

Detection on ectoparasites on small ruminants and their impact on the tanning industry in Sulaimani province

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Abstract

The study was carried out through the clinical examination on the skins of sheep and goats to identify the quality and processed in the tanneries. Parasitic skin diseases caused by ectoparasites such as mange mites, lice, and ticks are among these threats resulting in a serious economic loss to the tanning industry and the country as a whole. Out of 38066 sheep and 9889 goats examined in Sulaimani slaughterhouse in spring season 2017, shows statistically significant $P < 0.05$ between sheep and goats prevalence; 9.35% and 7.43% respectively with one or more ectoparasites. Three different of ectoparasites were infested in both sheep and goats namely; hard tick, lice and mite. Five species of hard tick (Ixodidae) were identified in sheep and goats as follows; *Boophilus* spp 3.68% and 14.16%, *Rhipicephalus sanguineus* 12.47% and 28.63%, *Rhipicephalus turanicus* 7.50% and 15.96%, *Hyalomma a. anatolicum* 11.90% and 31.30%, *Hyalomma marginatum* 9.26% and 9.95% respectively. Two species of lice were identified in sheep namely, *Damalinia ovis* 17.74% and *Linognathus stenopsis* 13.63%, and *D. caprae* 10.97% and *L. stenopsis* 6.22% on goats. Highly infested were identified with mite on sheep include *Psaroptis scabiei* 13.83% and *Psaroptis ovis* 9.98%, while only one species founded in this study in goats namely, *Psaroptis scabiei* 22.79%. The overall number of skins refused to tanning industry 164 (4.61%) in sheep and 116 (15.78%) in goat. The difference in the prevalence of skin disease infestation between refused skin in both sheep and goats were statistically significant in ruminants ($P < 0.05$). This paper deals with major skin defects in occurrence by ectoparasites sheep and goats in Sulaimani province.

Keywords: Sheep and Goat skin, Ectoparasites, Sulaimani Slaughterhouse

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الكشف عن الطفيليات الخارجية في الحيوانات المجترة الصغيرة وتأثيرها على صناعة الدباغة في محافظة السليمانية

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كلية العلوم الزراعية، جامعة السليمانية، السليمانية، العراق

الخلاصة

أجريت هذه الدراسة من خلال الفحص السريري على جلود الأغنام والماعز للتعرف على جودتها ومعاملتها في مصانع الدباغة. وتعتبر الطفيليات الخارجية مثل الجرب والقمل والقراد من الأمراض الجلدية الطفيلية التي تسبب خسائر اقتصادية خطيرة في صناعة دباغة الجلود بشكل عام. تم فحص جلود 38066 من الأغنام و 9889 من الماعز في مجزرة السليمانية خلال فصل الربيع من عام 2017. أظهرت انتشار الطفيليات الخارجية لكل من الأغنام والماعز 9.35% و 7.43% على التوالي، مع ظهور تأثيرات معنوية عند مستوى احتمالية $P < 0.05$ لأحد أو أكثر من الطفيليات الخارجية. حددت ثلاثة أنواع مختلفة من الطفيليات الخارجية تنتشر في كل من جلود الأغنام والماعز؛ القراد الصلب والقمل والعث. تم تحديد خمسة أنواع من القراد الصلب (Ixodidae) في الأغنام والماعز على النحو التالي: *Boophilus* spp (3.68% و 14.16%)، *Rhipicephalus sanguineus* (12.47% و 28.63%)، *Rhipicephalus turanicus* (7.50% و 15.96%)، *Hyalomma a. anatolicum* (11.90% و 31.30%)، *Hyalomma marginatum* (9.26% و 9.95%) على التوالي. نوعان من القمل تم التعرف عليهما في الأغنام، *Damalinia ovis* (17.74%) و *Linognathus stenopsis* (13.63%)، و *D. caprae* (10.97%) و *L. stenopsis* (6.22%) في الماعز. تم التعرف على نوع واحد من القمل في الأغنام في هذه الدراسة، *Psaroptis scabiei* (13.83%) و *Psaroptis ovis* (9.98%)، بينما تم التعرف على نوع واحد فقط في الماعز في هذه الدراسة، *Psaroptis scabiei* (22.79%). العدد الإجمالي للجلود المرفوضة للصناعة 164 (4.61%) في الأغنام و 116 (15.78%) في الماعز. الفرق في انتشار أمراض الجلد الطفيلية بين الجلود المرفوضة في الأغنام والماعز كان ذا دلالة إحصائية في المجترة ($P < 0.05$). يتناول هذا البحث العيوب الجلدية الرئيسية في الأغنام والماعز في محافظة السليمانية.

