Survey on Mite Infestations in Small Ruminants in Kindo Didaye District, Wolaita zone, Southern Ethiopia

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ABSTRACT

BACKGROUND: Mange is a parasitic skin disease caused by microscopic mites that feed on the skin of small ruminants and affect animal productivity.

METHODS: A study was carried out to determine the prevalence and possible risk factors for mite infestation in small ruminants in Kindo Didaye district, Wolaita zone, southern Ethiopia. Skin scraping samples were collected from 384 small ruminants (196 goats and 188 sheep) for the identification of mite species following the standard parasitological protocol.

RESULTS: Of the 384 examined animals, 6.25% of sheep and goats were infested with different mite species, namely, *Sarcoptes* (3.67%), *Demodex* (1.54%), and mixed infestation of *Sarcoptes* and *Demodex* (1.04%). A relatively higher prevalence of mite infestation occurred in goats (7.14%) than in sheep (5.3%), and the highest prevalence of lesions of mange mites was recorded in the neck region (3.13%). The multivariate analysis of factors revealed that only BCS and herd size have a significant role in mite infestation of small ruminants. In addition, the correlation analysis of mite infestation with factors revealed that herd size ($r = .106$), sex (.0434), and body condition score ($r = .104$) had a positive correlation with mite infestation.

CONCLUSION: Mites are among the most important health constraints of sheep and goats in the study area, requiring immediate attention and control interventions. Moreover, further epidemiological investigations that consider agroecology and other nonhost-related risk factors should be carried out for the appropriate control of mange mites.

KEYWORDS: Goat, Kindo didaye, mite infestation, sheep

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Introduction

Ethiopia has the largest livestock on the African continent. Of these, 2.4 million sheep and 2.2 million goats are found in the southern part of the country.[1,2] Meanwhile, small ruminants make up about 30% of the total livestock herd in Ethiopia and are a major contributor to food production, accounting for 35% of meat consumption and 14% of dairy consumption.[3] In smallholder combined crop-cattle production systems, small ruminants account for 40% of income and 19% of household meat consumption.[4]

Despite the fact that small ruminants are known for their ability to adapt to adverse settings, the combined effects of overcrowding, malnutrition, and disease can result in significant production losses. The infestation of mites and ticks, as well as dermatophilosis, is one of the diseases causing significant economic losses to sheep and goats, especially for hides and exports, due to its many anomalies.[5] Mange mites are prevalent in Ethiopia and have been documented in a variety of areas and agroclimates. Mange mites are most prevalent in four Ethiopian national regional states, Amhara, Oromia, Tigray, and Southern Nation and Nationalities, according to research. Three mite genera, *Sarcoptes*, *Psoroptes*, and *Demodex*, were proven to be harmful to small ruminants.[6,7]

Mange outbreaks usually occur during the cold months, whereas during spring, summer and early fall, mites tend to survive in reservoir sites such as the axillae, groin, infra-orbital fossa, and auditory canal.[8] Mites cause immediate skin damage and may also have an impact by lowering reproduction and productivity.[9-11]

Every year, Ethiopia loses 35% of sheep skin and 56% of goat skin for a variety of reasons,[12] with mange infestation accounting for 33% of sheep skin and 21% of goat skin rejections. In Sub-Saharan Africa, mange mite infestations are widespread in small ruminants. Contact with clinically infested and/or carrier animals may spread the infestation. Overcrowding in dwellings, markets, dumps, and shared pastures favors parasite transmission between animals.[13,14]

Although mange is assumed to be a widespread emergency in Ethiopia, public awareness remains limited, including in those parts of the country where the disease seems to spread faster and show higher clinical severity as in southern Ethiopia, particularly in the Wolaita zone. Accordingly, this survey was

