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PREVALENCE OF ECTOPARASITES IN SMALL RUMINANTS (CASE: AFAR REGION OF ETHIOPIA)

Endris FEKI[1]✉, Solomon GEBRE[2], Ayalew SHUMET[3], Yimer GOBENA[3], Hussen MOHAMMED[3] and Ashenafi EBREGERGIOUS[3]

[1]*Afar Pastoral and Agro-pastoral Research Institute, Afar, Semera, P.O.Box 16, Ethiopia*
[2]*National Animal Health Diagnostic and Investigation Centre (NADIC), Sebeta, P.O. Box 4, Ethiopia*
[3]*Samara Regional Veterinary Laboratory, Afar, Semera, P.O. Box 33, Ethiopia*

✉Email: endrisf@yahoo.com

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ABSTRACT: A study was conducted from August 2016 to November 2017 to investigate the prevalance of major ectoparasites of small ruminant and associated risk factors in fourteen districts found in the three Zones of Afar Regional State of Ethiopia. A total of 5376 small ruminants were examined to determine the prevalence of ecto-parasites, includes 3696 goats and 1680 sheep. 1443 (39.00%) goats and 839 (49.90%) sheep were found infested with different ectoparasites. The result of the study showed that statically significant difference was found between species of sheep and goats in related to ectoparasite infestation. The overall prevalence of ectoparasite indiocates that 2282 (42.45%) small ruminants were infested by ectoparasites. The most common ectoparasites encountered in order of their predominance were 1968 (36.6%), 155 (2.88%), 105 (1.95%) and 54 (0.56 %) ticks, mange mites, lice and flea infestation, respectively. In the present study, five genera of ticks (*Rhipicephalus, Hyalomma, Amblyomma and Boophilus*), *two genera of lice (Linognathus and Damalina) three genera of mites* (Sarcoptes, Demodex and Psoroptes), and one genera of flea ctenocephalides were identified on the study animals. *Rhipicephalus, Hylomma, Boophilus, Ambylomma* was identified as the predominant genera. The prevalence of ectoparasite infestation for different age groups, sex and body condition score were found to vary significantly. In conclusion, among ectoparasites species recorded in the area ticks was found to be highly prevalent in sheep and goats. Tick was predominant followed by mite, lice and flea. The present study revealed an overall ectoparasite prevalence of 2282 (42.45%) in both small ruminant species. Of this, 839 (49.9%) and 1443 (39%) was in sheep and goats, respectively. It also revealed that ticks, mites, lice and fleas are common ectoparasites in the study area. to reduce high prevalence of ectoparasites and their impact on the productivity in small ruminants requires immediate attention, control interventions.

Keywords: Ectoparasite, Ethiopia, Prevalence, Ruminant, Ticks.

INTRODUCTION

In Ethiopia, sheep and goats contribute a substantial proportion of the nation's meat supply and milk. The total numbers of sheep and goats in Ethiopia are estimated about 25.5 and 23.4 million respectively (CSA, 2003). Sheep and goats constitute about 30% of the total livestock population of the country. Gryscels and Anderson (1993) and are among important contributors to food production in Ethiopia, providing 35% of meat consumption and 14% of milk consumption (Asfaw et al., 1998).

Small ruminants are source of income for agricultural community and are also one of Ethiopia's major sources of foreign currency through exportation of live animals, meat and skin (Dessie et al, 2010; Mekuria et al., 2018). However in Ethiopia, contribution of sheep and goats to food production, rural and export income are far below the expected potential. This is because small ruminant production in Ethiopia is constrained by the compound effects of diseases, poor feeding and poor management (Kassa, 2005 and Ayele et al, 2003). Ecto-parasites including ticks, lice, mites etc. play an important role in the transmission of certain diseases (Mohd Zain et al., 2015). Infested animals scratch, rub and bite the affected areas and this end up with skin damage (Seyoum et al., 2015). Moreover, infected ruminants are the most important vectors of protozoan, bacterial, viral and rickettsial diseases (Radostits et al, 2007; Rhabari et al, 2009 and Stuchin et al., 2016).