التوالي. تم التعرف على نوعين من القمل في الأغنام هما *Damalinea ovis* ١٧,٤٧% و *Linognathus stenopsis* ١٣,٦٣% وفي ماعز *Scariei psaroptotic* ١٠,٩٧% و *L. stenopsis* ٦,٢٢%. تم تحديد إصابات عالية للميت على جلود الأغنام لكل من *Scariei psaroptotic* ٢٢,٧٩% العدد الإجمالي للجلود المرفوضة في صناعة الدباغة ١٦٤ (٤,٦١%) في الأغنام و ١١٦ (١٥,٧٨%) في الماعز. الاختلاف في معدل انتشار الإصابات الجلدية بين الجلد المرفوض في كل من الأغنام والماعز كانت لها دلالة إحصائية عند مستوى $P < 0.05$. تتناول هذا البحث العيوب الجلدية الرئيسية التي تحدث من قبل الطفيليات الخارجية لكل من الأغنام والماعز في محافظة السليمانية.

Introduction

Arthropod pests limit production in the sheep and goat industry in many ways. External parasites feed on body tissue such as blood, skin, and hair. The wound and skin irritant produced by these parasites result in discomfort and irritation to the animal (1). All ectoparasites cause intense irritation to the skin and skin damage (2). The arthropod ectoparasites have a variety of direct and indirect effects on the goat production (3). Tick, mite, lice, and ked are common and important parasites because of their disease transmission, blood feeding habit and skin damage in most of the livestock population (4), which caused by ectoparasites such as mange mites, lice and ticks are among these threats resulting in serious economic loss to the tanning industry. Skin from goat and sheep are important economic products contributing to the largest share of the total and agricultural export commodities (5) followed by live animals (6). The diseases that affect skin quality include: bacterial (Dermatophilosis); viral (pox, warts, foot and mouth disease); parasitic (lice, mange, ticks) (7), the major diseases of small ruminants causing serious economic loss to smallholder farmer, the tanning industry. Skin diseases cause mortality, decreased production and reproduction and downgrading and rejection of skins (8). Mechanical damages of skin most noticeable defects on hiding and skin like brand marks, scratches, scars and bruises are caused by mechanical means. Scratches are very common types of lesions caused mechanically by thorns, barbed wires, and horns; whereas branding is made by owners for animal identification and traditional healing purposing. Climate has also sizable impact on quality of the skin with, respect to the substance of skins and exposure to parasitic damage; highland skins are a bit thinner, less greasy and much stronger in fiber structure than skins from lowlanders (9). Ectoparasites including lice, ticks and mange are reported to cause wide range of health problem such as mechanical tissue damage due to reduction in wool quality meat and milk yield causing serious economic losses to the farmer, the tanning industries and country as whole (10). The present study was aimed to determine the distribution of the common ectoparasites of goat and sheep with risk factors on the quality of skin processing in the tanneries.

Materials and methods

Study area

The study on small ruminant ectoparasite was conducted in Sulaimani slaughterhouse during spring season (March, April, and May) 2017.

