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Prevalence and Associated Risk Factors of Small Ruminant Ectoparasites in Sire District, Arsi Zone, Ethiopia

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Abstract: Small ruminants constitute 30% of the total livestock population of the country and important contributors to food production in Ethiopia. Even though small ruminants are important for the Ethiopian farming system, their contribution to food production, rural and export incomes are far below expected potential due to different factors like ectoparasites and other diseases. A cross-sectional study was conducted from October 2014 to April 2015 with the objective of estimating the prevalence of ectoparasites in small ruminants and identifying the risk factors in Sire district, Arsi Zone. A total of 765 small ruminants (458 sheep and 307 goats) were examined for the presence of ectoparasites. Accordingly, 86.9% (n=398) of sheep and 67.10% (n=206) of goats were infested by one or more ectoparasites. The overall prevalence for both species was 78.95% (n=604). The major ectoparasites identified in sheep in order of predominance were lice (71.18%) and ticks (11.35%). In goats, ticks (44.30%) and lice (16.94%) were observed in the order of importance. This study has revealed a statistically significant difference in the prevalence of ectoparasites between agro-climatic zones and animal species (sheep vs. goats). In conclusion, the study found a high prevalence of ectoparasites in the study area which can hamper the health and productivity of small ruminants. Therefore, the existing control of ectoparasites should be scaled up with full involvement of the livestock keepers.

Key words: Ecto-Parasites · Prevalence · Small Ruminants · Sire District · Ethiopia

INTRODUCTION

Small ruminants constitute 30% of the total livestock population of the country and important contributors to food production in Ethiopia providing 35% meat consumption, 14% of milk consumption and account for 40% cash income and 19% of used household consumption [1]. Small ruminants are considered as investments and insurance to provide income and food during seasons of crop failure and to meet seasonal purchases such as improved seed fertility and medicine for rural households and also essential attributes like fertilizer, short generation time interval and adaption in a harsh environment [2]. Hide and skin account for 12-16% of the total volume of export from Ethiopia. The current utilization of skin is estimated to be 75% goat and 97% of sheep [3] with an expected off-take rate of 35% and 34% for goat and sheep respectively [4].

Ectoparasites are those parasites that live on the body of the host. Some spend entire life on the host and others part of their life on the host [5]. Important ectoparasites have short generation time, produce large offspring and have a very high potential rate of population growth [6]. Several arthropods live as Ecto-parasites on domestic animal. These parasites generally associated with dermatitis. The degree of affection of animals depends on their nutrition, immunological condition and parasitic intensity [7] and they are major causes of production losses in livestock throughout the world and acts as a vector of disease for both animal and human [8]. Ecto-parasites caused hide and skin problems due to lice, ticks, mange mites and ked are among the major pre-slaughter defects and cause downgrading and rejections. According to tannery reports, hide and skin problems due to external parasites cause 35% sheep's and 56% goats' rejection [9].

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The damage caused by ectoparasites may limit the expansion of sheep rising, reduce flock productivity and the damage caused by disease is usually greater among recently introduced animals compared to animals introduced earlier among which those with more resistant genotype have been selected over time [10].

Even though small ruminants are important to the Ethiopian farming system, their contribution to food production, rural income and export income are far below that the expected potential. This is because of the compound of disease, poor feeding and poor management [11]. Then those potential losses necessitate the nationwide detailed investigation on the distribution of skin disease and organized efforts between farmers, traders and government institutions [1]. No previous study conducted in Sire district on the ectoparasites of small ruminants.

Therefore, the objective of the present study was to estimate the prevalence and identify the composition of ectoparasites in small ruminants in and around Sire district.

MATERIALS AND METHODS

Study Area: The study was undertaken in Sire District, Arsi Zone, Oromia National Regional State, Ethiopia. Sire district is one the districts found Arsi zone and its town called Sire is located 147km southeast of Addis Ababa. The altitude of the area ranges from 1200m to 2700m.a.s.l. Its temperature ranges from 20 to 28°C and the average rainfall is 1950 mm. This area has bimodal rainfall occurring from March to April (short rainy season) and July to October (long rainy season). 29.5% of the woreda is high land, 28% is midland and 42.5% low land. The area is densely populated with small ruminants and other livestock [12].

Study Design: A cross-sectional study was conducted from October 2014 up to April 2015 to estimate the prevalence of ectoparasites and associated risk factors in small ruminants (Sheep and Goats).

