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# STUDY ON PREVALENCE OF TICKS AND ITS EFFECT ON HEMATOLOGICAL PROFILE OF CATTLE IN QUETTA DISTRICT

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**Abstract**

*Research was conducted to understand the effect of tick infestation on hematological profile of cattle. Ticks and blood samples were collected from cattle in the district of Quetta, Balochistan. 100 Cattle were selected, having no tick infestation, low tick infestation, mild tick infestation, and high tick infestation for hematological evaluation. 421 ticks were identified, out of which 66.03% (n=278) belonged to Hyaloma anatolicum and 33.97% (n=143) were of Rhepicephalus microplus. The blood parameters of non-infested and infested cattle were found to be significantly different. TEC (P<0.0001), PCV (P<0.05), MCV, Hb (P<0.0001), MCHC (P<0.01), Monocytes (P<0.0001), Neutrophils (P<0.05), and Platelets (P<0.0001) counts declined. At the same time, MCH (P<0.0001), TLC (P<0.01), Eosinophils (P<0.0001) and Lymphocytes (P<0.05) were elevated in tick-infested cattle. In conclusion, ticks and tick-borne diseases are highly responsible for altering the blood profile of infested cattle.*

**Key Words**: *Cattle, Hematology, Quetta, Ticks*

## INTRODUCTION

Balochistan is the largest of provinces of Pakistan where natives of the region are primarily adhere to agriculture and livestock for their livelihood (1). Ticks are the most prevalent ecto-parasites of various animals and spreads number of tick-borne diseases (TBDs) in them directly by sucking their blood along with nutrients and making them sick. Prevalence of ticks have severe effect on cattle health and productivity leading to high economic loss. They are the causing agents of many different types of diseases in livestock (2). Ticks are divided into three main families that are Ixodidae, Argasidae, and Nuttalliellidae (3). Ixodidae and Argasidae are the two major families of ticks. The Ixodidae family comprised of hard ticks and the Argasidae family consists of soft ticks (4).The most infecting ticks are *Hyalomma* and *Rhipicephalus* according to recent studies (5). *Rhipicephalus* which is occupying a number of geographical locations around the world and are effective in spreading as they have extraordinary adaptability and high potentiality for doing this (6).

A number of tick-borne diseases are spreading abruptly and developing public health issues across the globe (7). Haematology refers to the study of blood, and the study focuses on the morphology and numbers of the cellular components of the blood. These cellular components are: the erythrocytes, the leucocytes, and the thrombocytes or platelets. These help in the diagnosis of various diseases (8). Blood as homeostatic tissue, which is composed of various cells suspended in a fluid called plasma (9). Haematological parameters indicate the health and physiological status of animals (10). Haematological components are comprised of red blood cells (RBCs), white blood cells (WBCs), mean corpuscular or cell volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration, and alteration in these parameters affect the health status of livestock (11). Tick-borne hemoparasites that cause Tick-borne hematological diseases (TBHDs) are Babesia, Theileria and Anaplasma, which have considerable impact on animal health and economy worldwide in respect of mortality rate, reduced milk production, and as well as less meat production (12). The current research aimed to investigate the effect of

different degrees of tick infestation on hematological profile of cattle in Quetta district and microscopic identification of the cattle-infested tick's species. These findings could be helpful in tick control strategies.

# MATERIALS AND METHODS

Quetta was selected as the study area and a sample of 100 animals were selected. They were divided into 4 groups on the basis of tick infestation: cattle with no tick infestation (neutral group), cattle with low tick infestation (less than 40 ticks), cattle with mild tick infestation (less than 80 ticks), and cattle with high tick infestation (more than 100 ticks). Ticks were collected and their microscopic identification was carried out to explore different tick species infesting cattle.