Clinical Examination

Isolated and examined healthy and infesting pelts with ectoparasite in sheep and goat during routine inspection examination daily, Examination of each animal was conducted by visual inspection of skin for lesions, if any and by the eventual identification of ectoparasites. When skin lesions were evidenced the detailed history was taken from the owner and subsequently, a skin sample was taken from at least two sites covering the adequate depth and peripheral edges. Lice, ked, and ticks were collected in 70% ethyl alcohol in vials for preservation until subsequent examination. Skin scraping from suspected cases of mange was collected and preserved in 70% ethyl alcohol and taken to the laboratory. All samples were properly labeled as described by Wall and Shearer (11).

Specimen collection and identification

Ectoparasites were examined for the presence of tick, lice and mange mites and collected in a clean container, for detailed laboratory examination and identification by stereomicroscope and identification was performed according to the identification key given by Walker *et al.* (12) for tick; and Wall and Shearer (13) and Urquhart *et al.* (14) for lice. Skin scrapings were processed according to the method described by Cole (15). In this method, a few drops of 10% potassium hydroxide was added to the sample, allowed to stand for 30 minutes, and the sediment was examined under different microscopic magnification for mites, their eggs, and fragments. Mites were identified according to the key described by Wall and Shearer (13).

Skin examination

Skin in each group and all the skins were individually examined for detect the influence of the genus/species of parasite on sheep and goat skin, isolated the damaged and good type of skin (observed in the skins are pre- and post-slaughter) ectoparasite for tanning the processing occurrence by owner's animal.

Data Management and Analysis

The data were entered and managed in Microsoft Excel. All the data analysis was done by the Statistical Package for Social Science (SPSS) software version 20. Descriptive statistics such as percentages and frequency distribution were used to describe the nature and the characteristics of the data. The association of different risk factors with the prevalence of ectoparasites was computed by Chi-square (χ^2) test. In all the analysis, comparisons having a P-value of less than 0.05 ($P < 0.05$) were considered as statistically significant.

Results

Clinically examined for presences of ectoparasites and/or lesions, the overall prevalence in spring season showed 9.35% as follows; in March, April and May were 9.32%, 9.72% and 9.05% in sheep respectively, while in goat the overall prevalence of infested pelts with ectoparasite in spring was 7.43% as follows; in March, April and May were 5.94%, 8.32% and 8.47% in goats respectively in slaughterhouse- sulaimani province, shows a highly

significant prevalence rate of ectoparasites in the spring season, although recorded a slight increase in the prevalence rate of ectoparasites in both sheep and goats recorded a significant difference in prevalence rate between spring months; March, April, and May according to Chi-square (χ^2) test in sulaimani slaughterhouse of Kurdistan Region (Table 1).

Three genera and four species of ticks were identified in sheep during the spring season. In the study, tick genera of *Boophilus* spp. (3.68%), tick genera of *Rhipicephalus* spp.; includes two species, *Rhipicephalus sanguineus* (12.47%) and *R. turanicus* (7.50%), genera of *Hyalomma* spp. includes; *Hyalomma a. anatolicum* (11.90%) and *H. marginatum* (9.26%). Two species of lice identified in sheep were *Damalina ovis* (17.74%) and *Linognathus stenopsis* (13.63%) in spring season, two species of mange mites were identified; *Sarcoptes scabiei* (13.83%) and *Psoroptes ovis* (9.98%). The overall of ectoparasites of hard tick 2048 (44.81), Lice 1434 (31.37%) and mange mite 1088 (23.81%) were collected and identified during the spring in sheep -2017 (Table 2).

Table 1: Prevalence of ectoparasites in sheep and goats selected from Sulaimani slaughter house in spring season – 2017

Months	Sheep		Goats	
	NO. slaughter	Infested sheep %	NO. slaughter	Infested goat %
March	11355	1059 (9.32%)	3887	231 (5.94)*
April	12273	1193 (9.72%)	2979	248 (8.32) *
May	14438	1308 (9.05%)	3023	256 (8.47) *
Spring season	38066	3560 (9.35%)	9889	735 (7.43)**

Chi-square (χ^2) test, differences significant at the 0.01** and 0.05* level.

