

Research Article

Prevalence of Skin Diseases in Small Ruminants and Associated Risk Factors in Gamogofa Zone, South-West Ethiopia

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Submitted: 05 January 2019

Accepted: 22 January 2019

Published: 24 January 2019

ISSN: 2379-948X

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OPEN ACCESS

Keywords

- Demba Gofa
- Dermatophilosis
- External parasites
- Sheep and Goat Pox

Abstract

A cross-sectional study was conducted from November 2017 to March 2018 in Gamo Gofa Zone, Demba Gofa District in SNNPR, to determine the prevalence of skin diseases in sheep and goats and to identify dominant risk factors associated with skin disease at the study area. A total of 383 small ruminants (189 sheep and 194 goats) were examined and 22.54% (86/383) were affected by skin disease. When examining animals in a different agro-ecological zone, the highest prevalence was observed in Sawla (28.9%), which represents lowland, followed by Zelele (19.53%), which represents Midland and Tsangaderara (18.9%), which represents highland. However, There was no statistically significant difference ($p>0.05$) in the occurrence rates of skin diseases among the three selected sites. The prevalence of skin disease in sheep and goats was 23.04% and 21.88% respectively. In the current study, bacterial, viral, parasitic and fungal infection was observed. Sheep and goat pox was the predominant disease in the study area, which accounted for 11.23% (43/383), followed by parasitic infestation 4.7% (18/383). Furthermore, the least prevalence was seen in fungal infection (dermatophytosis, 2.7%). Out of 211 females and 172 males examined, 11.8% (25/211) females and 8.5% (18/172) males were infected hence, there was no statistically significant difference ($p>0.05$) in the prevalence rates of skin diseases among sex. Prevalence observed among the body condition score were 15.41% (59/383) in poor body condition, 4.4% (17/383) in medium body condition and 2.614% (10/383) in good body condition that associated with statistically significant difference ($p<0.05$) with the occurrence of skin disease. The study revealed that the high prevalence of skin disease on small ruminant in the study area was due to associated risk factors that facilitate favorable environment for etiological agents. Attention should be given to the control and prevention of skin disease and further study in the area should be conducted in order to determine the economic losses caused by small ruminant's skin disease.

INTRODUCTION

The term skin refers to an external surface layer of small ruminants such as sheep and goats whereas the term hide refers the external surface layer of large animals like cattle and camel [1]. Hides and skin are important sources of Ethiopia and SNNPR income [2,3]. The current utilization of hides and skins is estimated to be 48% for cattle hide, 75% for goatskin and 97% for sheepskin with the expected offtake rate of 33%, 35% and 7% for sheep, goat, and cattle respectively. Ethiopia supplies a wide range of both processed and semi-processed sheep and goat skins to the world market that account for 12-16% of total value exports [4,5].

In Southern Ethiopia, 2.4 million sheep and 2.2 million goats are found that are widely important as a source of income for the agricultural community [2]. Furthermore, Small ruminants are important contributors to food production in the country, providing 35% meat consumption and 14% of milk consumption. In central highlands where mixed crop-livestock production system is practiced, small ruminants account for 40% of cash income and 19% of the household meat consumption. Owing to their high fertility, short gestation interval, and adaptation

even in harsh environments, sheep and goats are considered as investments and insurance to provide income to purchase food during seasons of crop failure and to meet seasonal purchase such as improved seed, fertilizer, and medicine for rural household [4]. They also provide as much as 30% of meat and milk consumed in sub-Saharan Africa; however, these animals have received much less attention than cattle. The reason why sheep and goats have received scant attention is the small size of most breeds found in the tropics, but this is unjustified since their productivity relative to their size is greater than that of large ruminants like cattle [6,7].

Even though small ruminants are important components of Ethiopian farming system, their contribution to food production, rural income, and export income are far below the expected potential. This is because small ruminant production in Ethiopia is constrained by compound effects of the disease, poor feeding, and management [4]. Over the last 10 years, there are indications that the quality of raw material has deteriorated with an increasing number of reject grades and the appearance of skin diseases like "ekek" that is mainly due to lice, ticks and mange infestation. Hides and skins are downgraded as a result of various ante-mortem and post-mortem factors, including poor animal

husbandry, disease and transportation, storage and general handling [8].