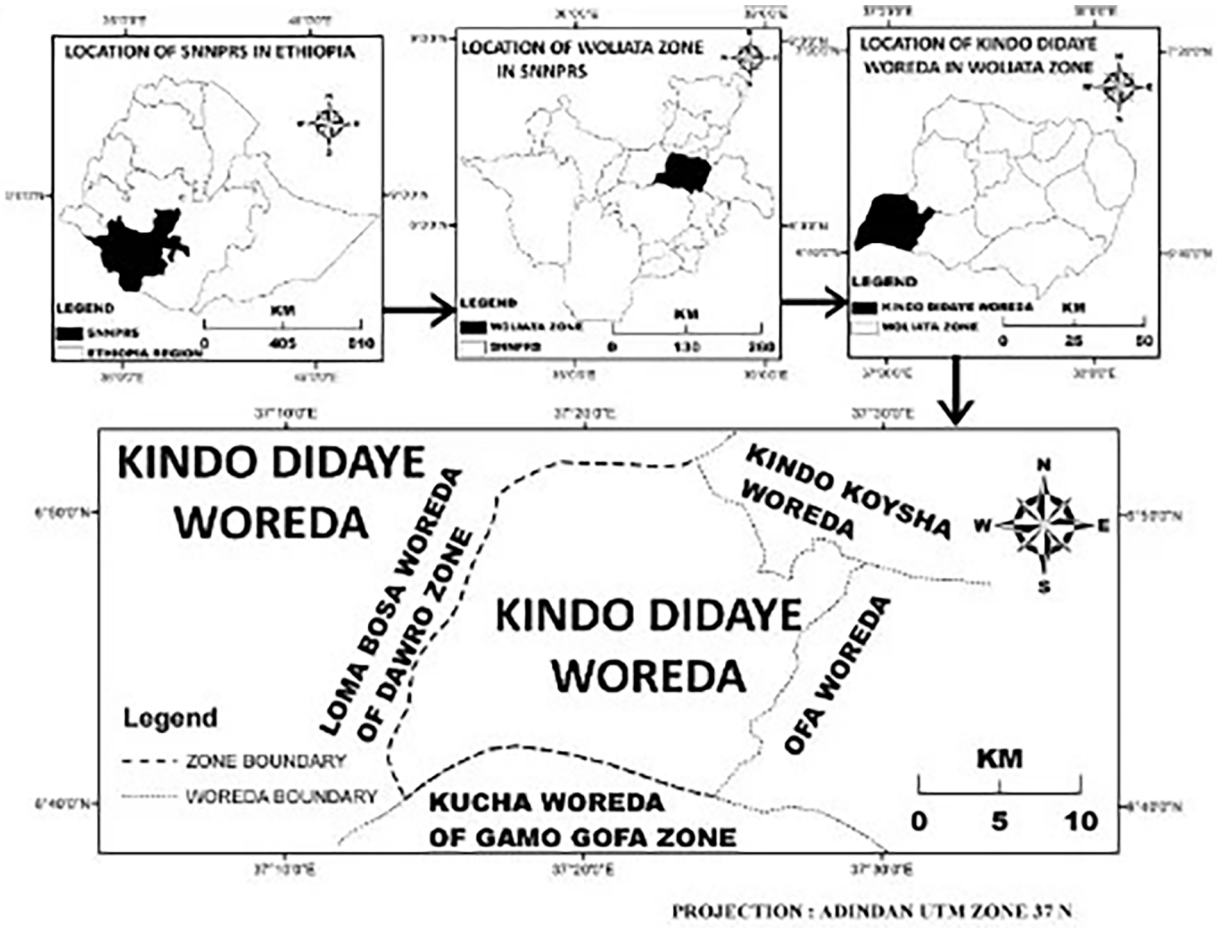

Figure 1. Map of the study area.

designed to describe the prevalence of mange among small ruminants in this region and identify potential risk factors.

Materials and methods

Study area. The research was carried out in the Kindo Didaye district, which is located 476 km south of Addis Ababa, 243 km south of Hawassa, and 50 km west of the zonal town of Wolaita Sodo, from January to October 2021. The investigated area has a total surface of approximately 26 870 km^2 and is located between 6.4°-7.2° North latitude and 37.4°-38.2° East longitude (Figure 1). The average annual rainfall ranges from 900 to 1800 mm, with mean annual lowest and maximum temperatures of 14.90°C and 26°C, respectively.[1] Production animals comprise 219 592 cattle, 16 157 sheep, 41 227 goats, 2210 donkeys, 1913 horses, and 186 435 poultry.[15]

The surveyed animals were small ruminants (sheep and goats) randomly selected according to origin, age, sex and body condition. Gatenby's approach was used to determine the age and body condition score (BCS).[16]

Sample size determination

The total number of small ruminants required for the study was determined using the Thrusfield[17] formula considering 50% expected prevalence, a 5% desired absolute precision, and a 95% confidence interval.

$$N = \frac{1.96^2 \left(Pexp\right)\left(1\text{-}Pexp\right)}{d^2}$$

where n = required sample size, Pexp = expected prevalence, and *d* = desired absolute precision. Hence, 384 small ruminants (188 sheep and 196 goats) were randomly selected for the study district based on the proportion of the total number of sheep and goats in the area.