The increasing severity and periodic rapid spread of the ecto-parasites and skin diseases in the Afar Region demanded that the different institutes to conduct a survey to characterize the true status of ecto-parasites and skin diseases problem and recommend possible control measures: Therefore, the objective of this study was:

- To identify different types of ecto-parasites and associated risk factors in small ruminants.
- To determine the prevalence ecto-parasites in sheep and goats.
- To recommend possible control and prevention measures of ecto-parasites in the region (Radostits et al, 2007; Rhabari et al., 2009 and Stuchin et al., 2016).

So, aim of present study was investigating the prevalance of major ectoparasites of small ruminant and associated risk factors in fourteen districts found in the three Zones of Afar Regional State of Ethiopia.

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MATERIALS AND METHODS

Study areas

The study was carried out in fourteen districts selected from zone one, four and five of Afar regional state, namely; Five districts of Zone 1 (AwsiRasu) namely (Afambo, Chifra, Ayssaita, Dubti, Mile), four districts of Zone 5 (HariRasu), (Telalak, Dewe, Hadalella & Dalifage) and Five districts of Zone 4 (FantenaRasu), (Golina, Awra, Ewa, Yalo & Teru) were selected for this study. The livestock population in the Afar region estimated at 3.6 million cattle, 2 million sheep, 3 million goats, 0.9 million camels and 0.2 million equines (ERIPAE, 2000). The Afar National Regional State is characterized by an arid and semi-arid climate with low and erratic rainfall. The altitude of the region ranges from 120m below sea level to 1500m above sea level. Temperatures vary from 20^{0}C in higher elevations to 48^{0}C in lower elevations. Rainfall is bi-modal throughout the region with a mean annual rainfall below 500 mm in the semi-arid western escarpments and decreasing to 150 mm in the arid zones to the east. The production system of the Afar region is dominated by pastoralist (90%) from which agro-pastoralist (10%) is now emerging following some permanent and temporary rivers on which small scale irrigation is developed. The season are traditionally classified as kerma (July-September), which is the long rainy season; sugum (March-April), which is the short rainy season; hagai (May-June) which is the hot dry spell; and gilal (October-February) which is the cool season. Gilal is sometimes interrupted by rains in January and February.

Animals and sampling

A cross-sectional study was used to investigate the occurrence of ecto-parasites in sheep, goats and associated risk factors. The study was conducted from August-2016 to November-2017, from the three zonal administrations 14 /fourteen districts/were selected for this study. The study districts selected based on the inclusion criteria on the high sheep and goats population, extent of parasite infection and infestation, accessibility of their Peasant associations and willingness of the pastoralists to participate in the survey. The studied animals were randomly selected using a systematic sampling technique from traditionally managed sheep and goats populations in the respective districts. The studied population was indigenous breed of sheep and goats kept under pastoral type of production which allows free grazing, usually mixed with other animals.

Sample size determination

Sample size was determined as described by Thrusfield (2005). Accordingly, 50% expected prevalence of ectoparasites infestations in each study agro-ecology, 5% acceptable error and 95% confidence level was applied to determine the sample size of study sheep and goats in each study agro-ecology.

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

Where n = sample size, d = desired absolute precision (0.05), P_{ex} = expected prevalence (50%), thus the desired sample size for P_{ex} = 0.05 is n = 384. Sampling was 384 from each district. Proportionally distributed based on the total large ruminant population in the study districts and PAs.

Data collection

Data was collected such as species type, age, sex, and body condition score. The ages of the animals were estimated using the definition described by Aiello and Mays (1998). When lambs and kids were less than 6 month old, they were considered as “young animals” whereas when small ruminants were more than 6 month old they were included in the “adult” group. And also the age determine by using dental formula. Body condition scores will be determined by modifying the system of Gatenby (2002) animals either poor or good body condition.

