

DISTRIBUTION PATTERN OF HARD TICKS INFESTING SMALL RUMINANTS IN JAFFARABAD DISTRICT, BALOCHISTAN**Hafizullah***Department of Zoology, University of Balochistan Quetta***Kashif Kamran****Department of Zoology, University of Balochistan Quetta***Mahrukh Naseem***Department of Zoology, University of Balochistan Quetta***Bakhtawar Habib***Department of Zoology, University of Balochistan Quetta***Zafar Ullah***Department of Zoology, University of Loralai, Balochistan****Corresponding Author:** kashifkamran944@gmail.com**Article Info**

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Abstract

Ticks are significant hematophagous arachnids that infest small ruminants and have been reported worldwide. In this study, ticks were collected from small ruminants using forceps, preserved in ethanol, and morphologically identified under a microscope using taxonomic keys. A total of 390 goats and sheep were sampled from 12 farms in different villages of the Jaffarabad district. In total, 950 ticks were collected from these 390 hosts, including sheep and goats. Two genera of ticks were identified: *Hyalomma* (735/950, 77.3%) and *Rhipicephalus* (215/950, 22.7%). The most abundant tick species were *Hyalomma anatolicum* (638/950; 67.15%), followed by *Hyalomma dromedarii* (97/950; 10.21%), *Rhipicephalus sanguineus* (138/950; 14.52%), and *Rhipicephalus microplus* (77/950; 8.10%). The monthly distribution pattern showed that *H. anatolicum* (230/638, 36.05%) peaked in June, *H. dromedarii* also peaked in June (32/97, 32.98%), *R. sanguineus* was most prevalent in June (34/138; 24.63%), and *R. microplus* reached its highest prevalence in June during the warmer season (27/77; 35.06%). The infestation rate was highest in goats (53.84%), followed by sheep (46.15%). It is suggested that similar studies be conducted to gain a more detailed understanding of ticks.

Keywords:*Ticks, TBDs, small ruminants, sheep, goat.*

Introduction

Ticks are significant hematophagous ectoparasite that transmit pathogens including bacteria, protozoans, viruses (Kernif et al., 2024). These small creatures can infest all vertebrates including wild animals, domestic animals and humans. Heavy tick burden can cause heavy annual economic losses worldwide (Nasirian 2022). These losses include animal death, loss of body weight, and their control strategies costs billions of dollars for purchasing acaricides and vaccinations (Narladkar 2018). Currently, 994 species of ticks have been identified globally (Khan et al., 2025). Ticks and TBDs have directly or indirectly significantly impact on livestock industry of Pakistan by decreasing milk and meat production, damaging hides and treatment costs for infected animals and human (Jabbar et al., 2015).

Hard ticks are thought to be the main carriers of diseases that impact livestock worldwide and are capable of spreading a wide range of pathogens (Dantas-Torres et al., 2012). When it comes to spreading diseases in tropical regions, ticks (Ixodidae) are the most common primary vector-borne pathogens in animals and the second most common vector-borne pathogen in humans after mosquito (Yu et al., 2015). Secondly, their blood sucking nature can harm animal by causing serious problems like anemia, stunted growth and some extreme cases it may cause death of infested animal due to tick-paralysis syndrome (Madison-Antenucci et al., 2020). The three diseases like anaplasmosis, babesiosis, theileriosis have great impact on Pakistan's economy (Jabbar et al., 2015; Mushtaq et al., 2021; Khan et al., 2022).

Participatory epidemiology (PE) can be used to gather information about farmer's attitudes and knowledge regards ticks and TBDs (Malak et al., 2012). In general, PE can help to understand the ticks, TBDs and other tick related problems of livestock in Pakistan, and to make effective diseases control strategies by engaging local community and conditions of area in which they living (Rajput et al., 2023). Conventional technique involved systematic sampling for research, identification of collected ticks from goat, sheep and cattle along with selected study area using research protocols such as morphological and anatomical examinations and subsequent laboratory identification with stereomicroscope (Jamil et al., 2021).

This research carries crucial importance because of the raising issues faced by tick infestations in livestock sector, especially in arid and semi-arid areas like Jaffarabad district. The livelihoods of rural communities depend highly depend on goats, sheep and cattle making the district important livestock-rearing region.

Material and Methods

Ethical Approval

This study was approved from the Advanced Studies and Research Board under letter UoB/Reg/GSO/135, dated 07-04-2025. No animal was harm during the studies.

