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Research Article

Seasonal Variations in Major Skin Diseases of Small Ruminants in Juba County, South Sudan

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Abstract

South Sudan possesses one of the largest livestock populations per capita globally, and small ruminants play an essential role in food security, rural livelihoods, and income generation. Despite their importance, skin diseases remain a major constraint to productivity, affecting hide and skin quality, meat and milk yield, and occasionally causing zoonotic transmission. This study investigated the seasonal prevalence of key skin diseases—ectoparasite infestation, mange, and wounds—among sheep and goats in Juba County, Central Equatoria State. A cross-sectional survey was conducted in Luri and Rejaf Payams during the dry season, incorporating structured questionnaires, clinical examination, and parasitological analysis. A total of 49 sheep and 332 goats were examined. Tick identification was performed using dissecting microscopy, while mange mites were identified following KOH digestion and light microscopy. Data were analyzed using SPSS.

Findings demonstrated a significant association between season and ectoparasite infestation ($p = 0.00$), with animals being more than twice as likely to be infested during the wet season (RR = 2.417). Ectoparasites affected 51.3% of animals examined in the wet season compared to 37.1% in the dry season, reflecting favourable wet-season environmental conditions for parasite development and transmission. Wounds also showed a strong seasonal association ($p = 0.00$), with animals being 20 times more likely to develop wounds during the wet season (RR = 20.33), likely due to muddy terrain, increased vector activity, and delayed healing in humid conditions. In contrast, mange infestation exhibited no significant seasonal variation ($p = 0.426$), suggesting that factors such as hygiene, overcrowding, and host immunity are more influential than climate.

The study concludes that seasonality plays a major role in the occurrence of ectoparasites and wounds but not mange. Strengthened acaricide application before and during the wet season, improved housing management, and enhanced farmer training are recommended to reduce disease burden and improve small-ruminant health and productivity in the region.

Keywords: Goat;

Background to the Study

South Sudan has large livestock resources. In 1954 the British colonial assessment found that, South Sudan had considerable livestock resources, a great asset that would be significant for sustainably increasing the financial self-sufficiency of the region [1]. Recently the livestock population in South Sudan was estimated to be 12 million heads of cattle, 20 million sheep and 25 million goats [2], making it a world leading in terms of animal wealth per capita.

Livestock plays an important role in providing export commodities, such as live animal, hides and skin to earn foreign exchanges to a country [3]. Small ruminant's goats (Caprine) and sheep (Oveis) represent important source of protein in the world, suppling a good percentage of the daily meat and milk products in urban and rural areas. Goat are among the earliest domesticated animal and have been associated with human for at least 10,000 years [4]. Due to their adaptability for different environmental and climatic condition, they are dispersed all over the world [5]. Goats are the most beneficial animal in the most parts of the world with warmer climates providing meat, milk, manure and draft power [6]. Goat farming is an integral component of smallholder farms in Asia and sub Saharan Africa. Goat milk and meat are produced and consumed locally among the poor in developing countries. Goat are also a source of immediate income in case of emergency, and this is the reason why they are considered a bank on the hoof"' in terms goat milk and meat production, developing countries are in the lead, reflecting the importance of these commodities to feed millions of smallholder farm families in these counties. Goat require less feed to raise because they are smaller, and they prefer brush and browse. goats are very active foragers, able to cover a wide area in search of scavce plants choosing only the most nutrition's available feed these are some of the reasons why goats are preferred species among smallholder farmers around the world. with scanty vegetation goats provide multiple benefits to farmers in developing countries. In small-scale goat exhibits a very high productivity potential that, if well promoted, can easily help to improve the rural economy with in a very short time.

Sheep and goats are affected by various skin problems, some of which are easily cured while others are more complicated with zoonotic importance. Skin diseases such as dermatophilosis, lumpy skin disease, ectoparasite, photosensitization and wart have been reported in several countries [7].

Skin diseases are accountable for significant and varied socio-economic impact, due to degradation of hides and skin, which induce associated economic losses such as reduction of meat, milk yield, losses due to culling and occasionally mortalities related with the high cost of treatment and prevention of the disease [8]. In addition, some skin diseases such as ring worm and sarcoptic mange are potential zoonosis [9,10].