Study methodology

Sampling collection, transportation, and identification of mites. Deep and superficial skin scrapings were taken from active lesions in cases characterized by combinations of hair loss, scratching, itching, and crusts. Apparently healthy sheep and goats were also sampled. Skin scrapings were then transferred into a labeled glycerin-filled container for parasitological investigation.[18-20]

Data analysis. Data from the study were recorded and coded using Microsoft Excel version 2019 and analyzed using STATA version 13 statistical software. The prevalence of mange mites

Table 1. Prevalence of mite infestation in sheep versus goats.

SPECIES	NO. OF EXAMINED ANIMALS	NO. OF POSITIVE ANIMALS	DEMODEX N (%)	SARCOPTES N(%)	MIXED* N (%)	CHI-SQUARE	*P* VALUE
Goat	196	14 (7.14)	3 (1.53)	7 (3.57)	4 (2.04)	3.88	.28
Sheep	188	10 (5.3)	3 (1.60)	7 (3.72)	0 (.0)		
Total	384	24 (6.25)	6 (1.56)	14 (3.65)	4 (1.04)		

*Mixed infestation of Demodex and Sarcoptes.

was calculated as the number of positive samples divided by the total number of samples tested. The association between the occurrence of mange mites and possible putative factors was analyzed using the chi-square test. In addition, bivariate followed by multivariate logistic regression using a 95% confidence level (CI) was conducted to estimate the magnitude of association between risk factors and the disease. Multivariate logistic regression analysis was employed to compute the real significant contribution of associated risk factors to minimize the effect of confounding factors. At $P < .05$, a correlation was considered statistically significant.

Results

Prevalence

A total of 384 small ruminants (196 goats and 188 sheep) were investigated for mite infestation, with an overall prevalence of 24 (6.25%). *Sarcoptes*, *Demodex*, and mixed infestations (*sarcoptes* and *Demodex*) were identified.

As shown in Table 1, the prevalence of mite-infested animals was higher in goats (7.14%) than in sheep (5.3%), although the difference was not significant. *Sarcoptes* were more prevalent than *Demodex* in both hosts.

Role of risk factors

According to Table 2, the prevalence of sarcoptic mite infestation was reported in both sheep and goats but was higher in sheep (3.72%) than in goats (3.57%). Male sheep and goats were highly infested with sarcoptic mites (5.41%), whereas female sheep and goats were infested with demodectic mites (3.02%). Age-related comparison of the current findings indicated that adults were highly infested with sarcoptic mites (4.90%), followed by demodectic mites (2.94%), and young adults were also infested with sarcoptic mites (2.22%), followed by mixed mites (1.67%). Sarcoptic (3.97%) and demodectic (3.97%) mite infestation was highly reported in the lowlands. However, the odds of mite infestation in midland was 0.64 (95% CI, 0.25-1.66) times higher than in lowland areas while holding highland as constant (Table 2).

The bivariate analysis of risk factors revealed that sex, age, agroecology, body condition and herd size were found to be significantly associated ($P < .05$) with mite infestation, but species was not statistically associated with mite infestation in small ruminants. On the other hand, multivariate logistic regression analysis of risk factors revealed that only body condition and herd size were found to be significantly associated ($P < .05$) with mite infestation in small ruminants. Those herds with more than 30 herd sizes were 8.79 (95% CI, 1.62-47.69, $P = .012$) times more likely to be infested with different species of mites compared to other herd sizes (16-30 and 5-15). Similarly, poorly conditioned goats and sheep were 5.54 (1.23-25.07, $P = .026$) times more susceptible to mite infestation than moderately conditioned animals (Table 2).

Prevalence mite in sheep

As indicated in Table 3, age ($P = .02$), body condition score ($P = .0001$), and agroecology ($P = .015$) has significant association with mite infestation whereas sex and herd size do not have statistically significant association ($P > .05$) with mite infestation in sheep.

Prevalence mite in goats

The study revealed that sex ($P = .012$), herd size ($P = .029$), and agroecology ($P = .033$) has significant association with mite infestation whereas age and body condition score do not have statistically significant association ($P > .05$) with mite infestation in goat (Table 4).

