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A Study on Prevalence of Lice Infestation and Associated Risk Factors on Small Ruminants in and around Jijiga Town, Eastern Ethiopia

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Abstract

Lice infestation is an important ectoparasitic problem affecting the health, productivity, and skin quality of small ruminants. This study aimed to determine the prevalence of lice infestation and identify associated risk factors in sheep and goats in and around Jigjiga, eastern Ethiopia. A cross-sectional study was conducted from April to July 2021 on 384 indigenous small ruminants selected for clinical examination. Data on species, age, sex, body condition score, and sampling month were recorded. Lice were identified through clinical examination and morphological assessment of collected specimens. Descriptive statistics and chi-square tests were used to assess associations between infestation and potential risk factors, with statistical significance set at $P < 0.05$. Overall, 189 animals were infested, giving a prevalence of 49.2%. The prevalence was significantly higher in goats (53.9%) than in sheep (39.8%) ($P = 0.001$). Body condition score was also significantly associated with infestation ($P < 0.001$), with the highest prevalence in animals with poor body condition (58.2%), followed by those with medium (53.5%) and good (26.7%) body condition. No statistically significant associations were observed with age, sex, or sampling month ($P > 0.05$). *Linognathus ovillus* was the predominant louse species, accounting for 56.6% of infestations, followed by *Damalinia ovis* (39.2%); mixed infestations accounted for 4.2%. Severe infestation was observed in 44.4% of infested animals. In conclusion, lice infestation was common among small ruminants in and around Jigjiga, particularly in goats and animals with poor body condition. Targeted ectoparasite control and improved animal health and husbandry practices are recommended to reduce the burden of infestation and its potential production losses.

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Keywords

Body condition; goats; lice infestation; risk factors; sheep.

Introduction

Small ruminants play an important role in the livelihoods and food security of rural communities, contributing substantially to meat and milk production in sub-Saharan Africa. They are widely raised by smallholder farmers and are particularly valuable in areas with harsh climatic conditions because of their adaptability and ability to convert low-quality feed into valuable products, including meat, milk, fibre, manure, and hides (Hansen and Perry, 1994; FAO, 2001). Ethiopia's economy is largely dependent on agriculture, with livestock production constituting an important component of the sector. The country possesses substantial livestock resources, including cattle, sheep, and goats, which contribute to household income, food security, employment, and export earnings. Small ruminants, in particular, are important sources of animal protein, cash

income, and raw materials for domestic industries. They also play a significant role in Ethiopia's livestock export trade, particularly through the supply of live animals, meat, skins, and hides (CSA, 2017; Gizaw, 2008). At the household level, sheep and goats are especially important in crop–livestock and pastoral production systems, where they support livelihoods and provide income under variable environmental conditions (Zelalem and Fletcher, 1993).

Sheep and goat skins are economically important products that contribute to Ethiopia's leather industry and export sector (Ayele *et al.,* 2003). However, skin damage caused by ectoparasites, including mange mites, lice, sheep keds, and ticks, results in considerable economic losses for smallholder farmers, the tanning industry, and the national economy. These parasites may cause skin lesions, reduced animal productivity, impaired growth and reproduction, and, in severe cases, mortality. Damaged skins may be downgraded or rejected by tanneries, reducing their market value. Kassa (1998) reported that skin defects associated with external parasites accounted for approximately 35% of sheep skin rejection and 56% of goat skin rejection.

The economic consequences of ectoparasite infestation have also been demonstrated by reports of substantial skin rejection in Ethiopia. During 1996/97, six tanneries in and around Addis Ababa reportedly rejected 2,037,745 skins, resulting in an estimated loss of US$6.3 million (Kassa, 1998). Similarly, three tanneries in the Amhara Region reported the rejection of 443,602 skins annually during 1998/99, representing an estimated loss of US$1.4 million (MoARD, 2005). These losses prompted the implementation of control programmes targeting skin diseases in several regions, including Tigray, Amhara, and Afar. Skin diseases have also been reported in Oromia, highlighting the widespread economic importance of ectoparasite control in Ethiopia (Shenkutie, 1987).

Lice are important ectoparasites of sheep and goats and may cause substantial irritation, skin damage, and production losses. They are broadly classified into biting lice, which feed primarily on skin debris and surface secretions, and sucking lice, which feed on blood. Important lice affecting sheep include *Bovicola ovis*, *Linognathus ovillus*, *Linognathus africanus*, and *Linognathus pedalis*. In goats, reported species include *Bovicola caprae*, *Bovicola limbata*, *Bovicola crassiceps*, *Linognathus stenopsis*, and *Linognathus africanus* (Radostits *et al.,* 1994). The occurrence and distribution of these species may vary according to host characteristics, husbandry practices, and environmental conditions.