Sample collection and handling procedure

During clinical examination the skin will be palpated across all parts of the animal for the presence of ectoparasites, and gross lesions suggestive of a clinical form of parasitic infestations. Animals found infested will be considered positive. From sheep and goats ticks, lice and fleas were collected with forceps from their predilection sites of attachment. The ticks were removed from the host skins whilst retaining their mouth parts for identification using forceps. Coat brushing techniques was used for collection of lice. They will be placed in labeled universal bottles containing 70% ethanol and identified under a stereoscopic microscope according to the descriptions of ticks (Walker et al., 2003). When skin lesions were evidenced skin scraping from suspected cases of mange were collected and preserved in 10% formalin. Mite identification was made according to Wall and Shearer (2001) and Taylor et al. (2007).

Ethical Regulation

Handling, sampling and all of animal related cantacts were in according to ethical regulation standart of Pastoral and Agro-pastoral Research Institute of Ethiopia.

Statistical analysis

The collected data were entered in Microsoft excel. An intercooled Stata 7 software (Stata Corporation, 2001) statistical program was employed for the data analysis. The prevalence of tick was determined by dividing the number of

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positive samples by the total sample size, and was expressed as percentage. Chi-square ($\chi 2$) test was used to assess if there was a statistically significant difference in tick infestation with in different groups. For this analysis P-value less than 0.05 was considered significant.