Mite infestation in relation to body sites

Mange mite lesions were found in several areas of the body, with the neck region (3.13%) having the highest occurrence, followed by the chest (1.56%), tail (1.3%), and wither (1.3%) (0.26%). Moreover, sacrcoptes mite lesions were found in the neck (58.33%) and chest (66.67) regions, whereas *Demodex* mites were seen in the tail (40%) and chest (33.33%). Additionally, mixed infestation of *Demodex and Sarcoptes* was seen in the neck region. There was a statistically significant association ($P < .05$) between the presence of mites and the presence of mange lesions. (Table 5).

The mange mite distribution in goat revealed that 3.13% (12/384) of the lesions were found in the neck area. Besides, Sarcoptes (58.33%) were the most commonly seen mite species in the neck area (Table 6).

Table 2. Bivariate and multivariate logistic regression analyses between mite infestation and different risk factors.

FACTORS	NO. OF EXAMINED ANIMALS	NO. OF POSITIVE ANIMALS (%)	NO. POSITIVE FOR SARCOPTES (%)	NO. POSITIVE FOR DEMODEX (%)	NO. POSITIVE FOR MIXED (%)	X^2 (*P* VALUE)	OR (95% CI)	*P* VALUE
Species						3.87 (.275)		
Goat	196	14 (7.14)	7 (3.57)	3 (1.53)	4 (2.04)		Ref	Ref
Sheep	188	10 (5.32)	7 (3.72)	3 (1.60)	0 (0)		0.73 (0.32-1.69)	.46
Sex						9.47 (.024)		
Male	185	11 (5.95)	10 (5.41)	0 (0)	1 (0.54)		0.90 (0.39-2.07)	.812
Female	199	13 (6.53)	4 (2.01)	6 (3.02)	3 (1.51)		Ref	Ref
Age						8.65 (.034)		
Young	180	7 (3.89)	4 (2.22)	0 (0)	3 (1.67)		0.45 (0.18-1.09)	.059
Adult	204	17 (8.33)	10 (4.90)	6 (2.94)	1 (0.49)		Ref	Ref
Agro-ecology						13.19 (.04)		
Highland	110	4 (3.64)	4 (3.64)	0 (0)	0 (0)		Ref	Ref
Midland	123	7 (5.69)	4 (3.25)	0 (0)	3 (2.44)		0.64 (0.25-1.66)	.359
Lowland	151	13 (8.61)	6 (3.97)	6 (3.97)	1 (0.66)		0.40 (0.13-1.26)	.119
BCS						16.86 (.01)		
Good	90	2 (2.22)	2 (2.22)	0 (0)	0 (0)		Ref	Ref
Moderate	169	8 (4.73)	5 (2.96)	0 (0)	3 (1.78)		2.19 (0.45-10.52)	.329
Poor	125	14 (11.2)	7 (5.60)	6 (4.80)	1 (0.80)		5.54 (1.23-25.07)	.026
Herd size						20.22 (.017)		
<5	104	2 (1.92)	1 (1.96)	0 (0)	1 (1.96)		Ref	Ref
5-15	137	4 (2.92)	4 (2.92)	0 (0)	0 (0)		1.53 (0.28-8.54)	.625
16-30	109	13 (11.93)	7 (6.42)	4 (3.67)	2 (1.83)		6.91 (1.52-31.41)	.012
>30	34	5 (14.7)	2 (5.88)	2 (5.88)	1 (2.94)		8.79 (1.62-47.69)	.012

Table 3. Association of different risk factors with mite infestation in sheep.

FACTORS	NO. OF EXAMINED ANIMALS	NO. OF POSITIVE ANIMALS (%)	NO. OF POSITIVE FOR SARCOPTES (%)	NO. OF POSITIVE FOR DEMODEX (%)	X^2	*P*-VALUE
Sex					0.796	.372
Male	82	3 (3.66)	3 (3.66)	0 (.0)		
Female	106	7 (6.60)	3 (2.83)	4 (3.77)		
Age					5.45	.02
Young	64	0 (0.0)	0 (0.0)	0 (.0)		
Adult	124	10 (8.06)	7 (5.65)	3 (2.42)		
Agro-ecology					8.46	.015
Highland	39	0 (0.0)	0 (0.0)	0 (.0)		
Midland	63	1 (1.59)	1 (1.59)	0 (.0)		
Lowland	86	9 (10.47)	6 (6.98)	3 (3.49)		

(Continued)

Table 3. (Continued)