Table 2: Prevalence and identified of genera of ectoparasites examined in sheep in Sulaimani slaughter house

Type of Ectoparasite	No. of ectoparasite collected in infested sheep/ Month %			Total of ectoparasite collected/spring season (%)
	March/ %	April/ %	May/ %	
Hard Tick				
<i>Boophilus</i> spp.	42 (25.00)	57 (33.92)	69 (41.07)	168 (3.68)
<i>Rhipicephalus sanguineus</i>	178 (31.22)	191 (33.50)	201 (35.26)	570 (12.47)
<i>Rhipicephalus turanicus</i>	104 (30.32)	117 (34.11)	122 (34.56)	343 (7.50)
<i>Hyalomma a. anatolicum</i>	141 (25.91)	176 (32.35)	227 (41.72)	544 (11.90)
<i>Hyalomma marginatum</i>	123 (29.07)	143 (33.80)	157 (37.11)	423 (9.26)
Total	588 (28.71)	684 (33.39)	776 (37.89)	2048 (44.81)
Lice				
<i>Damalina ovis</i>	235 (28.97)	264 (32.55)	312 (38.47)	811 (17.74)
<i>Linognathus stenopsis</i>	177 (28.41)	213 (34.18)	233 (37.49)	623 (13.63)
Total	412 (28.73)	477 (33.26)	545 (38.00)	1434 (31.37)
Mite				
<i>Sarcoptes scabiei</i>	197 (31.17)	208 (32.91)	227 (35.91)	632 (13.83)
<i>Psoroptes ovis</i>	134 (29.38)	146 (32.01)	176 (38.59)	456 (9.98)
Total	331 (30.42)	354 (32.53)	403 (37.04)	1088 (23.81)
Overall	1331 (29.13)	1515 (33.15)	1724 (37.72)	4570

Descriptive statistics were used to analyze the prevalence and identified genera species with the number of ectoparasites which collected on sheep infested during the spring season.

Table 3 showed that Ectoparasites were isolated and classified in goats, similar to sheep when compared between them, that meaning the breeding of both sheep and goats is mixed in this area. Three genera and four species of ticks were identified in goats during the spring season. In the study, tick genera of *Boophilus* spp. ((14.16%), tick genera of *Rhipicephalus* spp.; includes two species, *Rhipicephalus sanguineus* (28.63%) and *R. turanicus* (15.96%), genera of *Hyalomma* spp. includes; *Hyalomma a. anatolicum*(31.30%) and *H. marginatum* (9.95%). Two species of lice identified in goats were *Damalinea caprae* (10.97%) and *Linognathus stenopsis* (6.22%) in spring season. Among the spring s only asonone species of mange mites were identified; *Sarcoptes scabiei* (22.79%). The overall of ectoparasites of hard tick 2281 (52.73%), Lice

1059 (17.19%) and mange mite 986 (22.79%) were collected and identified during the spring/2017 (Table 3).

The overall prevalence of sheep was infested with hard tick 961 (27.00%) and 217(29.52%) in goats. The Prevalence of Mite infested sheep and goats 527(14.80%) and 120 (16.33%) respectively. Both biting and sucking lice were infested sheep and goats. Out of 514 (14.44%), sheep and 142(19.32%) of goats infected with lice Whereas, out of 515(14.47%) in sheep and 72 (9.80%) in goats show a mixed infested with hard tick and Lice. 428 (12.02%) and 106 (14.42%) sheep and goats respectively were infested with mixed Ectoparasites; Hard tick and Mite. 615 (17.28%) in sheep and78 (10.61%) in goats infected with mixed infested with Mite and Lice (Table 4).