The existence of various skin disease and other poor animal husbandry practices are frequently reported from different parts of the country in Ethiopia [4,5,8, 9]. But there was no sufficient study conducted before in Gamo Gofa Zone in general and in Demba Gofa Woreda specifically; and the status of the disease was not much known in this area, however, it is well understood that before any control attempt of skin defects and diseases, it is necessary to know what diseases are present and how important they are. It is, therefore, necessary to generate relevant information that helps to design control strategy. The objectives of the study were to estimate the prevalence and assess associated risk factors of skin diseases and to determine the etiological agents of skin diseases in small ruminants at the study area.

MATERIALS AND METHODS

Study area description

The study was conducted in Southwestern Ethiopia on small ruminant animals obtained from three selected sites of DembaGofa District, under GamoGofa Zone, representing three agro-ecological areas; namely Tsangaderara (Highland), Zelele (Midland) and Sawla (Lowland). The study area lies approximately 800 meters (at Omo river courses in the western lowland) to 2800 meters (Alva mountain at Tsangaderara of the District in West) above sea level and the average annual rainfall varying from 950 millimeters to 1150 millimeter that characterized by a bi-modal type of distribution. The three selected study areas are located 516 kilometers southwest of the capital city of Ethiopia, Addis Ababa. The mean annual minimum and maximum temperature respectively is 15.4°C in the high land and 37.2°C in the lowland. The geographical coordinate system of the DembaGofa District is considered as the area lies between 6° 25' to 6° 45' N latitude and 37.15° E longitude [10].

Study animals

Out of sheep and goat population at the study area, a total of 383 (194 goats and 189 sheep) small ruminants were selected. The selected study animals were categorized in two age groups namely, young (up to 2 years) and adult (above 2 years) by considering the rate of eruption of teeth as referred by Gatén by [11] and Steele [12]. Small ruminants of both sexes were included and their body condition scoring of the study animals was determined subjectively following the technique according to Desta *et al.*, [1], and Tefera [4] and was categorized into three groups as poor, medium and good both for adults and young.

Study design and sampling procedures

A cross-sectional type of study design was used to determine the prevalence and identify the causal factors for different skin diseases of small at the study area. Age, sex, geographical location and body condition of the study animals were recorded as test variables during data collection to identify the related risk factors with the occurrence of skin disease. Simple random sampling technique was used to select small ruminants in respective study areas. Three visits were made to each of the selected study

sites during the study period. A total of 383 small ruminants were sampled from the three selected sites (127 from Highland, 128 from Midland and lowland). All the recovered external parasites from the body part of the study animals were fixed in universal sampling bottle containing 70% ethyl alcohol. Skin diseases associated with bacterial, viral and fungal infection were identified by physical, clinical examination and laboratory tests as much as the laboratory facilities allowed.

Study methodology

The recovered external parasites of the study animals were preserved in 70% ethyl alcohol in a universal sampling bottle. Mite genera were identified directly under a light microscope (40x-100x magnifications) and tick genera using a stereomicroscope. Ticks and mites were identified by following the morphological keys according to Souls by [13], Urquhart [14] and Taylor *et al.*, [15]. Bacterial, viral and fungal infections were identified and diagnosed based on detailed physical clinical examinations. Furthermore, Staining and laboratory tests were done especially on bacterial and common fungal infections.

Sample size determination

The sample size was determined by using an expected prevalence of 42.33% from the previews report of the work done in the study area by Molla *et al.*, [16]. The sample size for the study was calculated by using the formula given by Thrufield [17] as shown below:

$$N = (1.96^2 * P_{exp} * q) / d^2 \text{ Where,}$$

N = sample size required

P_{exp} = expected prevalence

$$q = 1 - P_{exp}$$

d = desired absolute precision

Accordingly, total sample sizes of 375 small ruminants were required with 95% confidence level and 5% precision for the study. However, a total of 383 study animals were sampled to increase the precision of the estimated prevalence of skin diseases on small ruminants in the study area.

Statistical analysis

The data collected was entered into Microsoft Excel spreadsheet and analyzed using statistical software for social science (SPSS) version 17.0 for Windows [18]. The prevalence of skin disease of small ruminants in the selected study areas was calculated as the number of animals that harbor the skin diseases, divided by the total number of small ruminants examined. The degree of association with the various risk factors was assessed using the Pearson chi-square (χ^2) test. For all analyses, a P-value of less than 0.05 was taken as a significant association.