FACTORS	NO. OF EXAMINED ANIMALS	NO. OF POSITIVE ANIMALS (%)	NO. OF POSITIVE FOR SARCOPTES (%)	NO. OF POSITIVE FOR DEMODEX (%)	X^2	*P*-VALUE
BCS					15.91	.0001
Good	46	0 (0.0)	0 (0.0)	0 (.0)		
Moderate	67	0 (0.0)	0 (0.0)	0 (.0)		
Poor	75	10 (13.33)	7 (9.33)	3 (4.0)		
Herd size					6.08	.108
<5	51	1 (1.96)	1 (1.96)	0 (.0)		
5-15	22	2 (9.09)	0 (0.0)	2 (9.09)		
16-30	72	2 (2.78)	0 (0.0)	2 (2.78)		
>30	43	5 (11.63)	4 (9.30)	1 (2.33)		

Table 4. Association of different risk factors with mite infestation in goats.

FACTORS	NO. OF EXAMINED ANIMALS	NO. OF POSITIVE ANIMALS (%)	NO. POSITIVE FOR SARCOPTES (%)	NO. POSITIVE FOR DEMODEX (%)	NO. POSITIVE FOR MIXED (%)	X^2	*P*-VALUE
Sex						10.87	.012
Male	103	8 (7.77)	7 (6.80)	0 (0.0)	1 (0.97)		
Female	93	6 (6.45)	0 (0.0)	3 (3.23)	3 (3.23)		
Age						4.81	.186
Young	116	7 (6.03)	4 (3.45)	0 (0.0)	3 (2.59)		
Adult	80	7 (8.75)	3 (3.75)	3 (3.75)	1 (1.25)		
Agro-ecology						13.74	.033
Highland	71	4 (5.63)	4 (5.63)	0 (0.0)	0 (0.0)		
Midland	60	6 (10.0)	3 (5.0)	0 (0.0)	3 (5.0)		
Lowland	65	4 (6.15)	0 (0.0)	3 (4.62)	1 (1.54)		
BCS						12.51	.051
Good	44	2 (4.55)	2 (4.55)	0 (0.0)	0 (0.0)		
Moderate	102	8 (7.84)	5 (4.90)	0 (0.0)	3 (2.94)		
Poor	50	4 (8.0)	0 (0.0)	3 (6.0)	1 (2.0)		
Herd size						18.62	.029
<5	53	1 (1.89)	0 (0.0)	0 (0.0)	1 (1.89)		
5-15	12	3 (25.0)	2 (16.67)	0 (0.0)	1 (8.33)		
16-30	65	2 (3.08)	2 (3.08)	0 (0.0)	0 (0.0)		
>30	66	8 (12.12)	3 (4.55)	3 (4.55)	2 (3.03)		

Table 5. Location of mites in different body parts.

SITE OF LESION	NO. OF POSITIVE ANIMALS (%)	NO. POSITIVE FOR SARCOPTES (%)	NO. POSITIVE FOR DEMODEX (%)	NO. POSITIVE FOR MIXED (%)	X^2	*P* VALUE
Chest	6 (1.56)	4 (66.67)	2 (33.33)	0 (0)	525.71	.0001
Neck	12 (3.13)	7 (58.33)	1 (8.33)	4 (33.33)		
Tail	5 (1.3)	2 (60.0)	2 (40.0)	0 (0)		
Wither	1 (0.26)	0 (0)	1 (100)	0 (0)		
Total	24 (6.25)	14 (3.65)	6 (1.56)	4 (1.04)		

Table 6. Mite distribution in different part of goats.

SITE OF LESION	NO. OF POSITIVE ANIMALS	PREVALENCE (%)	NO. POSITIVE FOR SARCOPTES (%)	NO. POSITIVE FOR DEMODEX (%)	NO. POSITIVE FOR MIXED INFECTION (%)	X^2	*P*-VALUE
Chest	1	0.26	0 (0.0)	1 (100.0)	0 (0.0)	196.00	.0001
Tail	1	0.26	0 (0.0)	1 (100.0)	0 (.0)		
Neck	12	3.13	7 (58.33)	1 (8.33)	4 (33.33)		
Total	14	3.65	7 (3.57)	3 (1.53)	4 (2.04)		

Table 7. Mite distribution in different part of sheep.