Table 3: Prevalence and identified of genera of Ectoparasites examined in goat Sulaimani slaughter house

Type of Ectoparasite	No. of ectoparasite collected in infested goats/ Month %			Total of ectoparasite collected/spring season (%)
	March (%)	April (%)	May (%)	
Hard Tick				
<i>Boophilus</i> spp.	78 (24.10)	102 (31.57)	143 (44.27)	323 (14.16)
<i>Rhipicephalus sanguineus</i>	203 (31.10)	218 (33.38)	232 (35.53)	653 (28.63)
<i>Rhipicephalus turanicus</i>	97 (26.64)	126 (34.61)	141 (38.73)	364 (15.96)
<i>Hyalomma a. anatolicum</i>	146 (20.44)	265 (37.11)	303 (42.43)	714 (31.30)
<i>Hyalomma marginatum</i>	48 (21.14)	91 (40.08)	88 (38.76)	227 (9.95)
Total	572 (25.10)	802 (35.16)	907 (39.76)	2281 (52.73)
Lice				
<i>Damalinea caprae</i>	163 (24.11)	246 (36.39)	267 (39.50)	676 (10.97)
<i>Linognathus stenopsis</i>	96 (25.06)	134 (34.99)	153 (39.95)	383 (6.22)
Total	259 (24.45)	380 (35.88)	420 (39.66)	1059 (17.19)
Mite				
<i>Sarcoptes scabiei</i>	263 (26.67)	345 (34.99)	378 (38.34)	986 (22.79)
Overall	1094 (25.29)	1527 (35.30)	1705 (39.41)	4326

Descriptive statistics were used to analyze the prevalence and identified genera species with the number of ectoparasites which collected on goats infested during the spring season.

The total number of skin refused 164 (4.61) in sheep, whereas in goats were 116 (15.78) refused with a significant differences $P < 0.05$ while shows that the most rejected skins infested with hard ticks, lice, mite and in mixed infection; hard tick with lice, hard tick with mite, and mite with lice identified in goat when comparison with sheep. Found a strong association $P < 0.05$ in all infected skins except in mixed skins infested with Hard tick with Lice, Hard tick with Mite shows a highly significant difference at $P < 0.01$ between sheep and goats when test by Chi-square (χ^2) (Table 5).

Discussion

This study considers the first details on the distribution, identified and occurrence of some ectoparasites on sheep

and goats in sulaimani province. In this study, nine genera and species of ectoparasites belonging to ticks, lice, and mange mites were found infesting goats and sheep in sulaimani slaughterhouse in spring season 2017.

The major identified genera of ticks were *Boophilus* spp., *Rhipicephalus* spp., and *Hyalomma* spp., The overall prevalence of ectoparasites 3560 (9.35%) and 735 (7.43%) in sheep and goats respectively. This results agreement with Yacob *et al.* (16) that indicate the prevalence of ectoparasite 13.80% in sheep and 7.80% in goats. The total number collected from *Hyalomma* spp. 967 in the spring season shows slightly more than *Rhipicephalus* spp. 913 in sheep and in goats which shows the total number of *Rhipicephalus* spp 1017 is higher and more tolerant than *Hyalomma* spp. 941. One report was recorded the most of

them in livestock animals from Iraq except fleas (17). Muhaidi *et al.* (18) showed the highest numbers of tick-infested with genus *Hyalomma spp.* in sheep in villages Al-Fallouja city-Iraq. Their prevalence has been studied by Mustafa (19) observed the high numbers of *Hyalomma a. anatolicum* have infested the sheep in different zones in Suleiman province and the more frequent species than other species of ticks. Abadi *et al.* (20) showed that the *Hyalomma spp.* were higher population frequencies than other species in sheep and goat in Yazd province-Iran. These results contrasting with Mohammad (21) revealed the *Rhipicephalus spp.* were higher incidence than *Hyalomma spp.* in sheep and goats in the middle and south of Iraq, the predominant of *Hyalomma* may be due to their ability to tolerate the dry and harsh environment with little hiding places (22). Razmi *et al.* (23) identified five species of ticks from sheep and goats *Rhipicephalus sanguinus*, *Hyalomma anatolicum* most common and other species encountered *Hyalomma anatolicum anatolicum*, *H.asiaticum* on sheep in Iran. However, Nasiri *et al.* (24) identified two genera were *Hyalomma* and *Haemophysalis* and five species including