Leather and semi-processed hides and skin constituted major export product of some countries injecting foreign currency during the last decades [11]. In South Sudan, especially in Bahr el Ghazal region the major skin diseases Identified were ecto-parasite, papilomatosis (wart), Dermatophilosis, mange mite, photosensitization cutaneous myiasis, lumpy skin disease and wound [12].

General objective

To assess the seasonal variations in the prevalence of major skin diseases affecting small ruminants in Juba County, South Sudan.

Specific objectives

- To determine the prevalence of ectoparasite infestations in small ruminants during the dry and wet seasons.
- To assess the seasonal differences in the occurrence of wounds among small ruminants.
- To compare the prevalence of mange infestation across dry and wet seasons and identify its associated risk factors.

Materials and Methods

Study area

The study was conducted in Juba County, Central Equatoria State, South Sudan. Juba City is situated at latitude 4°51′5.94″N and longitude 31°34′56.89″E, at an elevation of 518 m above sea level,

covering approximately 1,699 km^2. Two payams—Luri and Rejaf—were purposively selected due to the presence of small ruminant farms. Luri Payam is characterized by rugged, mountainous terrain with a mixed crop–livestock production system dominated by livestock keeping. The region has a tropical climate with a wet season from April to October and a dry season from November to March.

Study population

The study population comprised sheep and goats of both sexes and various ages, predominantly Nilotic goats and local (Toposa) sheep. Farm owners and nearby community members were informed about the study objectives prior to data collection.

Study design and sample size

A cross-sectional study was conducted during the dry season (November–March). Data were collected through structured questionnaires, physical examination of animals, and parasitological analysis. Two farms in Luri Payam (Riverland and Freedom farms) and multiple smallholdings in Rejaf Payam were included. Sampling was performed early in the morning before animals were released for grazing under the free-grazing system.

Sample size was calculated following the formula described by Thrusfield [14], using an expected prevalence of 50%, 5% absolute precision, and 95% confidence level. A total of 49 sheep and 332 goats were sampled across the two payams.

[n = \frac{Z^2 \times P_{\mathrm{exp}} (1 - P_{\mathrm{exp}})}{d^2}]

Data collection

Questionnaire survey

A semi-structured questionnaire (Annex 1) was administered to farm owners to assess knowledge, attitudes, and management practices related to major skin diseases.

Clinical examination

Each animal was individually assessed through visual inspection and palpation to detect clinical signs of skin diseases. Animals were restrained by the owners during examination. Cases suggestive of ectoparasitic infestation or mange were recorded and sampled for laboratory diagnosis.

Sampling and laboratory procedures

Tick collection and identification

Ticks were collected from common predilection sites (tail, eyes, ears, and hooves) using forceps. Specimens were preserved in methanol and labelled according to species and farm. Tick identification was performed using a dissecting microscope based on morphological characteristics.

Mange mite sampling and identification

Skin scrapings were obtained from animals showing clinical signs of mange, scraped until slight capillary oozing occurred. Samples were preserved in methanol and transported to the laboratory. For microscopic examination, 10% KOH was added to the sample in a test tube, heated for 5 minutes, mixed thoroughly, and a drop was mounted on a glass slide with a coverslip. Samples were examined under 10× magnification for morphological identification following Greiner (2012).

Data management and analysis

Questionnaire responses and clinical records were coded and entered into SPSS for analysis. Descriptive statistics were used to determine the prevalence of major skin diseases in the two payams. Laboratory results were recorded and organized using Microsoft Excel for further analysis.

Results

Here is a complete finding on the association between season and ectoparasite infestation based on the above (table data 1).