SITE OF LESION	NO. OF POSITIVE ANIMALS	PREVALENCE (%)	NO. POSITIVE FOR SARCOPTES (%)	NO. POSITIVE FOR DEMODEX (%)	X^2	*P*-VALUE
Chest	5	1.30	4 (80.0)	1 (20.0)	237.24	.0001
Tail	4	1.04	3 (75.0)	1 (25.0)		
Wither	1	0.26	0 (0)	1 (100)		
Total	10	2.60	7 (3.72)	3 (1.60)		

The lesion distribution of mange mite in sheep revealed that 1.30% (5/384) of the lesions were found in the chest area. Besides, Sarcoptes were the most commonly seen mite species in the chest (80%) and tail (75%) part of the body. However, no mixed infection was appreciated in sheep during the study period (Table 7).

Correlation of mite infestation with potential risk factors

The correlation analysis of the genera of mites infesting small ruminants with factors such as species, herd size, origin, sex, age, and body condition revealed that herd size ($r = .106$), sex (0.0434), and body condition score ($r = .104$) had a positive correlation with mite infestation. However, other factors, such as species (−.0295), origin (−.0423), and age (−.0713), of small ruminants have an inverse correlation with mite infestation (Table 8).

Discussion

The current study revealed that the overall prevalence of mite infestation in small ruminants in the study area was 6.25%. Of these, the prevalence of Sarcoptes, Demodex, and mixed infestations of Sarcoptes and Demodex was 3.64%, 1.56%, and 1.04%, respectively. The prevalence of mite infestation was relatively higher than that reported by Mandado et al,[21] who reported a prevalence of 4.67% and species-level prevalence of 2.67% Sarcoptes, 1.33% Demodex, and 0.67% mixed (Sarcoptes and Demodex); Pal et al,[22] who reported a prevalence of 4.68% and species-level prevalence of 2.08% Sarcoptes, 1.83% Demodex, and 0.78% mixed (Sarcoptes and Demodex); Dansure and Belay,[23] who reported a prevalence of 3.11% and species-level prevalence of 1.92% for Sarcoptes, 1.02% for Demodex, and 0.11% mixed infestation; and Sheferaw et al,[2] who reported a prevalence of 3.98% and species-level prevalence of 2.61% Sarcoptes 1.23% Demodex and 0.14% mixed infestation.

Table 8. Correlation between mite infestation and potential risk factors.

	GENERA OF MITE	SPECIES	HERD SIZE	SEX	AGE	ORIGIN	BCS
Genera of mite	1.0000						
Species	−0.0295	1.0000					
Herd size	0.1060	−0.0716	1.0000				
Sex	0.0434	−0.0894	0.0770	1.0000			
Age	−0.0713	−0.2518	0.0286	0.6087	1.0000		
Origin	−0.0423	−0.1716	0.0325	0.4064	0.3844	1.0000	
BCS	0.1040	0.0832	0.3280	0.1554	0.0674	0.0975	1.0000

On the other hand, the prevalence of mite infestation in the current study was lower than the findings of Guash et al,[24] Fesseha et al,[25] Ambilo and Melaku[26]; Agumas et al,[12] and Asmare et al[5] who reported an overall prevalence of 11.57%, 34.6%, 34.56%, 40%, and 41.76% in different parts of Ethiopia, respectively. The variation in the prevalence of mange mite infestation in different areas of the country might be related to changes in agro-climate conditions as well as management systems.

According to the current data, goats (7.14%) were more infested with mites than sheep (5.3%). Similarly, Sheferaw et al[2] reported a prevalence of 2.85% in goats and 1.98% in sheep in southern Ethiopia; Yacob et al[27] reported a prevalence of 1.06% in goats and 0.98% in sheep in southern Ethiopia; Chalachew[28] reported a prevalence of 6.8% in goats and 5.3% in sheep in southern Ethiopia; and Gashaw[29] reported a prevalence of 11.8% in goats and 7.85% in sheep in Harrarghe, Eastern Ethiopia.