Sample Size and Sampling Method: The district was selected based on the history of a higher number of small ruminants and reports of ectoparasites in the area. Sampling frames of sheep and goats were taken from respective agro-ecological zones. A simple random sampling technique was used to determine the sample size required for each agro-ecological zone. Since there was no previous study done in the area, the sample size was determined based on the expected prevalence of 50% and the absolute desired precision of 5% at a 95% confidence level. As a result, a total of 384 sheep and goats were needed to be sampled according to the formula given by [13]. But with the intension of increasing the precision of the study, a total of 765 (458 sheep and 307 goats) were sampled and included in the study. A greater number of sheep were sampled because of their predominance in the area.

$$n = \frac{1.96^2 pq}{d^2}$$

where,
n = sample size,
d = abdolute percision,
p = expected preavalence, q = 1 – p and 1.96 the value of Z at 95% confidence interval

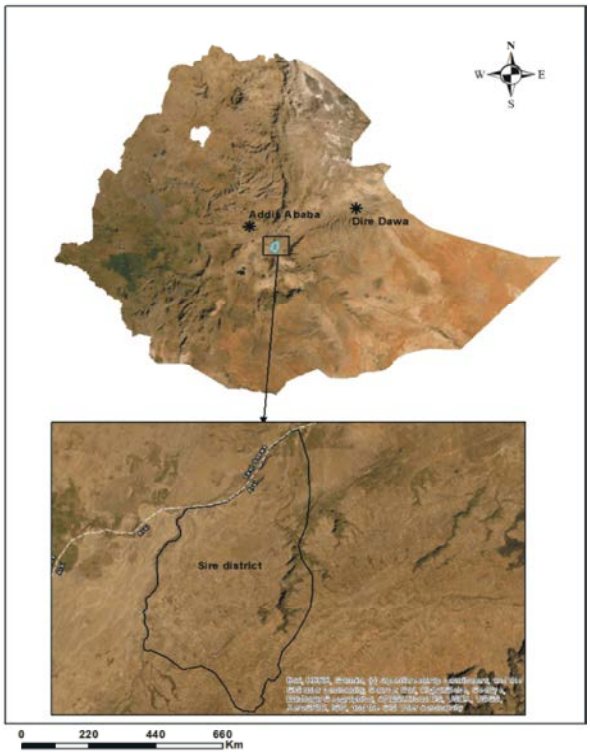

Fig. 1: Map of study area

Sample Collection and Ecto-parasite Identification: Different ectoparasites like ticks, lice, sheep ked and fleas were collected by visual inspection and palpation from different parts of the body of the animal and

transported to the laboratory in a clean universal bottle with 70% alcohol. For the detection of mange mites, skin scarping samples were collected from clinically affected areas and preserved in bottles containing 5% formalin. The identification of species of the ectoparasites was carried out in the laboratory according to morphological characteristics described for each parasite [14]. For all ectoparasites, animals were recorded as positive and negative for infested and non-infested.

Age and Body Condition Score Determination: Determination of the age of the goats and sheep included in the study was carried out by looking at the front (incisor) teeth according to Steele [15] and Gatenby [16] respectively. Animals were grouped as poor and good body condition as described By Steele and Gatenby [15, 16].

Data Analysis and Management: The data obtained from the study were recorded in the Computer Microsoft Excel spreadsheet and coded before analysis. All the analyses were performed using Stata software (version 9). Descriptive analyses (frequency and percent) carried out by disaggregating the total number of animals examined and found positive for different parasites into a different age, sex and agro-ecological groups. In this study factors like agro-climates, species, sex, age and body condition score were supposed to have an impact on the prevalence of ecto-parasites in the small ruminants. Animals were grouped into two age groups, as < 2 years and > 2 years ages. Hence chi-square was used to observe the possible association between the dependent variable (i.e. prevalence of ectoparasites) and aforementioned hypothesized risk factors. Statistical significance declared at $p<0.05$.

RESULTS

Prevalence of Ecto-Parasites in Small Ruminants: From a total of 765 small ruminants examined for ectoparasites, 78.95% of animals (n = 604) were found to be infested by one or more ectoparasites. The major ectoparasites identified in order of predominance in sheep were lice (71.18%), ticks (11.35%), tick-lice (mixed infestation) (3.93%), mite (0.22%) and lice-mite (0.22%) whereas in goats ticks (44.30%), lice (16.94%), mite (0.33%), tick-lice(5.54%) and no lice- mite mixed infestation (Table 1).