Study Area

Jaffarabad is one of the smaller districts of Balochistan. The district experiences hot and dry weather, with rainfall averaging less than 200mm annually. The annual mean temperature ranges between 18°C and 21°C during winter, while in summer, it can rise between 23°C and 50°C, accompanied by high humidity, which supports large tick populations. Like other rural communities, this district faces several issues, such

as poor infrastructure for livestock, limited access to basic healthcare facilities, and a lack of educational opportunities. In Jaffarabad, livestock rearing is a major component of the agricultural economy due to its favorable climate and geographical location within the province. Cattle farming is common and provides a livelihood for many local residents. According to the latest animal census, the district has 216,962 sheep and 284,682 goats (https://smeda.org/phocadownload/Balochistan/District_Profiles). This district was selected for study for the following reasons: (a) livestock studies are given little attention, (b) there is a lack of awareness about ticks and TBDs (tick-borne diseases), (c) there is limited interest from the government and NGOs in controlling TBDs, and (d) there is a shortage of veterinary services.

Sample Size Collection and Preservation

A total of 390 goats and sheep were selected for tick sampling from different villages in Jaffarabad district. Twelve villages were selected, and twelve farms were visited to collect samples. The farms were located at least 10-18 km away from urban areas and one to two km from rural areas. Livestock of varying age, breed, and sex housed in barns were selected under the assumption that if ticks are present on the farm, at least 25% of the livestock would be infested. Animals were examined for ticks following a standardized protocol. Ticks were carefully removed using forceps to ensure that their mouthparts remained intact. Veterinarians assisted in recording the data, which included age, breed, date, host species, location, and gender. Ticks were preserved in Falcon tubes containing 70% ethanol. The morphological identification of the sampled ticks was carried out using a compound microscope (model: Olympus CH-2, 1600x) following identification keys (Walker, 2003).

Statistical Analysis

Meteorological data were obtained from the local weather station of the study district. Prevalence data of ticks, including information about the study collection site and farm animal details such as age, breed, host, and seasonal infestation rate, were analysed using R software. The statistical analysis used is likely a Chi-square test or Fisher's exact test to compare the infestation rates between male and female sheep and goats.

Results

The prevalence of tick infection among sheep and goats is presented in Table 1. A total 180 sheep were examined for the presence of ticks and only (21.11%, $n = 38$, $p > 0.02$) animals were reported to be infested. In case of goats, a total 210 were observed and only 18.57% ($n = 39$, $p > 0.03$) were reported to be infested with hard ticks. Female sheep and goats were more heavily infested than male sheep (26.10%, $n = 17$, $p > 0.03$) and male goats ($n = 13$, 14.40%).

Table 1. Prevalence of tick infestation among sheep and goat.

Species	Gender	Total Host	Total Number of Infested Hosts (%)	p-value
Sheep	Male	65	17 (26.10%)	0.02
	Female	115	21 (18.20%)	
Goat	Male	90	13 (14.40%)	0.03
	Female	120	26 (21.60%)	



Figure 2. (A) Observing the infestation in goat, (B) sheep in the farm, (C) tick infestation in ear of sheep and goat.

Meteorological data of the study area is given in the Table 2. This data presents information on temperature, rainfall and humidity. The weather showed dynamics characterized by high temperatures, low precipitation and low humidity levels. The highest temperature was observed in June, while lowest temperature was recorded in March. Low rainfall and low humidity were consistently observed throughout the study period.

Table 2. Meteorological Data for the Study Region.

Month	Average Temp (Low-High)	Rainfall (mm)	Humidity (%)
March	20 (12-28)	5	~40-50
April	26 (18-35)	5	~35-45
May	31 (23-40)	10	~45-55
June	36 (29-44)	10	~60-65
July	35 (28-42)	50	~70-75
August	33 (27-39)	30	~75-80

In this study, four species of ticks were identified namely *H. anatolicum*, *H. dromedarii*, *R. microplus* and *R. sanguineus*. of *R. sanguineus*, and (d) fourth column shows the male and female of *R. microplus*. Among these species, *H. anatolicum* (67.15%) was most prevalent followed by *R. sanguineus* (14.52%), *H. dromedarii* (10.21%) and *R. microplus* (8.10%). Tick infestation was higher in sheep than goats.