H. marginatum (44.67%) *Hyalomma anatolicum* (43.1%), *H. asiaticum* (6.37%), *H. dromdareii* (5.55%) and *H. sulcata* (0.24%) from Ilam province-Iran., this variable distribution depending on the zone and grazing system (25). Two species of lice identified in sheep were *Damalina ovis* and *Linognathus stenopsis* with a prevalence (17.74%) and (13.63%) respectively, while in goats identified two species of lice in goats were *Damalina caprae* and *Linognathus stenopsis* with a prevalence (10.97%) and (6.22%), this results agreement in sheep but shows contrasting in goats prevalence with Zangana *et al.* (26) which revealed that the prevalence of lice-infested with two species; *Damalinea ovis* (75%) and *Linognathus stenopsis* (33.3%) in sheep, while in goats *D. caprae* (80.74%) and *L. stenopsis* (19.2%). Yakh chali and Hosseine (27) recorded (67.5%) on sheep and (71.4%) on goats were infested with lice. These were *D. ovis* (58.8%) and *D. caprae* (71.4%) on sheep and goats respectively. Sarkar *et al.* (28) identified two species of lice; *D. caprae* (20.8%) and *Linognathus stenopsis* (18.4%) infested on black goats in Bangladesh.

Table 4: Distribution of ectoparasites on infected sheep and goats in spring season

Month	Total infected sheep /monthly	The number of infected sheep with ectoparasite %						Total infected Goat /monthly	The number of infected Goat with ectoparasite %					
		Hard tick	Mite	Lice	Hard tick and Lice	Hard tick and Mite	Mite and Lice		Hard tick	Mite	Lice	Hard tick and Lice	Hard tick and Mite	Mite and Lice
March	1059	284 26.81	148 13.96	164 15.49	154 14.54	128 12.10	181 17.10	231	72 31.17	32 13.85	49 21.21	22 9.52	37 16.02	19 8.23
April	1193	329 27.58	176 14.75	165 13.83	174 14.59	141 11.82	208 17.44	248	77 31.05	43 17.34	46 18.55	23 9.27	33 13.31	26 10.48
May	1308	348 26.61	203 15.52	185 14.14	187 14.30	159 12.16	226 17.28	256	68 26.56	45 17.58	47 18.36	27 10.55	36 14.06	33 12.89
Total	3560	961 27.00	527 14.80	514 14.44	515 14.47	428 12.02	615 17.28	735	217 29.52	120 16.33	142 19.32	72 9.80	106 14.42	78 10.61

Descriptive statistics were used to analyze the distribution of ectoparasites such as; the type ectoparasites with the number of sheep and goats infested individually during the spring season.

Table 5: Effects of some ectoparasites on skin quality in sheep and goats

Type of ectoparasites collected on infested sheep pelts/spring	Sheep			Goat		
	No. of skin infected / spring	No. of skin accepted	No. of skin refused %	No. of skin infected / spring	No. of skin accepted	No. of skin refused %
Hard Tick	961	914	47 (4.89)	217	188	29 (13.36)*
Lice	527	511	16 (3.04)	120	106	14 (11.67)*
Mite	514	486	28 (5.44)	142	105	37 (26.06)*
Hard tick and Lice	515	492	23 (4.27)	72	66	6 (8.33)**
Hard tick and Mite	428	396	32 (7.48)	106	87	19 (17.92)**
Mite and Lice	615	597	18 (2.92)	78	67	11 (14.10)*
Overall	3560	3396	164 (4.61)	735	619	116 (15.78)*

Chi-square (χ^2) test, differences significant at the 0.01** and 0.05* level.