Accordingly, agro-climates and species of animals were found to have a statistically significant association ($p<0.05$) with the prevalence of ectoparasites in the study area. The infestation of ectoparasites slightly increased with age (77.06% to 81.85%). This difference among different age groups was not significant ($x^2 = 2.599$, $p>0.05$). The prevalence of ectoparasite infestation with sex was 77.92% and 77.21% in females and males respectively in examined small ruminants. However, the difference in prevalence of ectoparasite infestation between female and male small ruminants was not significant ($x^2 = 0.8012$, $p>0.05$). The prevalence of ectoparasites infestation was 86.90% and 67.10% in sheep and goats respectively and this difference in prevalence between the species of animals was significant ($x^2 = 43.3582$, $p<0.05$). The area where the research undertaken has three agro-climates, highland, midland and lowland and the prevalence of ectoparasites infestation was 82.83%, 83.52% and 64.20% respectively. The difference in the prevalence between the three altitudes was statically significant ($x^2 = 27\ 8057$, $p = <0.05$) (Table 2).

Different ectoparasites identified were ticks (11.35% in sheep and 44.30% in goats), Lice (71.18% in sheep and 16.94% in goats), Mite (0.22% in sheep and 0.33% in goats) and poly infestation (3.93% in sheep and 5.54% in goats) and the overall prevalence of ectoparasites was significantly higher in sheep (86.68%) than in goats (67.10%) ($P< 0.05$) (Table 3 Table 4). The prevalence of ectoparasites was 90.45% and 84.72% in male and female sheep respectively and 60% and 71.35% in male and female goats respectively (Table 3 Table 4). No significant association between the ectoparasite prevalence and the sex and the age was evidenced in both species of small ruminants.

The proportion of goats infested by ticks was significantly higher than that of sheep ($p<0.05$). No significant increase of tick infestation risk was associated with the age or the sex in both small ruminant species (Table 3 Table 4). The lice infestation was diagnosed in sheep with a very high prevalence (71.18%) whereas relatively low prevalence (16.94%) was observed in goats. The incidence of lice infestation was similar in both sexes, while in both age groups, there was no significant difference in prevalence (Table 3 Table 4). Mite infestation was found in one female sheep and one male goat and its prevalence were very low in both species of small ruminants.

Table 1: The prevalence of ecto-parasites in small ruminants of Sire district, Arsi zone, Ethiopia

	Sheep (n=458)		Goats (n=307)		Total (n=765)	
Types of Ectoparasites	No. infested	Prevalence (%)	No. infested	Prevalence (%)	No.infested	Prevalence (%)
Ticks	52	11.35	136	44.30	188	24.58
Lice	326	71.18	52	16.94	378	49.41
Mite	1	0.22	1	0.33	2	0.26
Tick-lice	18	3.93	17	5.54	35	4.58
Lice-mite	1	0.22	-	-	1	0.13
Overall	398	86.9	206	67.10	604	78.95
Risk factors						

Table 2: Association of different factors with the overall prevalence of ecto-parasites in small ruminants

Variables	No. examined	No. positive	Prevalence (%)	P-value
Sex				
Female	493	394	79.92	0.371
Male	272	210	77.21	
Species				
Sheep	458	398	86.90	<0.001
Goats	307	206	67.10	
Age				
<2 years	462	356	77.96	0.107
>2 years	303	248	81.85	
Body condition score				
Good	617	482	77.06	0.110
Poor	148	123	83.82	
Agro-climates				
Highland	134	111	82.83	<0.001
Midland	455	380	83.52	
Lowland	176	113	64.20	

Table 3: Sex and age wise prevalence of ectoparasites in sheep (n=458) in Sire district, Arsi zone, Ethiopia

	Sex				Age		
Ectoparasites	Prevalence (No)	Male (n=157)	Female (n=301)	p-value	<2years (n=251)	>2years (n=207)	p-value
Ticks	11.35(52)	12.74(20)	10.63(32)	0.500	12.35(31)	10.14(21)	0.459
Lice	71.18(326)	73.89(116)	69.77(210)	0.350	70.12(176)	72.40(150)	0.581
Mite	0. 22(1)	0.33(1)	0.00(0)	0.166	0.00(0	0.48(1)	0.270
Tick-lice	3.93(18)	3.18(5)	4.32(13)	0.553	3.19(8)	4.83(10)	0.368
Total	86.68(397)	90.45(142)	84.72(255)	*p*>0.05	85.66(215)	87.92(182)	p>0.05

