Angacha district, Southern Ethiopia

Risk factor		No. of samples	Tick	Lice	Ked	Mite	Fleas	OverallPrevalenc	P-value (x^2)
Species	Sheep	241 (62.8%)	33(13.7%)	19 (7.88)	13(5.39)	4 (1.6%)	19 (7.9)	77(31.9%)	0.05 (7.762)
	Goat	143 (37.2)	20 (13.1)	2(1.39)	0(0)	2 (1.4%)	2(1.4%)	28(19.6%)	
Age	Young	141 (36.7%)	23(16.3%)	11(7.81)	9(6.38)	1 (0.7%)	11 (7.8%)	48(34%)	0.019 (5.46)
	Adult	243 (63.3%)	30(12.3%)	10 (4.11)	4(1.64)	5 (2%)	10 (4.1%)	57(23.4%)	
Sex	M	218 (56.8%)	35 (16%)	13(5.96)	7(3.21)	4 (1.8%)	13 (5.9%)	65(29.8%)	0.168 (1.91)
	F	166 (43.2%)	18(10.8%)	8(4.81)	6(3.61)	2 (1.2%)	8 (4.8%)	40(24%)	
Body condition score	Poor	199 (51.8%)	30(15%)	12 (6.03)	8(4.02)	4 (2%)	12 (6%)	63(31.6%)	0.00(153.7)
	Medium	132 (34.4%)	17(12.9%)	8(6.06)	5(3.78)	4(3%)	8 (6%)	37(28%)	
	Good	53 (13.8%)	6 (11.3%)	1(1.88)	0(0)	0	4 (7.5%)	10(18.9%)	
Origin	Lowland	155 (40.4%)	23(14.8%)	6(3.87)	6(3.87)	2 (1.3%)	6 (3.9%)	43(27.7%)	0.999 (0.00)
	Midland	229 (59.6%)	30(13.1%)	15(6.55)	7(2.34)	4 (1.7%)	15 (6.5%)	62 (27%)	
Total		384	53(13.8%	12 (3.1%)	13(3.4)	6 1.6%)	2 (0.5%)		

(34%) had higher overall prevalence of small ruminant ectoparsite than adults (23.4%). The prevalence of ectoparasites from a total of males 65 (29.8%) were positive for at least one of the ectoparasite species and among the total females considered 40 (24.1%) were found to be with ectoparasite and it was statistically significant between sex of the animals. The overall prevalence of ectoparsite among different body conditions score categories was significantly different with poor (31.6%) highest which is followed by medium and good.

DISCUSSION

The overall prevalence of ectoparasites in Angacha district was comparatively lower than most of studies in the country. The overall prevalence of small ruminant ectoparasites 27.3% was markedly lower than 73.3% that recorded by Tadesse *et al.* [22] from Wolaita Sodo and the prevailing study identified an overall 56.80% prevalence of ectoparasites infestation among small ruminants in and around Bahir Dar town Ethiopia [23]. It is also lower than the report of 37.0% by Tamerat *et al* [24]; 47.5% by Tamerat and Zeryehun [25]; 48.9% by Dawit *et al* [26]*;* 71.35% by Amuamuta *et al* [27] and 78.38% by Fentahun *et al* [28].

Species level prevalence of ectoparasites infestation was 77 (31.9%) in sheep and 28 (19.6%) in goats which is lower than 54.8% in sheep and 34.9% in goat [26]; 61.40% in sheep and 57.69%in goat [29];85.6% in ovine and 95.0% in caprine [30]. The lower prevalence of ectoparasites in study area might be due to less exposure of grazing different species of animals in the field due to scarcity of land. Also it might be having good awareness of communicating veterinarians so; they use different drugs to control ectoparasites.

In this study, three genera of ticks such as *Ambylomma*, *Hyalomma* and *Rhipicephalus* (Boophilus) were identified with a total prevalence of 4.7, 4.4 and 4.7% in both species. In this study lower prevalence were recorded when compared with Teshome [13] report with the prevalence of 23.8% in sheep and 16% in goats in Sidama Zone, Southern Ethiopia. In addition, higher prevalence rate of ticks in small ruminants was reported by Asnake, Yacob and Hagos [30] with prevalence of 18.8% sheep and 57.6% goats in three different agro-ecological zones of southern Ethiopia.