This might be explained either by the fact that the immunity of both sheep and goats becomes more compromised than usual or because the 2 species have never been exposed to the mange mite before, and their resistive ability to disease once exposed to the disease is the same.[30] In addition, this could be due to the management system, which can influence the prevalence of mange mite infestations, and the presence of a higher density of animals in small areas, which can facilitate higher infestation rates because the main mode of transmission is close contact between infested and seemingly healthy animals.[31]

According to the present study, the prevalence of the disease in the 3 agroecological zones of the study area was different. The prevalence was higher in the lowland (8.44) than in the high land and midland (3.64% and 5.83%, respectively). The findings of the current study agreed with those of Dansure and Belay[23] and Sheferaw et al,[2] who reported a higher prevalence of mite infestation in lowland areas than in other agroecological zones. This could be due to the variations in climatic conditions and the environment, such as altitude, humidity, management, temperature, and rainfall, that may be suitable for mite occurrence (Wall and Shearer, 1997).[30]

The results of the current study indicated a relatively similar infestation rate in both sexes, with prevalence rates of 6% in males and 6.53% in females. This finding agreed with the findings of other researchers, such as Nigatu,[32] Amanuel,[33] Sheferaw et al,[2] and Dansure and Belay,[23] who reported that the rate of infestations was relatively similar in both sex groups. The reason might be that sex seems to have no effect on the prevalence and occurrence of mange mites and indicates that both sexes of animals are equally susceptible to mange mite infestation when they are both exposed to manage mites.

The occurrence of the disease in different age groups in the current study indicated that the highest prevalence occurred in adults (8.33%) compared with young adults (3.88%). This was in agreement with Sheferaw et al[2] and Yifat et al,[34] who reported a higher rate of mite infestation in adults than in young animals. This might be due to the adult animals' regular interaction and chronic exposure to infested animals, especially females, during mating.

According to the present study, the highest prevalence of infestations occurred in animals with poor body conditions (11.2%) compared to animals with moderate (4.73%) and good (2.22%) body conditions. The findings were in agreement with Sheferaw et al[2]; Yifat et al[34]; Demissie et al,[11] and Molu,[35] who reported that the mite infestation rate was higher in animals with poor body conditions but lower in animals with good body conditions. This might be because the infestation is primarily transmitted through contact. As a result, an apparently healthy animal that comes into touch with infested animals or materials has an equal risk of getting the parasite, regardless of their physical condition. If they are in good physical shape, their body condition may aid in their recuperation. This difference might be attributed to highly exposed animals having poor body conditions as a consequence of limited food absorption and higher infestation as a result of reduced immunity.[36,37]

The different body sites of small ruminants were affected, with a higher prevalence of 3.13% on the neck, 1.56% on the chest, and 1.3% on the tail and a lower prevalence of 0.26% on the withers, with no lesions on the flank, face, ear, perineum,

and back. These findings contradict those of Asmare et al[5] and Agumas et al[12] who reported that the wither, back, and flanks were the most preferred sites for mange mite infestation, whereas Fesseha et al[25] reported that the head and leg area was the most common mite-infested area. This might be because parasitic mites are obligate parasites, and once the animals have been exposed to the mite, the mite can penetrate different body areas of the host to feed on the host's cell contents, body fluids, and sebaceous secretions without regard for the body's predilection locations.[31]

The variation in the site of infestation might be due to the living condition of the parasite as commensals that leads to suddenly pathogenic states or due to the frequent exposure of the neck and shoulder to various stress conditions, such as roping, traumatic injury, and skin sore, due to biting, which facilitates the mite feeding easily by puncturing the host skin and sucking out the tissues of the injured area.

Conclusions

Mange mites are common in small ruminants in the research region (6.25%), and the 2 mite genera discovered in the study area are Sarcoptes and Demodex. According to the findings of this study, the prevalence of mite infestation has a positive correlation with herd size, sex, and body condition score and an inverse correlation with species, origin, and age of small ruminants. Moreover, multivariate logistic regression analysis of risk factors revealed that body condition and herd size were significantly associated ($P < .05$) with mite infestation. In conclusion, the district should employ strategic acaricide application and routine management mite treatment practices. Further study on mange mites in small ruminants should be undertaken, with a focus on determining the species involved in the disease process and identifying risk factors that may contribute to disease occurrence and prevalence.

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Authors' Contributions

All authors (HF, GG, MM, & EM) contributed significantly to the conception and design, data acquisition, and data analysis and interpretation; participated in the drafting of the article or critically revised it for important intellectual content; agreed to submit it to the current journal; gave final approval of the version to be published; and agreed to be accountable for all aspects of the work.

Authors' Information

Not applicable.

Availability of Data and Materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Consent for Publication

Not applicable.

Ethics Approval and Consent to Participate

The best practice guidelines for veterinary care were followed, and those animal owners were informed of the purpose of the study. The Wolaita Sodo University of Research Ethics and Review Committee approved this study and the verbally informed consent process in the manuscript.

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