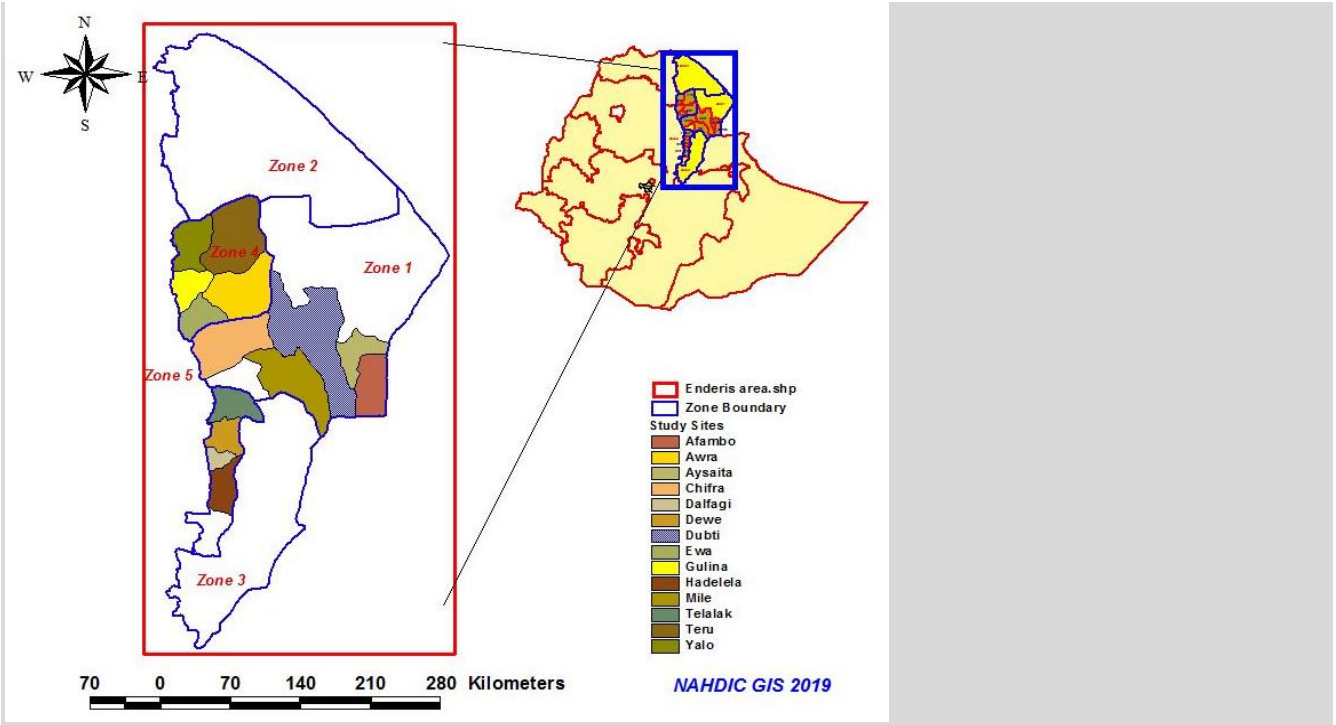

Figure 1 - Map of study districts in the region. ** National Animal Health Diagnostic and Investigation Centre (NADIC) GIS, 2019*

RESULTS and DISCUSSION

Prevalence of ecto-parasites disease

A total of 5376 small ruminants were examined to determine the prevalence of ecto-parasites infestation in 14 districts of Afar region. Of these, 2282 (42.45%) were infested by ecto-parasites identified. The overall prevalence of ectoparasites was higher in sheep than goats (Table 1). Ticks were identified as the predominant ectoparasites in small ruminants followed by mite, lice and Flea infestations (Table 2). The total number of ectoparasites collected were 2282 (42.45 %). Of these 1968 (36.6%), 155 (2.88%), 105 (1.95 %) and 54 (0.56 %) accounted for tick, mange mites, lice and flea infestation, respectively (Table 2).

Table 1 - Prevalence of ectoparasites in small ruminants of Afar region, Ethiopia

Characteristics		Parasites states of the area		COR (95% CI)	P-value	AOR (95% CI)	P-value
		Positive	Negative				
Animals	Goats	1443(39%)	2253(61%)	1	0.0001	1	0.001
	Sheep	839(49.9%)	841(50.1%)	1.558 (1.387, 1.750)		0.642(0.572, 0.721)	

*statically significant P<0.05. COR: Crude odd ratios and AOR: Adjusted odds ratios. CI: confidence interval.

Table 2 - Percentage of ectoparasites prevalence found in small ruminants in the Afar region, Ethiopia

Ectoparasites	No. of positive shoats	%
Tick	1968	36.61
Mange	155	2.88
Lice	105	1.95
Flea	54	0.56
Total ecoparasites count	2282	42.41

Prevalence of ectoparasites by Genus level

In the present study four genera of ticks (*Rhipicephalus, Hyalomma, Boophilus and Amblyomma, three genera of mites* (sarcoptes, Demodex and Psoroptes), two genera *lice (Linognathus and Damalina)* and one genera of flea Ctenocephalides were identified. Of the total of 3696 goats and 1680 sheep examined for the infestation of ticks, mite, lice and flea; 1968 (36.61%), 155 (2.88%), 105 (1.95%), 54(0.56%) of shoats were infested with these ectoparasites respectively (Table 3).

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Prevalence of ecto-parasites at species level

Nine species of ticks which belong to the five genera were identified. *Rhipicephaluspulchellus,* 599 (11.14%) *Rhipicephalus evertsi,* 495 (9.21%) *and Rhipicephalus Pravus,* 191 (3.55%) were the dominant ones. Mange mites genera identified were; Sarcoptes 77 (1.43%), Psoroptes 48 (0.89%) and Demodex 30 (0.56%). The most prevalent lice species found on animals were Damalina *ovis,* 33 (1.96%), *Linognathus ovis,* 20 (1.19%) on sheep and *Linognathus caprae,* 28 (0.76%) and *Damalina caprae,* 24 (0.65%) on goats. The overall prevalence of Ctenocephalidia was 22 (0.48%) in sheep and goats (Table 4).