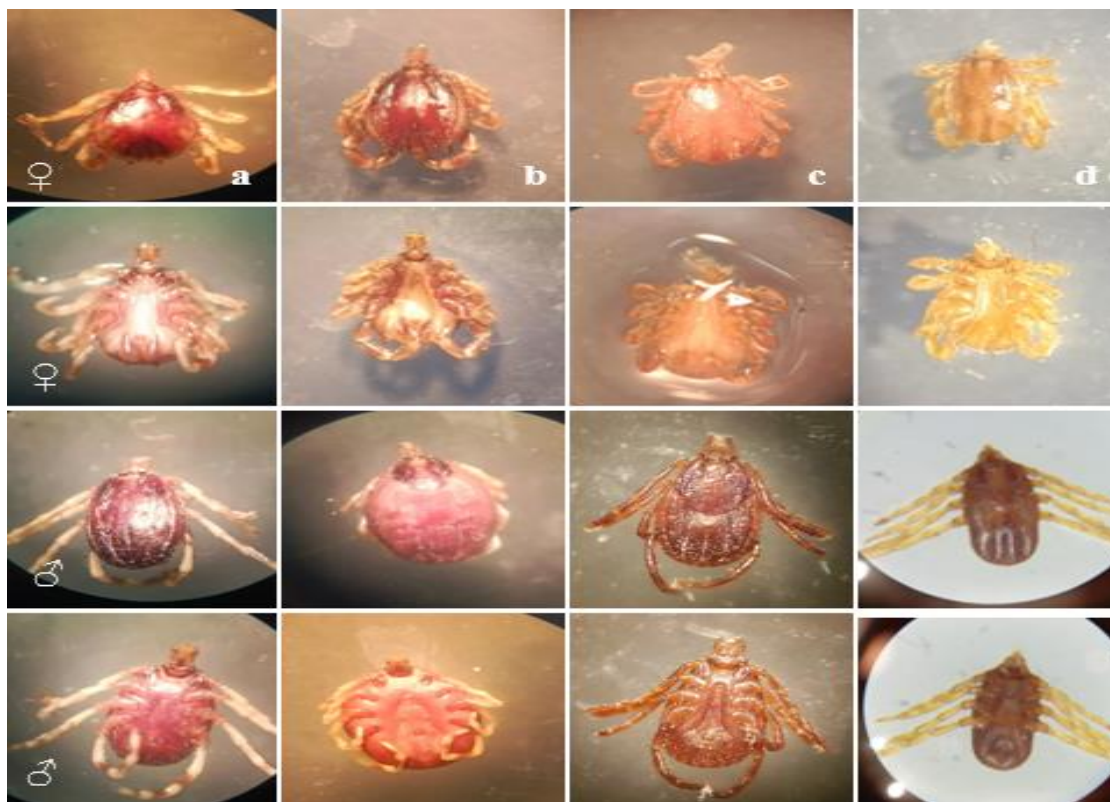
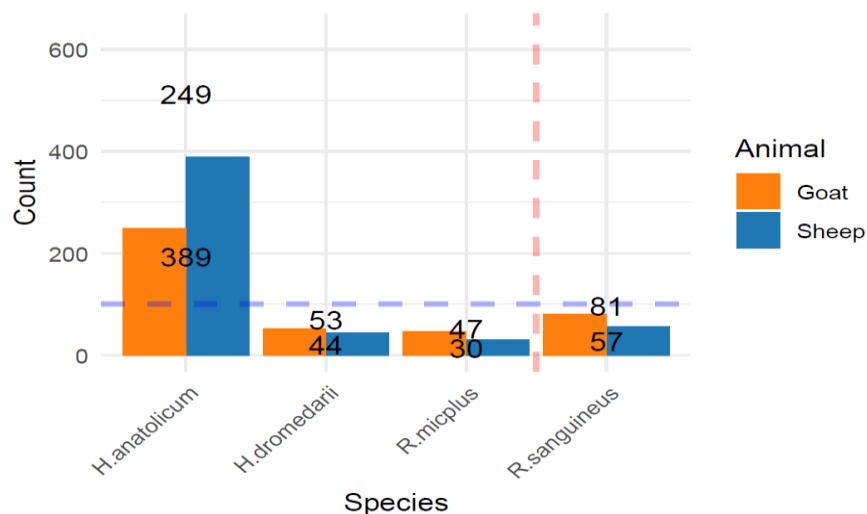


Figure3: (a) first column shows the male and female of *Hyalomma anatolicum*, (b) second column shows the male and female of *Hyalomma dromedarii*, (c) third column shows the male and female

Figure 4. Prevalence of tick species among infested sheep and goats.