The results demonstrate a statistically significant association between season and the occurrence of ectoparasite infestation in animals, with a highly significant p-value (Sig. = 0.00) and a relative risk (RR) of 2.417, indicating that animals are more than twice as likely to be infested during the wet season compared to the dry season. Out of the 314 animals examined in the wet season, 51.3% were infested with ectoparasites, accounting for 53.3% of all recorded infestations. In contrast, only 37.1% of animals examined during the dry season were infested, representing 46.7% of all infestations. Moreover, a higher proportion of animals were ectoparasite-free in the dry season (62.9%) compared to the wet season

			Ectoparsite		Total	Siqni.	R.R
			Present	Not present			
Season	Wet	Count	161	153	314	00.00	2.417
		% within season	51.3%	48.7%			
		% within ectoparsite	53.3%	39.0%			
	Dry	Count	141	239	380		
		% within season	37.1%	62.9%	100.0%		
		% within ectoparsite	46.7%	61.0%	54.8%		
Total		Count	302	392	694		
		% within season	43.5%	56.5%	100.0%		
		% within ectoparsite	100.0%	100.0%	100.0%		

Table 1

(48.7%). These findings suggest that environmental conditions in the wet season—such as increased humidity, vegetation growth, and higher insect activity—create favorable conditions for the proliferation and transmission of ectoparasites. The data highlight the need for intensified ectoparasite control measures during the wet season to reduce infestation risk and mitigate the associated health and productivity impacts on livestock.

Association between season and mange (table 2)

Here is a complete and finding on the seasonal result the association between season and mange, based on the data provided in the table above (table 2).

			Mange		Total		
			Present	Not Present		Sign.	R.R
season	Wet	Count	32	283	315	0.426	2.13
		% within season	10.2%	89.8%	100.0%		
		% within mange	50.8%	44.8%	45.3%		
	Dry	Count	31	349	380		
		% within season	8.2%	91.8%	100.0%		
		% within mange	49.2%	55.2%	54.7%		
Total		Count	63	632	695		
		% within season	9.1%	90.9%	100.0%		
		% within mange	100.0%	100.0%	100.0%		

Table 2

The analysis of the association between season and mange infestation shows no statistically significant relationship (Sign. = 0.426), indicating that mange occurrence does not have seasonal variation differ meaningfully between the wet and dry seasons. Although the relative risk (RR = 2.13) suggests a slightly higher likelihood of mange cases occurring in the wet season, this difference is not strong enough to be considered significant. During the wet season, 10.2% of animals were affected by mange compared to 8.2% in the dry season, showing only a marginal increase. Overall, 50.8% of all mange cases occurred in the wet season and 49.2% in the dry season, reflecting an almost equal distribution of cases between the two seasons. The majority of animals in both seasons were mange-free, with 89.8% in the wet season and 91.8% in the dry season remaining unaffected. These findings suggest that environmental conditions—such as humidity, temperature, and management factors—do not substantially influence the occurrence of mange in this population. Instead, mange may be more closely related to host immunity, hygiene, overcrowding, or animal-to-animal contact rather than seasonal variation. This highlights the importance of continuous year-round mange prevention and control strategies rather than seasonal interventions alone.

Association between season and wound (table 3)

			Wound		Total	sign	R.R
			Present	Not Present			
Season	Wet	Count	107	208	315	0.00	20.33
		% within season	34.0%	66.0%	100.0%		
		% within wound	87.0%	36.4%	45.3%		
	Dry	Count	16	364	380		
		% within season	4.2%	95.8%	100.0%		
		% within wound	13.0%	63.6%	54.7%		
Total		Count	123	572	695		
		% within season	17.7%	82.3%	100.0%		
		% within wound	100.0%	100.0%	100.0%		

Table 3

The findings show a highly significant association between season and the occurrence of wounds in animals (Sign. = 0.00), indicating that seasonal conditions have a strong influence on wound prevalence. The relative risk value (RR = 20.33) suggests that animals are over 20 times more likely to develop wounds during the wet season compared to the dry season. During the wet season, 34.0% of animals experienced wounds, which accounts for 87.0% of all recorded wound cases. In contrast, only 4.2% of animals in the dry season had wounds, representing just 13.0% of total wound cases. Additionally, a much higher proportion of animals remained wound-free in the dry season (95.8%) compared to the wet season (66.0%). These results clearly indicate that the wet season poses a significantly greater risk for wound occurrence, likely due to factors such as slippery or muddy ground, increased vector activity, higher stocking density in shelters, and greater exposure to sharp objects or environmental hazards softened by moisture and some skin condition due to disease that cause wound. Moreover, wound healing may be delayed in humid conditions, increasing the number of cases observed. Overall, the strong seasonal impact suggests that strong preventive measures—including improved housing, environmental management, and routine inspection—are highly needed during the wet season to reduce wound incidence and improve animal welfare.