Table 3 - Prevalence of ectoparasites at the genus level

Types	Genus	Goat 3696	Sheep1680	Shoat 5376
		Prevalence	Prevalence	Prevalence
Ticks	*Rhipicephalus*	918 (23.94%)	528 (31.43%)	1446 (26.90%)
	Hyalomma	126 (3.41 %)	72 (3.92%)	198 (3.68%)
	Boophilus	109 (2.95%)	56 (3.33%)	165 (3.07%)
	Amblyomma	97 (2.62%)	62 (3.69%)	159 (2.96%)
	Sub total	1250 (33.82%)	718 (42.74%)	1968 (36.61%)
Mite	*Sarcoptes*	67 (1.81%)	10 (0.60%)	77 (1.43%)
	Psoroptes	16(0.43%)	32 (1.90%)	48 (0.89%)
	Demodex	26 (0.70%)	4 (0.24%)	30 (0.56%)
	Sub total	109 (2.95%)	46 (2.74%)	155 (2.88%)
Lice	*Damalinia*	24 (0.65%)	33 (1.96%)	57 (1.06%)
	Linognathus	28 (0.76%)	20 (1.19%)	48 (0.89%)
	Sub total	52 (1.41%)	53 (3.15%)	105 (1.95%)
Flea	*Ctenocephalides*	32 (0.60%)	22 (0.48%)	54 (0.56%)
	Sub total	32 (0.60%)	22 (0.48%)	54 (0.56%)
	Total	1443 (39.00%)	839 (49.90%)	2282 (42.45%)

Table 4- Prevalence of tick species in small ruminants of Afar region, Ethipia

Genera and species of ecto-parasites		Goat 3697	Sheep 1679	Shoats 5376
		Prevalence	Prevalence	Prevalence
Rhipicephalus	*Pulchellus*	386 (10.44%)	213 (12.68 %)	599 (11.14%)
	Evertsi evertsi	297 (8.04%)	198 (11.79%)	495 (9.21%)
	Pravus	131 (3.54%)	60 (3.57%)	191 (3.55%)
	Praetexatus	104 (2.81%)	57 (3.39%)	161 (2.99%)
	Over all	918 (24.84%)	528 (31.43%)	1446 (26.90%)
Hyalomma	*Truncatum*	72 (1.95%)	42 (2.50%)	114(2.12%)
	Dromedarii	39 (1.06%)	17 (1.01%)	56 (1.04%)
	Anatolicum anatolicum	15 (0.41%)	13 (0.77%)	28 (0.52%)
	Over all	126 (3.41%)	72 (3.92%)	198 (3.68%)
Boophilus	*Decoloratus*	109 (2.95%)	56 (3.33%)	165 (3.07%)
	Over all	109 (2.95%)	56 (3.33%)	165 (3.07%)
Amblyomma	*Gemma*	80 (2.16%)	54 (3.21%)	134 (2.49%)
	Variegatum	17 (0.46%)	8 (0.48%)	25 (0.47%)
	Over all	97 (2.62%)	62 (3.69%)	159 (2.96%)

Prevalence of ectoparasites in sheep and goats by different host related factors

An effort was made to determine the prevalence of ectoparasites in relation to different host factors such as sex, age, and body condition scores. The result is presented in table 5. In regard to sex, male small ruminants were more infested (64%) than females (23.6%) and this was found to be statistically significant (Table 5). The result shows statically different ($P<0.05$). The prevalence of infestation with different ectoparasites age and body condition score groups. The study revealed a higher prevalence in male, adult age groups and poor body condition score animals higher than good body condition (Table 5).

Table 5 - Prevalence of ectoparasites in sheep and goats by different host related factors.

Characteristics		Status of parasites		COR (95%CI)	p-value
		Positive	Negative		
Sex	Female	678 (23.6%)	2191 (76.4%)	1	< 0.001 [a]
	Male	1604 (64%)	903 (36%)	5.740 (5.098, 6.463)	
Age	Young	500 (30%)	1168 (70%)	1	< 0.001 [a]
	Old	1782 (48.1%)	1926 (51.9%)	2.161 (1.911, 2.444)	
BCS	Poor	2244 (90.9%)	225 (9.1%)	1	< 0.001 [a]
	Good	38 (1.3%)	2869 (98.7%)	0.001 (0.001, 0.002)	

*With in different row a common superscript statically significant (P<0.05).