Table 4: Prevalence of ecto-parasites observed in goats (n=307) according to the age and sex in Sire district, Arsi zone, Ethiopia

	Sex				Age		
Ectoparasites	Prevalence (No)	Male (n=115)	Female (n=192)	p-value	<2years (n=211)	>2years (n=96)	p-value
Ticks	44.30(136)	39.13(45)	47.40(91)	0.158	42.65(90)	47.92(46)	0.389
Lice	16.94(52)	14.78(17)	18.23(35)	0.436	16.59(35)	17.71(17)	0.808
Mite	0.33(1)	0.00(0)	0.52(1)	0.438	0.000(0)	1.04(1)	0.138
Tick-lice	5.54(17)	6.09(7)	5.21(10)	0.745	4.11(15)	2.08(2)	0.074
Total	67.10(206)	60(69)	71.35(137)	p>0.05	66.35(140)	68.75(66)	p>0.05

DISCUSION

The problem of ectoparasites in small ruminants of the study area seems to be very important as they are distributed in all agro-ecological zones affecting all age groups. The majority of the observed animals (86.9% sheep and 67.10% goats) were found to be infested by one or more ectoparasite. The present finding is considerably higher than that of reported from Adama veterinary clinic, Oromia regional state (26.33% in sheep

and 23.05% in goats)[1]. Another study in Wolaita Soddo reported a relatively higher prevalence in sheep (68.7%) but a lower prevalence in goats (28.4%)[3].

In this study, the overall prevalence of ectoparasite was significantly higher in sheep than in goats. This is in agreement with the two reports [1, 3] in which sheep were mentioned to be infested more often than goats but contrary to study conducted in Amhara regional state [17].

Ticks were the leading ectoparasite recorded in goats and lice in sheep across all the three agro-climates. The present finding concurs with the study conducted by Sertse and Wossene [17] that have reported lice as the major ecto-parasite in sheep and ticks in goats. On the other hand, the present finding contradicts the studies conducted in Adama and Wolaita Sodo in Ethiopia [1, 3] and with another study conducted in Iran [18].

Both *Linognathus* and *Damalina* species of lice were identified both in sheep and goats. This result agrees with the study done in Amhara regional state on the impact of ectoparasites in tanning industries [17] that have reported biting lice (*Damalina* species) in addition to *Linognathus* species in both sheep and goats. A study conducted by Lehmann on the direct impact of host fitness observed a greater susceptibility of young animals to ectoparasites and attributed it to a higher ratio of accessible surface to body volume and a poor grooming behavior [19]. But in the present study, no significant difference for tick or other ectoparasite infestation between young and adult animals was evidenced in both species of small ruminants. This discrepancy would be related to poor access of young animals to pasture and to the climate favorable to tick development during the study period.

No privileged tick infestation in females of both species of small ruminants was encountered in this study contrary to a report by Hoskins which observed a particular susceptibility of females to tick attacks[20]. The lice prevalence observed in the present study was by far higher than previous results obtained from central Ethiopia [21] and from Southern Ethiopia (Sidama zone) [22]. These discrepancies could be explained by favorable climatic conditions of the study area for the biology of lice. In the present study, poor body condition of the small ruminant could not be evidenced as the cause of increment of the prevalence of ectoparasites in small ruminants. The loss of body condition could be undernutrition or due to different infections.

Two cases of mange in sheep were identified in this study with a prevalence of 0.66% whereas one case was diagnosed in goat with a prevalence of 0.4%. In contrast to this study, Kedir reported a higher prevalence of mange mite infestation in small ruminants (26% in goats and 30% in sheep) from the Tigray region in Northern Ethiopia [23]. Nevertheless, this study was conducted on non-randomly selected sheep and goats showing visible skin lesions. Environmental factors might also have contributed to this great variation.

CONCLUSION AND RECOMMENDATION

This study had shown that external parasites were very common in the sheep and goats of the study area, in that more than half (78.95%) of the sampled animals were found to be infested by one or more ectoparasites. Ticks were the major ectoparasites encountered in goats and lice in sheep. Agro-climate and species of the animal were statistically significant factors affecting the ectoparasite infestation in small ruminants in the study area. Therefore, taking these findings of the study into account, sick and heavily infested animals should be treated with acaricides, management of animals against ectoparasites should be based on the feeding and season of occurrence as well as heavily infested pastures should be avoided to reduce the prevalence and impact of these parasites in small ruminant husbandry and production.

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