RESULTS

The overall prevalence of skin diseases at Demba Gofa, District of Gamo Gofa Zone in SNNPR, was 22.5% (86/383). Sheep and goat pox were the predominant diseases which account for 11.23% (43/383), followed by parasitic infestation 4.7% (18/383), (2.78% for mange mites and 1.83% for ticks). Dermatophytosis

was the least prevalent disease with the occurrence rate of 2.7% at the area. The prevalence of skin diseases was compared among the three selected sites as well as different causative agents that cause skin diseases in both sheep and goats. As the study reveals, the highest prevalence was observed in Sawla (28.9%), which represents low l and, followed by Zelele (19.53%), which represents a midland and Tsangaderara (18.9%), which represents a highland. As the finding reveals, a relatively higher infection was observed in Sawla (lowland, 28.91%) as compared to mid and high altitude. There was no statistically significant difference ($p > 0.05$) in the prevalence rates of skin diseases among the three selected sites (Table 1).

Prevalence of dermatophilosis

Lesions observed on the skin of lips, nose, face, ears, neck, and limbs were scabs and dry crusty exudates matted with hairs. The overall prevalence of dermatophilosis observed was 3.66% (14/383). Prevalence among animals in medium body condition was 13.6 % (3/22), 13.0% (10/77) in poor body condition and 0.4 % (1/284) in good body conditioned animals. There was a statistically significant difference ($p < 0.05$) on the prevalence of Dermatophilosis infection among the body condition. On the other hand, no statistically significant difference was observed in the prevalence among small ruminants of different sexes, species, age and origin (Table 2).

Prevalence of sheep and goat Pox

The overall prevalence of shoa pox was 11.23% (43/383), out of which 12.9 % (25/194) of goats and 9.5 % (18/189) of sheep were infected by a pox virus. Out of total 211 females and 172 males were examined, 11.8% (25/211) females and 8.5%

(18/172) males were infected. The prevalence of sheep and goat pox in animals which had medium body condition accounts 40.9% (9/22), followed by animals that had poor body condition 40.3% (31/77) and had good body condition 1.1% (3/284). There was no statistically significant difference ($p > 0.05$) among both sexes, species, age or origin of animals, but there was a statistically significant difference ($p < 0.05$) among body condition of the study animals (Table 2).

Prevalence of mange mite infestation

Out of total 383 small ruminants (136 young and 247 adults) examined, the overall prevalence of Mange Mite infestation was 2.87% (11/383). Out of which 4.4% (6/136) and 2.15% in young and adults were observed respectively. The prevalence of mange mite infestation 2.1% (4/194) in caprine, 3.7% (7/189) in ovine and 3.3% (7/211) in females, 2.3% (4/172) in males were observed. There was no statistically significant difference ($p > 0.05$) in the prevalence of mange mites among the age of animals, agro-ecology, species and sex, but there was a significant difference ($p < 0.05$) among the body condition of small ruminants (Table 2).

Identification of mite genera

The genera of Mite identified in the current study according to agroecology of the area were *Demodex*, *Psoroptes*, *Sarcoptes* and *Chorioptes* in Highland, Midland, and lowland with the percentage indicated in the (Table 3) below. These genera of Mite were also identified based on the species of the study animals with the rate of 1.58%, 1.58%, .78% and .78% of *Demodex*, *Psoroptes*, *Sarcoptes* and *Chorioptes* respectively in the sheep whereas, 1.03%, 0.51%, 0.51% and 0% of *Demodex*, *Psoroptes*, *Sarcoptes* and *Chorioptes* respectively in goats (Table 3).

Table 1: Prevalence of skin diseases in small ruminants within three study districts.

Agroecology	N	Dermatophilosis		Sheep and Goat Pox		Mange Mite		Tick		Dermatophytosis		Total	
		Infected	%	Infected	%	Infected	%	Infected	%	Infected	%	Infected	(%)
Highland	127	4	3.2	11	8.7	3	2.4	3	2.4	3	2.4	24	18.9
Midland	128	6	4.7	12	9.4	3	2.3	2	1.6	2	1.6	25	19.53
Lowland	128	4	2.4	20	15.6	5	3.9	2	1.6	6	2.4	37	28.9
Total	383	14	3.7	43	11.2	11	2.9	7	1.8	11	2.9	86	22.45
χ^2		0.582		3.763	0.737	0.303		2.418		3.645			
p-value		0.748		0.152	0.692	0.860		.0299		0.162			

Table 2: Association of different skin diseases with risk factors.