Louse infestations can persist within flocks, with some animals remaining heavily infested throughout the year and serving as sources of infestation for other animals (Urquhart *et al.,* 1996). Infestation commonly causes itching, restlessness, scratching, rubbing, and licking, which may damage the skin and fleece and reduce animal comfort and productivity. Heavy infestations can contribute to poor body condition, reduced production, and deterioration in the quality of skins and wool. In addition, irritation and self-inflicted skin injuries may predispose affected animals to secondary skin damage and infections (Peter, 1995).

Several studies have investigated ectoparasites and lice infestation in small ruminants in different parts of Ethiopia. Previous investigations have been conducted in the Amhara National Regional State, northwestern Ethiopia, and around Kombolcha (Sertse, 2004; Woldemariam, 2011; Tadesse *et al.,* 2011; Kebede and Fetene, 2012). However, information on the prevalence of lice infestation and its associated risk factors in small ruminants in the Fafan Zone, particularly in and around Jigjiga, remains limited. This information gap restricts the development of locally appropriate prevention and control strategies. Therefore, investigating lice infestation in sheep and goats in the study area is important for understanding the magnitude of the problem and identifying animals or management conditions associated with infestation. Therefore, this study aimed to determine the prevalence of lice infestation in small ruminants in and around Jigjiga and identify the potential risk factors associated with infestation.

Materials and Methods

Study Area

The study was conducted from April to October 2021 in and around Jigjiga, the capital city of the Ethiopian Somali Regional State (ESRS), located in eastern Ethiopia, approximately 630 km from Addis Ababa. Jigjiga is situated at an elevation of approximately 1,660–1,710 m above sea level, at 9.3568° N latitude and 42.7955° E longitude. The area has a semi-arid climate characterized by relatively high temperatures and low rainfall. The mean annual temperature is approximately 22 °C, and the mean annual rainfall is about 543 mm

(CSA, 2012). The study area lies within the Fafan Zone, which is bordered by the Republic of Somalia to the east, Oromia Regional State and Fik Zone to the west, and Jarar Zone to the south. According to the Somali Regional Pastoral and Agro-Pastoral Research Institute (SoRPARI, 2003), the zone encompasses eight districts: Jigjiga, Kebribeyah, Harshin, Babile, Awbare, Gursum, Tulu Guled, and Gololcha. The zone covers approximately 40,861 km², of which about 36,629 km² consists of rangeland. Its landscape is predominantly flat to gently sloping, with hills and steep slopes accounting for smaller proportions of the terrain. The area is primarily classified as midland agroecology, with elevations ranging from 1,500 to 2,300 m above sea level (SoRPARI, 2003).

Livestock production is an important component of livelihoods in the region. According to the Ethiopian Somali Regional State Livestock and Rural Development Bureau (ESRSLRDB, 2015), the regional livestock population was estimated at 3,796,000 cattle, 9,053,000 sheep, 8,547,000 goats, and 2,032,000 camels. These livestock resources support household livelihoods and contribute to the regional economy. The area's climatic conditions and dependence on livestock production make it relevant for investigating lice infestation and associated risk factors in small ruminants.

Study Design and Sampling Method

A cross-sectional study was conducted to determine the prevalence of lice infestation in indigenous sheep and goats in and around Jigjiga, Somali Regional State, Ethiopia. The required sample size was calculated using the formula for estimating prevalence in a population under simple random sampling, as described by Thrusfield (2005). In the absence of reliable prior information on the prevalence of lice infestation in the study area, an expected prevalence of 50% was assumed to obtain the maximum sample size. A 95% confidence level and an absolute precision of 5% were used. The required sample size was calculated using the following formula:

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

Where: n = required sample size, Pexp = expected prevalence, d= desired absolute precision. Therefore; based on the above formula the sample size was 384 Goat and sheep.

Study Animals

The study animals comprised indigenous sheep and goats of both sexes and different age groups, classified as young and adult, from the study area in and around Jigjiga, Somali Regional State, Ethiopia.

Clinical Examination

Animals were selected randomly and clinically examined for the presence of lice infestation. Before examination, data on species, sex, age, and body condition score were recorded for each animal. Age classification was performed according to the method described by Hamito (2009). Body condition was categorized as poor, medium, or good, following a modified system based on Johns (2006).

Clinical examination involved parting the fleece or hair against its natural direction, followed by visual inspection and palpation of the skin for lice. Particular attention was given to the neck, shoulders, withers, flanks, and rump. At each anatomical site, a section approximately 10 cm long was examined on both the left and right sides of the animal. Animals in which lice were detected at one or more examination sites were classified as positive for lice infestation. Lice were initially identified based on their morphological characteristics, following the procedures described by Wall and Shearer (1997). Specimens that could not be identified confidently during field examination were collected for further laboratory identification.