The prevalence of lice was 19 (7.88%) in sheep and 2.8% in goats was higher than reports obtained in southern range land 0% in sheep and 1.55% in goats [3], but lower than the prevalence reported by Tefera [14] in Amahara region who reported 29.2% in goats and 41.2%[30] from southern Ethiopia in sheep's. The genera of lice identified in sheep and goat in common at the study area was Damilina which was 3.3% in sheep and 2.8% in goats.

The two genera of mange (*Demodex* and *Sarcoptes* with prevalence of 3 (1.2%) and 1 (0.4%) respectively) were identified in this study. Of the mange mites affecting sheep and goats in the study area, Demodex was found to be the most prevalent in sheep's. The prevalence obtained in this study was higher than the frequencies of Demodex in sheep 0.80%, 0.84% and 0.4% in the central Ethiopia [31], Eastern Ethiopia [32] and Nigeria [33] respectively; whereas similar infestation rates were observed in sheep (1.33%) [15] and (1.23%) [34] in Southern Ethiopia. A higher prevalence was noticed by [22] with the prevalence of 6.58% in sheep and 1.51% in goats.

The study revealed 7.9% and 2(1.39%) in sheep and goat, respectively which showing variation among species in flea infestation that was higher in sheep and species variation act as a risk factor in flea infestation. This goes in line that of [35] who has reported prevalence of 7.3% in sheep's. Higher prevalence in sheep recorded it might be due to wool of sheep is proper for fleas survival than goat. The prevalence of flea recorded in the current study in age groups of small ruminants in young and adult were 7.8% and 4.1%, respectively. This result

was lower when compared with report of Mulugeta, Yacob and Ashenafi [36] with the infestation rate of 18.06% and 8.2% young and adult sheep and goats respectively in and around Wolaita soddo, Southern Ethiopia.

Significant difference among different body condition scores whoed that the variable was acting as risk factor with prevalence of ectoparasites among poor, medium and good body condition were 86.8%, 37.8% and 6%, respectively with hieghest in poor followed by medium and good at last. This could be due to the fact that loss of body condition might be absence of sufficient feed, this result for the animal to be easily susceptible to different infection due to reduction in the immunity of small ruminants. Therefore, the prevalence of different ectoparasites like tick, lice and flea was high infested in poor body condition than that of good body condition small ruminants. This finding is similar with Hussen [37].

The prevalence of tick (16% in male and 10.8% in female), lice (13(5.96) in male and 8(4.81) in female), mite (1.8% in male and 1.2% in female), ked (3.21% in males and 3.61% in female) and flea (5.9% in male and 4.8% in female) not statistical significant variation between sex differences which is agreement with some previous studies including [38] and Yacob, Yalow and Dink [15]. Unlike the previous studies [26] reported that there was significant variation between males and female animals. However it was not statistically significant the variation with males having highest prevalence, it may be due to the fact that the farmers in the area use one male for many flocks of sheep and goats that makes males high chance with frequent contact with infested sheep and goat. The prevalence of ectoparasites in low land and midland were 27.7% and 27% respectively. There was no variation detected among agro ecology (low land and midland) in the current study.

CONCLUSION

The study showed that the overall prevalence of ectoparasites of small ruminants in the study area was comparably low; however noteworthy clinical presentation in the study area. The most important ectoparasites identified were tick, lice, fleas, ked and mange mite with higher prevalence rate of ticks. Tick identification revealed *Amblyomma*, *Hyalomma* and *Rhipicephalus* were the major once. As an output of the study species, age and body condition of the small ruminants were significantly considered as risk factors for overall prevalence of ectoparasites in the study area.

Worth considering animal welfare concerns and economic impact on skins foreign currency to the country, different strategic control methods should be implemented with further detailed study on the study area in particular and in the country in general.

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