Monthly distribution of the ticks is shown in the Figure 5. *H. anatolicum*, the dominate species, peaked in June (n = 137). However, its population high to moderate with rising temperature in July and August,

declined in winter and reemerged in March. *R. sanguineus* demonstrated higher tick counts in June ($n = 34$) followed by decline as temperature decreased. *H. dromedarii* showed highest population ($n = 32$) also in June and progressive decline in March ($n = 9$). *R. microplus* displayed a Gaussian distribution pattern, with peak counts in in June and then decline during colder months.

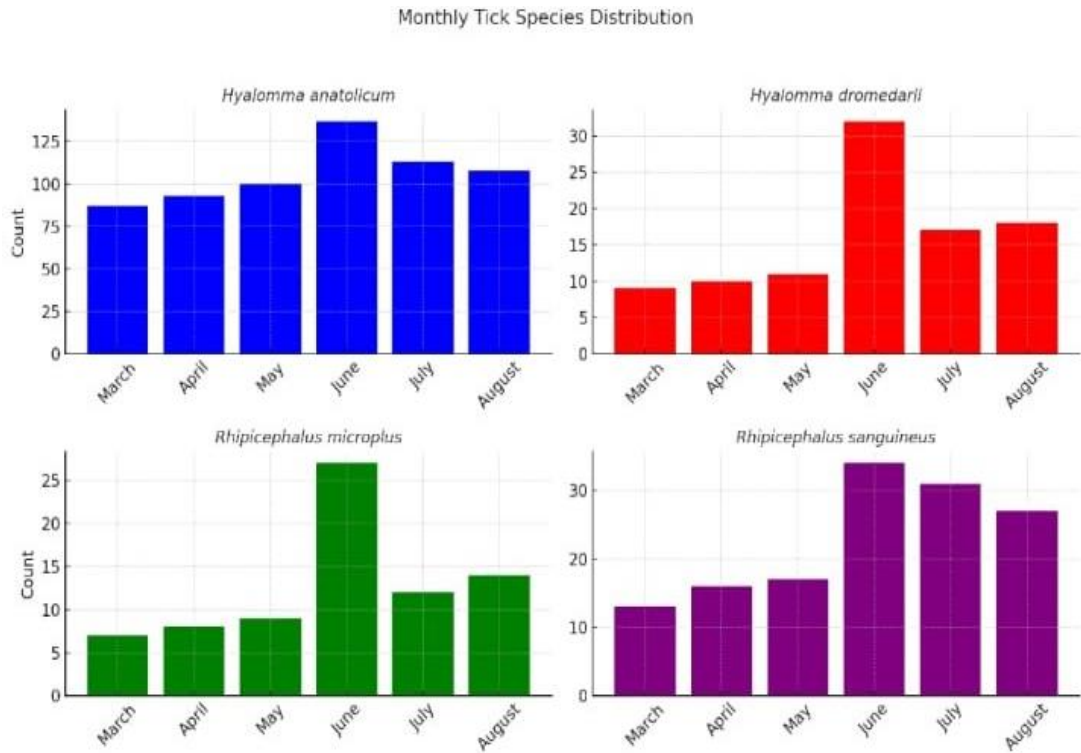


Figure 5. Monthly tick prevalence among sheep and goats.

The distribution pattern of the ticks is shown in the Figure 6. Female ticks were more common than males. For instance, the number of female *H. anatolicum* increased progressively, whereas the male population fluctuated throughout the study period. Female *H. dromedarii* showed highest counts as temperature dropped, while male exhibited a slight increase with temperature becomes in June and July. Female *R. microplus* showed almost consistent distribution, while male showed first increase than later decrease in numbers. Female of *R. sanguineus* peaked in May, while males displayed a consistent distribution pattern.