Specimen Collection and Laboratory Examination

Lice that could not be identified confidently during clinical examination were collected by forceps or hand-picking, together with hairs from their attachment sites where necessary. The specimens were placed in separate, clean, labeled universal containers and preserved in 70% ethanol before transportation to the Jigjiga Regional Veterinary Laboratory for further examination, following the procedures described by Urquhart *et al.,* (1996). The collected specimens were examined under a stereomicroscope, and identification was based on morphological characteristics using the identification keys described by Wall and Shearer (1997).

Data Management and Analysis

The data was subjected for statistical analysis by entry in to Microsoft Excel spread sheet and descriptive statistics

like prevalence and analytical statistics such as chi-square ($\chi 2$) was conducted by using SPSS 20 for determining the significance of association between age groups, sex, body condition scores, and month with lice infestation. For the purpose of this study, 95% confidence level and $P< 0.05$ was used for significance.

Results and Discussion

Prevalence of Lice Infestation and Associated Risk Factors

A total of 384 small ruminants were examined from April to July 2021 in and around Jijiga. Of these, 189 animals were infested with lice, resulting in an overall prevalence of 49.2%.

The prevalence was significantly higher in goats (53.9%) than in sheep (39.8%) ($\chi^2 = 6.752$, $P = 0.001$).

Body condition score was also significantly associated with lice infestation ($\chi^2 = 24.556$, $P < 0.001$), with animals in poor body condition exhibiting the highest prevalence (58.2%), followed by those in medium (53.5%) and good (26.7%) body condition.

In contrast, no significant associations were observed between lice infestation and age ($\chi^2 = 0.493$, $P = 0.482$), sex ($\chi^2 = 0.063$, $P = 0.802$), or month of sampling ($\chi^2 = 5.464$, $P = 0.141$). Although the prevalence appeared higher in June (58.2%) than in the other months, the variation was not statistically significant (Table 1).

Distribution of Lice Species and Severity of Infestation

Among the 189 infested animals, *Linognathus ovillus* was the predominant lice species, accounting for 107 (56.6%) infestations, followed by *Damalinia ovis* with 74 (39.2%) infestations. Mixed infestations involving both species were recorded in 8 (4.2%) animals. The most common attachment sites were the neck, shoulder, flank, and rump regions of the animals (Figure 1).

Regarding infestation severity, 84 (44.4%) animals were classified as severely infested, 58 (30.7%) as moderately infested, and 47 (24.9%) as slightly infested. Severe infestation was most frequently observed in animals with mixed infestations (62.5%), followed by those infested with *D. ovis* (51.4%) and *L. ovillus* (38.3%). Overall, severe infestation represented the predominant clinical presentation among lice-positive animals (Table 2).

In the present study, 384 small ruminants were examined to determine the prevalence of lice infestation and associated risk factors. Of these, 189 animals were infested, yielding an overall prevalence of 49.2%. This finding is comparable with the report of Tamiru *et al.,* (2020) from Nono District, West Shoa Zone, Ethiopia. However, it is higher than the prevalences reported by Tadesse *et al.,* (2011) in northwestern Amhara Region (30.9%) in and around Kombolcha (37.5%). Conversely, it is lower than the prevalences reported by Kebede and Fetene (2012) (63.5%) and (75.5%) in southern Ethiopia. These differences may be attributed to variations in agroecological conditions, animal management systems, veterinary service provision, sample size, and diagnostic approaches.

The prevalence of lice infestation was significantly higher in goats (53.9%) than in sheep (39.8%). The prevalence observed in sheep was comparable with the finding of Derara (2020), whereas the prevalence in goats was higher than several previous reports from different regions of Ethiopia. The significant association between host species and lice infestation observed in this study agrees with the findings of Adugna and Tsegay (2019). However, it contrasts with reports by Derara (2020, who found no significant association. Such discrepancies may result from differences in husbandry practices, environmental conditions, and study methodologies.

Among the evaluated risk factors, body condition score was significantly associated with lice infestation, whereas age and sex were not. Animals with poor body condition exhibited a higher prevalence than those with medium or good body condition. Similar observations have been reported by Amare *et al.,* (2013). Poor body condition may predispose animals to infestation through impaired immune function, while severe lice infestation may itself contribute to weight loss and poor body condition due to irritation, stress, and reduced feeding efficiency. The predominant lice species identified in the present study were *Linognathus ovillus* and *Damalinia ovis*. This finding is consistent with previous studies conducted in different parts of Ethiopia, including those of Rahmato *et al.,* (2011), which identified these species as the major lice affecting small ruminants.