Risk factors	N	Dermatophilosis				Sheep and Goat pox				Mange Mite				Tick				Dermatophytosis				
		n	%	χ^2	p-value	n	%	χ^2	p-value	n	%	χ^2	p-value	n	%	χ^2	p-value	n	%	χ^2	p-value	
Sex	Female	211	5	2.4	2.2	0.138	25	11.8	0.18	0.67	7	3.3	0.33	0.563	4	1.9	0	0.912	7	3.3	0.33	0.563
	Male	172	9	5.2			18	8.5			4	2.3			3	1.7			4	2.3		
Age	Young	136	5	3.7	0	0.987	14	10.3	0.18	0.668	6	4.4	1.48	0.223	6	4.4	7.8	0.005	6	4.4	0.33	0.562
	Adult	247	9	3.6			29	11.7			2	2.1			1	0.4			5	0.24		
Species	Caprine	194	5	2.6	1.29	0.255	25	12.9	1.08	0.297	4	2.1	0.92	0.336	4	2.1	0.1	0.729	4	2.1	0.92	0.336
	Ovine	189	9	4.8			18	9.5			7	3.7			3	1.6			7	3.7		
Body condition	Good	284	1	0.4	34	0	3	1.1	114	0	0	0	35.3	0	3	1.1	7.6	0.022	3	1.1	16.1	0
	Medium	22	3	13.6			9	40.9			1	4.5			2	9.1			2	13.6		
	Poor	77	10	13			31	40.3			10	13			2	2.6			6	6.5		

Prevalence of tick infestation

On basis of Tick infestation, 1.83% (7/383) small ruminants were affected by ticks. The overall prevalence of tick infestation in small ruminants according to agroecology was 2.4% (3/127) in Highland, 1.6% (2/128) in both Midland and lowland. A significant difference of prevalence was found among an association of age and body condition. There was no statistically significant difference ($p > 0.05$) on the tick infestation among the agro-ecology, sex and species association (Table 2).

Identification of tick genera

The current study reveals that there was a different genus of Tick at the area that distributed in different agroecology which addressed on the study. The genus *Amblyomma* was common in highland, lowland, and midland of the area and it was also predominant in goats and sheep species. *Boophilus* and *Hyalomma* were not identified on midland whereas *Rhipicephalus* and *Hyalomma* were not observed in highland and lowland (Table 4).

Prevalence of dermatophytosis

According to Dermatophytosis, out of total 383 small ruminants examined, 2.87% (11/383) of them were affected. The respective prevalence of dermatophytosis in sheep and goats were 3.7% (7/189) and 2.1% (4/194). Poor and medium body conditioned small ruminants were significantly highly infected than animals in good body condition (6.5%, 13.6%, and 1.1%,) respectively with $p < 0.05$ that indicates a significant association. There was no statistically significant difference ($p > 0.05$) among the three selected sites of Demba Gofa District regarding age, species and the sex of animals (Table 2).

DISCUSSION

The overall prevalence of skin diseases in the different agro-ecological zone were 28.9% in lowland (Sawla), 19.53% in Midland (Zezele), and 18.9% in highland (Tsangaderara). These finding with relatively high prevalence would be associated with poor veterinary services, husbandry system, feeding problems,

climatic stress, and favorable environment for multiplication of disease-causing agent. This spread of skin diseases infections was also amplified by close contact of different animals at contact points such as common grazing and watering sites. The current finding was lower than the prevalence of skin disease around GamoGofa reported by Molla *et al.*, [16]. but higher than the finding of Dessie *et al.*, [19], who reported 1.98% on sheep and 5.85% on goats at three ecological zones of Wolita-Sodo, Southern Ethiopia. The variation could be attributed due to a geographical location of the study areas. There was no statistically significant difference ($p > 0.05$) among the prevalence of the skin diseases of small ruminants in the three selected sites of DembaGofa district representing three agro-ecological zones thus agree with the finding of Molla *et al.*, [16] at the similar study area. The respective prevalence of skin diseases in small ruminants, 11.49% in sheep, and 10.96% in goats were observed. The prevalence of sheep and goat pox in the present study 11.23% was closely similar to the finding of Yacobet *et al.*, [5] in Adama who reported 11.46%.