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A total of 3697 goats and 1679 sheep were examined for the infestation of ectoparasites. The overall prevalence of ectoparasite infestation in the present study was found to be 2282 (42.45%). The present finding of ectoparasites in the study area was lower than the prevalence study reported from Zone four of Afar region by Fikre et al. (2015), with the prevalence of 94.62% and 91.86% in sheep and goats respectively. Bekele et al. (2011) reported the prevalence of 99.38% and 96.92% in sheep and goats respectively in Wolmera districts of Oromia region central Ethiopia; Tewodros et al (2012) stated prevalence of 80.97% in sheep and 72.07% in goats around Gonder town, Ethiopia. Our findings showed higher than the result explained by Teshome (2002) that stated the prevalence of 23.8% in sheep and 16% in goats and 15.41% and Yacob et al. (2008). In addition the present study revealed that there is a significant variation in the prevalence of ectoparasites among the animal species, sex of animals, age groups and body conditions of the animals (Table 1, 5 and 6). The rates of infection in this survey were relatively more in sheep (49.9%) than goats (39.0%) which agree with a study conducted by Yacob et al. (2008) that in Wolaita Soddo region reported that the rate of infestation by ectoparasites higher in sheep than goats 68.7% and 28.4%, respectively. Similarly also, the host differences reported in present region by Fikre et al. (2015), that is (94.62%) sheep and (91.86%) goats were found infested with ectoparasites. But, Due to this goats appeared to be significantly more resistant than sheep. The result is in goat lower because of their self-grooming, licking, scratching, rubbing and grazing behaviors, which would contribute to rapid ectoparasite elimination, management practice and in the environmental conditions.

These study shows that ticks, mite, lice, flea; 1968 (36.61%), 155 (2.88%), 105 (1.95%), 54(0.56%) of shoats were infested with above-mentioned of these ectoparasites, respectively. Ticks were found to be the most prevalent ectoparasites in both sheep and goats throughout the study areas. The present result indicates that infestation still need more efforts to achieve expected control result and reduction of impact excreted by ticks but on the other hand others ectoparasite species like mite, lice and flea infestation result is reduced on the present study result. A relative low prevalence of tick infestation (31.8%) in sheep and (18.6%) in goats were reported by Teshome (1994) and were as low result were reported by Zelalem (1994), 23.8% in sheep 16% in goats from the Sidama Zone in Southern Ethiopia.

Different study indicated that ectoparasites affected both sexes. In this study, a higher prevalence of ectoparasite infection was in male sex group (64%) than female sex group (23.6%) and this was significantly ($P<0.05$) different (Table 5). Similarly, Tewodros (2012) reported higher ectoparasite prevalence was observed in male than female and also the result collaborated with those reported by Abebe et al. (2011) and Sertse and Wossene A. (2007). However, dissimilar to the previous reports of Yacob et al. (2008), was also noticed that females were significantly more frequently affected than males (75.45% vs. 61.54%): The variation compare with our findings is due to areas of people use one male for many flocks of sheep and goats in the areas, due to this the males has opportunity to frequent contact with infested goats and sheep.

In present study the prevalence of ectoparasites of adult age group (48.1%) was higher than young age group (30%) (Table 5). The result was significant association ($P<0.05$). This finding was similar with Tefera (2004) and Fikre et al. (2015), with the infection rate of 51.05% and 54.2% in young and adult age, and also the prevalence of ectoparasite was higher in adult (96.91% in sheep ,93.83% in goat) than young, and (88.52% in sheep, 86.25% in goat) respectively. The result dissimilar with the result of Yakob et al. (2008), that reported the prevalence of 53% and 15% for adult and young age group small ruminants in Wolaita Sodo, respectively. This is may be due to differences to infection as a result of variation in also the management system where animals are allowed to graze together in communal fields.