Discussion

The results of this study has shown that there was a clear difference in the seasonal distribution of ectoparasites and wounds, while mange infestation show not to be significantly influenced by seasonal variation. These findings highlight the complex interplay between environmental conditions, animal health, and management practices with in the farms.

A significant association was observed between season and ectoparasite infestation, with the wet season showing higher prevalence (51.3%) compared to the dry season (37.1%), and animals were 2.4 times more likely to be infested during the wet season. This trend bring into line with numerous studies reporting that humidity and warm temperatures create optimal conditions for the reproduction, survival, and transmission of ectoparasites such as ticks, lice, and fleas [16,17]. Ticks in particular produce well during the wet season because moisture enhances egg hatching rates and larval survival [18]. Increased vegetation during this period also provides favourable condition for ticks, increasing exposure to grazing animals. There for in additionally, shared grazing and seasonal movement of livestock during the wet season may increase animal-to-animal contact, facilitating parasite transmission [19].

Mange showed no statistically significant association with season ($p = 0.426$), with similar proportions of mange cases occurring in both seasons. This suggests that mange mites may be less influenced by environmental conditions and more associated with host immunity, overcrowding, hygiene, and close physical contact. Similar observations were reported by [7], who found that mange prevalence remained relatively stable across seasons due to the mites' ability to complete their life cycle on the host regardless of climatic conditions. Sarcoptic and demodectic mites survive primarily based on host factors—such as stress, malnutrition, or immune suppression—which may occur year-round, especially in resource-poor, post-conflict settings where animal welfare is compromised. Hence, the absence of seasonal variation in mange infestation supports the view that management and health status play a larger role than environmental variation in the epidemiology of mange [20].

The study has shown a highly significant association between season and wound occurrence ($p = 0.00$), with animals being 20 times more likely to develop wounds during the wet season. The high concentration of wounds in the wet season (87% of all cases) may be attributed to multiple environmental and behavioral factors. Muddy and slippery ground conditions commonly lead to trauma, falls, and abrasions [21]. Furthermore, wet-season housing conditions may promote overcrowding as animals are confined to avoid rain and flooding, increasing the likelihood of injuries from fighting or competition for space [22]. The wet season also enhance the proliferation of biting flies and other mechanical vectors that can cause skin injuries or exacerbate minor wounds [23]. Additionally, humidity delays wound healing and increases the risk of secondary bacterial infections, making wounds more visible and clinically significant during this season [24].

The high prevalence of ectoparasites and wounds during the wet-season suggests that preventive interventions—such as strategic acaricide application, improved housing, and better pasture management—should be concentrated before and during the wet season. Meanwhile, the non-seasonal nature of mange distribution need for continuous monitoring and treatment throughout the year. These results contribute to a deeper understanding of animal health risks in unstable environments and support evidence-based planning for livestock health programs.

Conclusion

This study demonstrates that seasonality significantly influences the occurrence of major skin diseases in small ruminants, particularly ectoparasite infestations and wound prevalence. Both conditions were markedly higher during the wet season, likely due to favourable climatic factors that enhance vector survival, reproduction, and transmission, as well as environmental conditions that predispose animals to injury and delayed wound healing. In contrast, mange infestation showed no notable seasonal variation, suggesting that management practices, hygiene, and host-related factors may play a more important role than climate.

Recommendations

- Strengthen ectoparasite control through routine acaricide use, with intensified treatment before and during the wet season.
- Improve housing and management practices—especially maintaining dry, well-drained shelters—to reduce injuries and support wound prevention during the wet season.
- Enhance farmer awareness and access to veterinary services through training on skin disease identification, wound care, and year-round monitoring of mange.