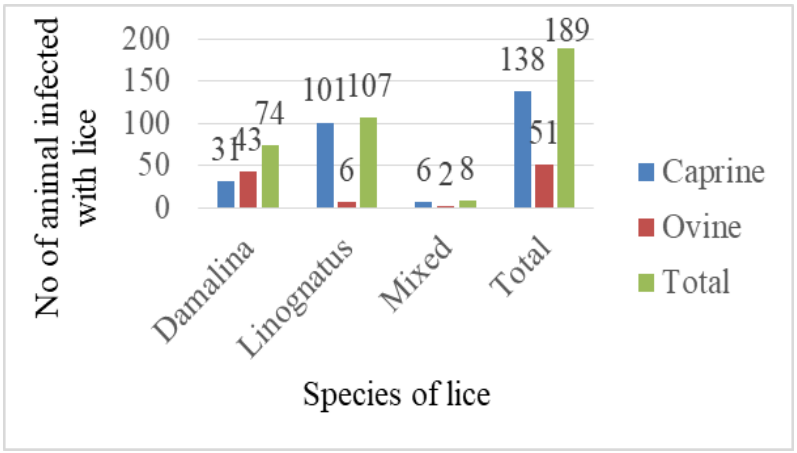
Table.1 Prevalence of lice infestation in small ruminants according to different risk factors in and around Jijiga, Ethiopia, 2021 (n = 384)

Variable	Category	Examined (n)	Positive (n)	Prevalence (%)	χ^2	P-value
Species	Caprine	256	138	53.9	6.752	0.001
	Ovine	128	51	39.8		
Age	Adult	184	94	51.1	0.493	0.482
	Young	200	95	47.5		
Sex	Female	230	112	48.7	0.063	0.802
	Male	154	77	50.0		
Body condition	Good	90	24	26.7	24.556	<0.001
	Medium	129	69	53.5		
	Poor	165	96	58.2		
Month	April	106	45	42.5	5.464	0.141
	May	112	56	50.0		
	June	98	57	58.2		
	July	68	31	45.6		
Overall	Total	384	189	49.2	—	—

Table.2 Distribution and severity of lice infestation among small ruminants in and around Jijiga, Ethiopia, 2021 (n = 189)

Lice species	Slight n (%)	Moderate n (%)	Severe n (%)	Total n (%)
Linognathus ovillus	32 (29.9)	34 (31.8)	41 (38.3)	107 (56.6)
Damalinia ovis	14 (18.9)	22 (29.7)	38 (51.4)	74 (39.2)
Mixed infestation	1 (12.5)	2 (25.0)	5 (62.5)	8 (4.2)
Total	47 (24.9)	58 (30.7)	84 (44.4)	189 (100.0)

Figure.1 Species of lice affected small ruminants in and around Jijiga 2021, n=384.



A substantial proportion of infested animals exhibited severe infestation, particularly among animals with mixed infestations and those infested with *D. ovis*. Heavy lice burdens can cause intense irritation, excessive grooming, damage to wool and hair, reduced productivity, and deterioration of skin quality, leading to considerable economic losses in small-ruminant production systems.

Although the prevalence of lice infestation was numerically higher during May and June, no statistically significant variation was detected among the sampling

months. This finding differs from that of Eticha *et al.,* (2017), who reported seasonal differences in lice infestation levels. The discrepancy may be due to differences in climatic conditions, geographic location, management practices, and sampling periods. Nevertheless, the results suggest that lice infestation remains a persistent problem throughout the study period in the study area.

Conclusion and Recommendations

Lice infestation was highly prevalent among small ruminants in and around Jijiga, with an overall prevalence of 49.2%. The predominant lice species identified were *Linognathus ovillus* and *Damalinia ovis*. Host species and body condition score were significantly associated with infestation, whereas age, sex, and month of sampling showed no significant association. Goats were more frequently infested than sheep, and animals with poor body condition had the highest prevalence.

These findings demonstrate that lice infestation remains an important constraint to small-ruminant health, productivity, and skin quality in the study area. Implement routine surveillance and strategic control programs targeting lice infestation in small ruminants. Improve animal nutrition and management practices to maintain good body condition and reduce susceptibility to infestation.

Strengthen farmer awareness regarding the economic impact of lice and the importance of timely treatment. Enhance veterinary extension services and promote the proper use of effective ectoparasiticides. Conduct further longitudinal studies to assess seasonal dynamics, economic losses, and control strategies for lice infestation in small-ruminant production systems.

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Conflict of Interest

The authors declare that they have no conflict of interest.

Data Availability Statement

The data generated and analyzed during this study are available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate

Not applicable.

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