The prevalence of dermatophilosis in the current study was 4.8% and 2.6% in sheep and goats, respectively. There were few reports on small ruminant dermatophilosis from Ethiopia where a prevalence of 3% was observed [20,21], which was slightly lower than the current finding. The overall prevalence of mite in sheep and goat were 3.7% and 2.1% respectively, with a prevalence of 2.1% for *Demodex*, 2.2% for *Psoroptes*, 2.14% for *Sarcoptes* and 0.70% for *Chorioptes*. This was lower than different mange mite infestation rates that had been reported from different parts of the country by various researchers who reported 3.96% [22] and 4.27% [23] from central and Southern parts of Ethiopia respectively. This may be because special attention was given to manage small ruminants in the study area. There was no statistically significant difference ($p > 0.05$) among the prevalence of mange mite infestation in small ruminants in the different districts of the study area, but there was statistically significant difference ($p < 0.05$) among the body condition score of the animals, which was found to be 13.0% in animals with poor body condition, 4.54% in medium condition and 0% in good body

Table 3: Identification of Mite genera.

Mite genus	Agroecology						Species			
	Highland		Midland		Lowland		Sheep		Goats	
	n	%	n	%	n	%	n	%	n	%
<i>Demodex</i>	1	0.78	1	0.78	2	1.56	2	1.58	2	1.03
<i>Psoroptes</i>	1	0.78	-		1	0.78	2	1.58	1	0.51
<i>Sarcoptes</i>	1	0.78	1	0.78	1	0.78	1	0.78	1	0.51
<i>Chorioptes</i>	-		-		1	0.78	1	0.78	-	-

Table 4: Identification of tick genera.

Tick genus	Agroecology						Species			
	Highland		Midland		Lowland		Sheep		Goats	
	n	%	n	%	n	%	n	%	n	%
<i>Amblyomma</i>	2	1.57	1	0.78	1	0.78	2	1.03	1	0.51
<i>Boophilus</i>	1	0.78	-		1	0.78	1	0.51	1	0.51
<i>Rhipicephalus</i>	-	-	1	0.78	-	-	-	-	1	0.51
<i>Hyalomma</i>	-		-		-	-	1	0.51	-	-

condition. This difference may be due to small ruminants under poor body condition lack well developed immune status that can respond to any disease-causing agent unlike that of small ruminants with good body condition.

The overall prevalence of tick infestation in the present study was, 2.1% in goats, 1.6% in sheep, out of which 1.54% *Amblyomma*, 1.03% *Boophilus*, 0.52% *Rhipicephalus* and 0.515% *Hyalomma*, which was lower than the previous work by Serste and Wossene [24] in North East Ethiopia with 3.4% and 22.2% for goats and sheep respectively. This difference in the prevalence might be due to the geographical difference, breed and seasonal difference. The overall prevalence of tick infestation was 0.4% and 4.4% in adults and young respectively, and 2.4% in highland and 1.6% in both lowlands and Midland. The current result reflected that the occurrence of external parasites in small ruminants of the study area was lower than the prevalence of external parasites reported by Serste and Wossene [24] who reported about 50 % and 56% in sheep and goats respectively in different agro-climatic zones of Eastern Amhara Region of Ethiopia.

CONCLUSIONS

The present study indicated that small ruminants in the three selected sites of Demba Gofa district, under Gamo Gofa zone, South West Ethiopia were highly infected by different infectious agents that cause skin problems in the study area. Out of the infectious agents, the highest prevalence was observed for sheep and goat pox. In this study, skin diseases were more common in lowland areas than in mid- and highland. All skin diseases investigated in this study were especially prevalent in animals in poor body condition. Further research works in the areas of small ruminant's skin disease should be conducted in order to determine the economic losses caused by these diseases.

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Cite this article

Woga Z, Alemu B (2019) Prevalence of Skin Diseases in Small Ruminants and Associated Risk Factors in Gamogofa Zone, South-West Ethiopia. *J Vet Med Res* 6(1): 1173.