In this study identified two species of mange mites; *Sarcoptes scabiei* (13.83%) and *Psoroptes ovis* (9.98%) in sheep, and only one species of mange mites were identified in goats; *S. scabiei* (22.79%) and shows a highly prevalent rate and statistically significant at level $P < 0.01$, when associated with sheep infected with *S. scabiei*, the highest prevalence of mite infested in goat due to the difference in management area and decline of dipping process and breeding methods of goats and this methods favorite in sheep in most area in district and subtract in sulaimani province. This results agreement with Hagos *et al.* (29) revealed that the presence of cockle at pickled stage on sarcoptic mange infested goat pelts group was 100 %. Haffeze (30) shows frequencies of mange in sheep and goats were 0.80% and 1.37% respectively. Al-Shebani *et al.* (31) investigated the prevalence of the infestation was highest in sheep more than 2 years. The mange mite (*S. scabiei*) is important cosmopolitan parasites of many domestic mammals causing Sarcoptic mange (32). Zangana *et al.* (26) revealed that the prevalence of *S. scabiei* (25.84%) and *Psoroptes ovis* (74.15%), one species of goat was found (0.1%) infested with *S. scabiei*. Yakhchali and Hosseine (27) found (2.6%) of sheep were infested by *S. scabiei*.

The difference in the prevalence of skin infection with ectoparasites; Hard tick, mite, lice and in mixed infection mite and lice, among sheep and goats host was statistically significant ($P < 0.05$), while shows a highly significant ($P < 0.01$) when infection with mixed infection (Hard tick and Lice) and (Hard tick and Mite). The major skin diseases identified on ruminants were tick 47 (4.89%) and 29 (13.36%), lice 13(3.04) and 14 (11.67), mite mange 28 (5.44) and 37 (26.06), Hard tick and Lice 23 (4.27) and 6 (8.33), Hard tick and Mite 39 (9.11) and 19 (17.92), Mite and Lice 18 (2.92) and 11 (14.10) respectively. with overall of skin refused (4.71%) in sheep and 116 (15.78%) in goats with a highly significant ($P < 0.01$) between both small ruminants sheep and goats, Although collected higher number of ectoparasites in infested sheep and Goats but not indicated highly prevalence infestation and skins refused because might be attributed to various important factors including favorable climatic factors, malnutrition especially during long dry season, poor husbandry system, poor awareness of farmers to the effects of ectoparasites, and inadequate animal health services in the study area (28). This agreement with Hagos *et al.* (29) that indicated a statistically significant association ($P < 0.001$) between cockle and scratch both on pickled sheep and wet blue goat skins. A similar observation was noted on pickled sheep and wet blue goat skins (33). The effect of these parasites on sheep and goat skins in the spring season showed a slight increase may be because these ectoparasites in the growth and reproduction stage, this results contrasting with Sayyad *et al.* (34) that investigated that the seasonal

ectoparasitic infestation during the study was higher in summer season than winter. Variations in climate and feeding of animals are major factors in determining the quality and impact on quality of the skin with respect to substance of skins and exposure to parasitic damage; highland skins are a bit thinner, less greasy and much stronger in fiber structure than skins (35). The major drawback associated with louse infestation is the basis of reduced hide and skin quality, which impact tanner industry thus it affects country economy. A large number of parasites infect the domesticated animals and are responsible for production loss (36). Skins and the leather industry are still constrained by the poor quality of raw materials, lack of an efficient market structure, a weak extension service, competition from local/rural tanning industries and a lack of price incentive for production of good quality raw material (37). Skin quality is primarily defined by the absence of damage to the grain layer of the skin and finished leather is related to a number of surface and structural defects that hides and skins acquire during the life of the animal, slaughtering, storage and transportation stages (38).

Conclusion

The present study revealed that extremely high prevalence and widespread occurrence of ectoparasites (especially hard ticks and mixed infested) in small ruminant in the study area, and the major ectoparasites identified were a tick, lice, and mange mite. Ectoparasites are the major causes of skin relegation and rejection in tanneries, revealed that the infested rate in sheep is higher than goats, the present study disclosed that infection by mixed ectoparasites; hard tick and mite in sheep, and lice in goats were found to be strongly associated with defect in skin

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