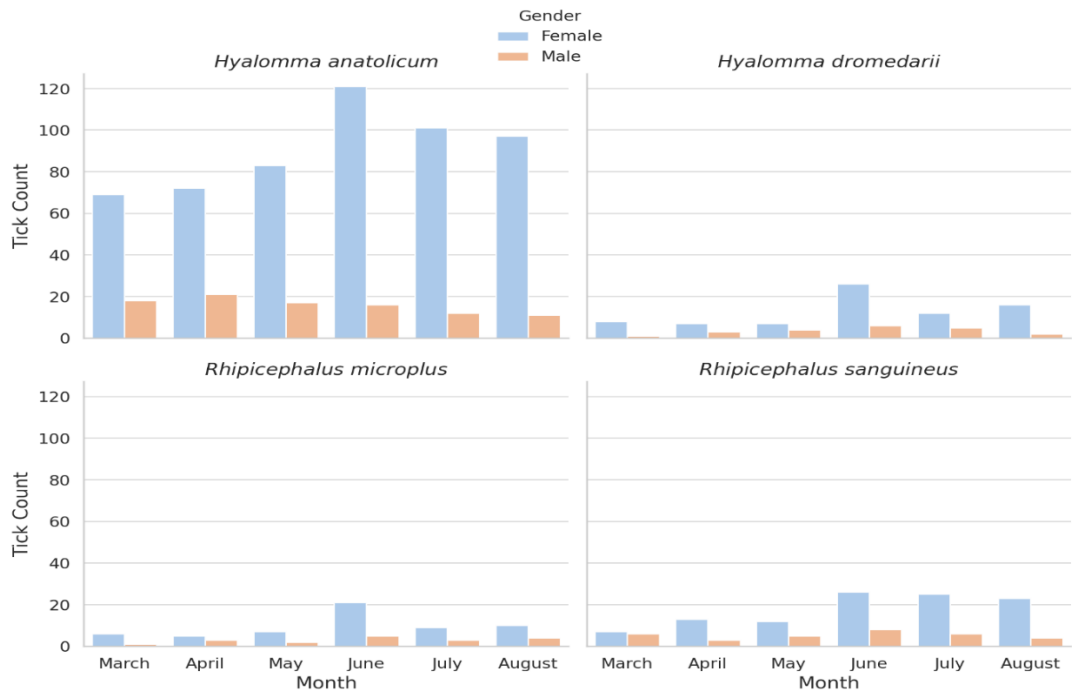


Figure 6. Distribution pattern of male and female ticks.

The distribution of ticks on different body parts is shown in Figure 7. Among the body regions, the highest tick infestation in sheep was observed on the legs (n = 46) followed by head (n = 43) and back (n = 41). In goats, the highest infestation was recorded legs (n = 40), belly (n = 40) and head (n = 34). *H. anatolicum* showed the highest distribution among belly and legs. Highest tick count for *H. dromedarii* was observed on back and belly of sheep and the legs and neck of goats. *R. microplus* preferred the legs (sheep: n = 36; goats: n = 19), tail (sheep: n = 29), and belly (sheep, n = 21). *R. sanguineus* was most common on the back and tail regions.

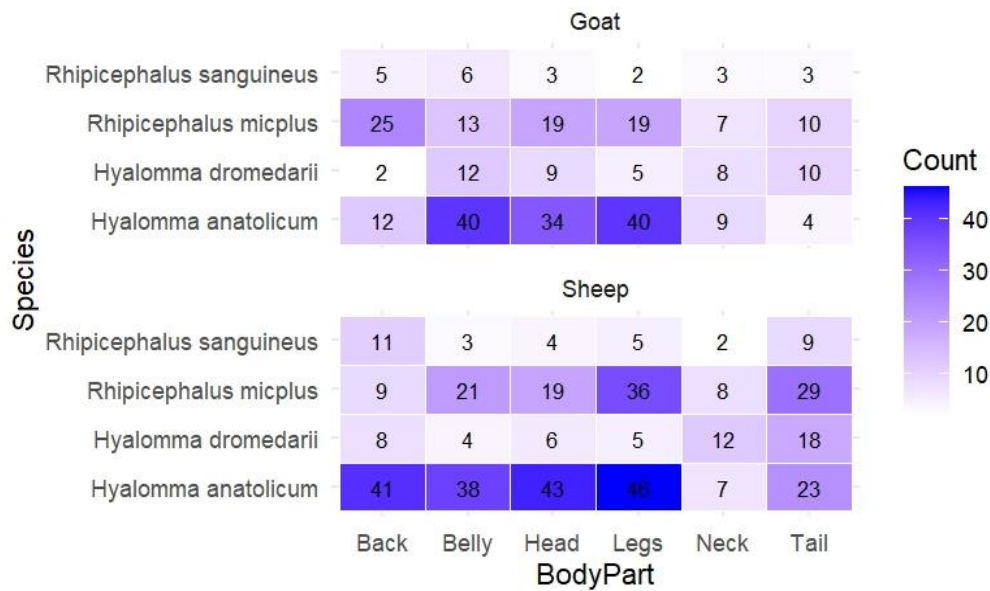


Figure 7. Anatomical distribution of ticks on different body parts of animal.