Bibliography

1. Sudan government. "Natural Resources and Development Potential in the southern provinces of Sudan". A preliminary report by the southern development investigation team 1954 London (1955).

2. FAO. Online Statistical Database. Food and Agriculture Organization of the United Nations (FAO), Rome (2018).

3. CSA. "Central Statistical Agency, Agricultural sample survey 2012/13". Statistical bulletin 570, Addis Ababa (2013).

4. Monteiro A., *et al*. "Goat System Productions: Advantages and Disadvantages to the Animal, Environment and Farmer". *Goat Science Sándor Kukovics, Intech Open* (2018).

5. Mahmoud AA. "Present Status of the World Goat Populations and their Productivity". *Lohman Information* 45.2 (2010): 42.

6. Sinn R and P Rudenberg. "Raising Goats for Milk and Meat". Little Rock, Arkansas: Heifer International (2008).

7. Yacob H T., *et al*. "Prevalence of major skin disease in cattle sheep and goat at dama veterinary clinic, oromia regional state". *Ethiopia Revue de Medecine Vtereinarire* 159 (2008): 455-446.

8. Salih D A., *et al*. "Diagnostic Approaches for tick born haemoparastic disease in livestock". *Journal of Veterinary Medicine and Animal Health* 7.2 (2015): 45-56.

9. Quinn CJ., *et al*. "Secondary plant product causing photosensitization in grazing herbivores: their structure, Activity and regulation". *International Journal of Molecular Science* 15.1 (2014): 1441-1465.

10. Quinn JC., *et al*. "Secondary Plant Products Causing Photosensitization in Grazing Herbivores: Their Structure, Activity and Regulation". *International Journal of Molecular Sciences* 15.1 (2014): 1441-1465.

11. Theo V. "The importance of the leather foot wear sector for development in Ethiopia". Addis Ababa university printing press, Adidis Ababa., Ethiopia (2003).

12. Jubara S Ambrose., *et al*. "Prevalence of Major Skin Disease among Nilotic Zebu Cattle in Bahr El Ghazal Region". *JONARES* 1 (2019): 8-16.

13. FAO. "Livestock population in South Sudan". Wikipedia (2018).

14. Thrusfied M. "Veterinary Epidemiology." 3rd ed. UK: Blackwell Science Ltd. (2005): 229-45.

15. Greiner E. "Diagnosis of artheopod parasites". In: Veterinary Clinical parasitology, 8th Ed., Zajac, A. M., Conboy, G. A., editors (2012).

16. Abebe R., *et al*. "Prevalence of ectoparasites in cattle in Ethiopia". *Journal of Veterinary Medicine and Animal Health* 10.1 (2018): 1-6.

17. Dantas-Torres F. "Biology and ecology of the brown dog tick, Rhipicephalus sanguineus". *Parasites and Vectors* 3.1 (2010): 1-11.

18. Walker AR., *et al*. "Ticks of Domestic Animals in Africa: A Guide to Identification of Species". *Bioscience Reports* (2003).

19. Kassa SA., *et al*. "Seasonal distribution of tick infestation in livestock: A review". *Veterinary World* 1209 (2019): 1552-1560.

20. Rahman S., *et al*. "Mange in farm animals: Epidemiology, diagnosis, and control". *Journal of Advanced Veterinary and Animal Research* 6.2 (2019): 161-170.

21. Jember T., *et al*. "Seasonal patterns of cattle injuries and associated risk factors". *Tropical Animal Health and Production* 52 (2020): 2309-2316.

22. Mekonnen N., *et al*. "Management-related risk factors for cattle injuries in communal farms". *Livestock Research for Rural Development* 33.4 (2021).

23. Wall R and Shearer D. "Veterinary Entomology: Arthropod Ectoparasites of Veterinary Importance". *Springer* (2001).

24. Radostits O M., *et al*. "Veterinary Medicine: A textbook of the diseases of cattle, horses, sheep, pigs, and goats (10^{th} ed.)". Saunders Elsevier (2007).