Concerning the prevalence of different ectoparasites high infested in poor body conditions than that of good body condition of small ruminants. Our findings showed that the prevalence of poor body condition (90.9%) and good body condition (1.3%; Table 5). Present finding is similar with results reported by Madeira et al. (2000), Sertse and Wessene (2007), Mulugata et al. (2010) and Tewodros (2012).

Table 6 - Prevalence of ectoparasites in different districts

Zone	Districts	Positive	Negative	COR (95%CI)	p-value
Zone 4 (Fantena Rasu)	Ewa	188 (49.0%)	196 (51%)	1.099 (0.828, 1.458)	0.516[a]
	Awra	150 (39.1%)	234 (60.9)	0.734 (0.551, 0.978)	0.035 [a]
	Gulina	147 (38.3%)	237(61.7%)	0.710 (0.533, 0.947)	0.020 [a]
	Yallo	108 (28.1%)	276 (71.9%)	0.448 (0.332, 0.605)	0.001[b]
	Teru	88 (22.9%)	296 (77.1%)	0.340 (0.249, 0.465)	0.001[c]
Zone 1 (Awsi Rasu)	Afambo	155 (40.4%)	229 (59.6%)	0.775 (0.582, 1.032)	0.005[b]
	Asayta	179 (46.6%)	205 (53.4%)	1	0.000[d]
	Dubti	161 (41.9%)	223 (58.1%)	0.827 (0.622, 1.100)	0.191[a]
	Mille	138 (35.9%)	246 (64.1%)	0.642 (0.481, 0.858)	0.003[e]
	Chifra	144 (37.5%)	240 (62.5%)	0.687 (0.515, 0.916)	0.011[a]
Zone 5 (Hari Rasu),	Telalak	188 (49.0%)	196 (51.0%)	1.099 (0.828, 1.458)	0.516[a]
	Dewe	250 (65.1%)	134 (34.9%)	2.137 (1.598, 2.856)	0.000[b]
	Dalifage	197 (51.3%)	187 (48.7%)	1.206 (0.909, 1.602)	0.194[a]
	Hadelela	189 (49.2%)	195 (50.8%)	1.110 (0.836, 1.473)	0.470[a]

Different superscripts within subgroup represent statically significance of difference prevalence $P<0.05$. COR: Crude odd ratios. CI: confidence interval.

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CONCLUSION

Its concluded that, among ectoparasites species recorded in the area *ticks* was found to be highly prevalent in sheep and goats tick was predominant followed by mite, *lice* and *flea.* The present study revealed an overall ectoparasite prevalence of 2282 (42.45%) in both small ruminant species. Of this, 839 (49.9%) and 1443 (39%) was in sheep and goats, respectively. It also revealed that ticks, mites, lice and fleas are common ectoparasites in the study area.

It is suggested that, due to this higher economic losses occur through animal deaths and damages of the skin. Hence, the following recommendations are forwarded:

- Treatment campaign needs to cover of all affected areas and population of small ruminants because of free livestock movement in the region for grazing and watering.
- Sustainable veterinary services and improved management practice and well-coordinated control interventions and Strong monitoring and evaluation measures during the control campaign is very essential.
- It is valuable to implement effective Extension services and training programs aiming at awareness creation about the importance and control of ecto-parasites for livestock owners is very important.
- Moreover further epidemiological investigation is needed in the study area.

DECLARATIONS

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Authors' contribution

All authors contributed equally to this research work. All authors read and approved the final manuscript.

Availability of data and materials

Data will be made available up on request of the primary author

Consent to publish

Not applicable.

Competing interests

The data can be available to the journal upon request.

Conflict of interest

The authors declare they have no competing of interests.

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