Discussion

According to the current study, most of sheep and goats had a moderate prevalence of hard tick infestation in small ruminants (Mushtaq et al., 2021). Infestation rates were higher among female sheep and goats than in male animals. Similar observation has been reported in other regional studies (Malla et al., 2021; Rind et al., 2023; Niazi et al., 2025). This increase in infestation is due to weak immune responses and possible exposure to high tick population that can lead to the changes in physiological and hormonal changes occur during reproductive phases (Kitsou et al., 2021).

The recorded highest temperature in June and July aligns with other geographical studies showing the warming of climate during particular season, forming link with climate change phenomenon like El Niño-Southern Oscillation (ENSO), which shows an impact on temperature variation regionally (Kemarau & Eboy 2023). Moreover, the lowest temperature recorded in March supports the assumption of seasonal variations that are often seen in temperate latitudes, where the winters are experience declined thermal activity (Lisovski et al., 2017). Our study area experiencing low rainfall and supportive higher tick population. In semi-arid ecosystem, moderate rainfall can support higher species distribution (Aamir & Hassan 2020; Bolan et al., 2024).

Hyalomma anatolicum was reported the most common species and this finding has been reported in other regional studies (Biglari et al., 2018; Kumar et al., 2020). This specie is important vector source of many tick-borne pathogens (Jabbar et al., 2015; Kumar et al., 2020). *Rhipicephalus microplus* showed comparatively low population. Although, this tick specie is also important as it is effecting livestock productivity and health (Hussain et al., 2024). *Rhipicephalus microplus* is also reported in this studies and it is also common in Pakistan (Hussain et al., 2024) while, *R. sanguineus* was also reported common in this region and also reported in Pakistan (Khan & Hussain 2012).

Among tick species observed, *H. anatolicum* showed its peak existence in June, subsequently increase in the temperature it's population increases further temperature drops its population decline, and again rose in March (Shoaib et al., 2022). These changes are consistent with the previous literatures suggesting that the increase and decrease in temperature adversely affect the tick survival, showing a critical relation in-between temperature variation and tick growth (Nielebeck et al., 2023). *Hyalomma dromedarii* reveals a distinctive pattern, with the peak population observed also in June decline after that declined in further cold temperature (Černý et al., 2019). This pattern may show a specie specific climatic adaptation, where a specific tick specie can adapt itself to survive in lowered temperature, this adaptation supports the previous data showing the tick-host relation in changing seasons (Ostfeld & Brunner 2015; Taha et al., 2022). The fluctuation pattern of *R. sanguineus*, that it reaches its peak population in June, lowered in winter, and again rise in March, indicates a specific breeding pattern and some climatic factors that have an impact on tick development (Andrade-Ponce et al., 2025).

The recorded result of the tick distribution pattern shows the differences in population dynamics of male and female species of ticks. It was recorded that female ticks were more dominantly infesting than male ticks (Atif 2012), which is in-line with the earlier studies showing same pattern in ecology of tick. For example, female tick of the specie *H. anatolicum* is prominent due to its stable reproductive habits than the male tick (Rooman et al., 2021). Moreover, the total count of female *H. dromedarii* was affected by

temperature, proving that temperature fluctuations had an important effect on tick population. This results are previously documented that climate such as humidity and temperature had a critical impact on tick reproductive behavior (Ogden & Lindsay 2016; Nielebeck et al., 2023). It is observed that count of the male *H. dromedarii* was increased in cooler months, suggesting an influence of local micro-climate state on the response of tick specie (Eisen & Eisen 2024).

Tick distributions on different body regions of goat and sheep has a specific infestation pattern, having significance for animal health management techniques. The recorded pattern shows that in sheep had highest infestation on leg region followed by head and back (Murshed et al., 2022). In contrast, goats show similar pattern for leg along with the infestations on belly and head. The findings are consistent with existing literatures showing that the ticks prefer the region where the skin is thin and hairs are short hairs, like the leg, which provides excessive warmth and nourishment needed for tick survival (Addo et al., 2024).

Conclusion

Hard ticks (Ixodidae) transmit pathogens causing diseases in both animals and humans, making tick and TBD knowledge essential for farmers and veterinarians to manage infections. Ticks also lead to economic losses through blood loss, irritation, and weakened immunity. In Jaffarabad, *Rhipicephalus microplus* and *Hyalomma anatolicum* are the most prevalent species. Tick burden is higher in female goats and sheep, especially in June, with increased tick counts during high temperature and humidity. As temperatures decline, tick counts decrease but re-emerge with rising temperatures. A strategic tick control program is recommended, with localized studies crucial for effective, region-specific management. This study provides baseline data for long-term monitoring and better tick control, protecting livestock and preventing disease spread.

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