Blood samples were collected from all the four cattle groups in ethylene diamine tetra-acetic acid (EDTA) containing vials by carefully puncturing their jugular veins. These samples were examined to study the effect of tick infestation on blood profile of cattle. The hematological parameters: Total erythrocyte count (TEC), total leucocyte count (TLC), platelets count, haemoglobin, differential leukocytes count (DLC), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) were examined by HORIBA ES 60 hematology analyzer. Microscopic examination was done to identify the ticks. Hematological results were analyzed by using GRAPHPAD Prism (Version 8). The one way analysis of variance (ANOVA) was used to show significant differences in the hematological parameters between infested and non-infested cattle. A p-value (<0.05) was considered statistically significant.

# RESULTS

## PREVALENCE OF TICKS

The ticks collected were from two different genera; *Hyaloma* and *Rhepicephalus*. Beside this two tick's species *Hyaloma anatolicum* and *Rhepicephalus microplus* were identified. Total 421 ticks were identified out of that 278 (66.03%) were *H. anatolicum* and 143 (33.97 %.) were *R. microplus*. On the basis of gender the male *H. anatolicum* were 22.09% (n=93) and female were 43.94% (n=185) while male of *R. microplus* were 12.83% (n=54) and female were 21.14% (n=89), as detailed in Table I.

**Table I.** Frequency distribution and prevalence of tick's species

| Tick species | Frequency of ticks (n) | | Total no. of ticks | Prevalence of ticks (%) | | Total (%) |
|---|---|---|---|---|---|---|
| | Male | Female | | Male | Female | |
| *H. anatolicum* | 93 | 185 | 278 | 22.09 | 43.94 | 66.03 |
| *R. microplus* | 54 | 89 | 143 | 12.83 | 21.14 | 33.97 |
| | | | 421 | | | 100 |

Seasonal distribution of ticks was recorded from March, 2024 to February 2025. The seasonal distribution of *H. anatolicum* was n=34 (12.23%) in March-May, n=122 (43.88%) in June-August, n=99 (35.61%) in September-November, n=23 (8.27%) in December-February and it was n=16 (11.18%) in March-May, n=63 (44.05%) in June-August, n=50 (34.96%) in September-November, n=14 (9.79%) in December-February in *R. microplus* respectively. A little fluctuation was observed in the population of ticks. The number of ticks were declined slightly in colder months as compared to warmer months as shown in Table II.

**Table II.** Seasonal variation of ticks

| Months | March-May (%) | June-August (%) | September-November (%) | December-February (%) | Total (%) |
|---|---|---|---|---|---|
| *H. natolicum* | 34 (12.23) | 122 (43.88) | 99 (35.61) | 23 (8.27) | 278 (100) |
| *R. microplus* | 16 (11.18) | 63 (44.05) | 50 (34.96) | 14 (9.79) | 143 (100) |

## HEMATOLOGICAL PARAMETERS

There is significant decrease in the hemoglobin level (P<0.0001) in all the tick infested-cattle groups of cattle with respect to non-infested cattle group. Similarly a decreasing significant difference (P <0.0001) was observed in the erythrocyte count. The mean PCV values of infested cattle were significantly lower (P <0.05). The MCH was found to be statistically high (P <0.0001) in infested groups. A high significant difference (P

<0.01) was recorded in the MCHC of Cattle with high tick infestation (>100 ticks). The mean values of infested cattle were statistically lower. An increasing significant difference (P <0.01) was recorded in the mean values of TLCs of infested groups in respect of control group. The neutrophils and lymphocytes of cattle with mild and high infestation were found to be statistically different (P <0.05). A significant difference (P <0.0001) was also observed in the mean values of monocytes. Cattle with high infestation found to be statistically different (P <0.0001) in the mean value of eosinophils. The hematological parameters are presented in Table III.

**Table III.** Hematological parameters of cattle with low, mild, and heavy tick infestation in respect of non-infested cattle

| Parameters | Mean±SEM | Mean±SEM | Mean±SEM | Mean±SEM |
|---|---|---|---|---|
| | Non-infested cattle | Infested cattle (<40 ticks) | Infested cattle (<80 ticks) | Infested cattle (>100 ticks) |
| Hemoglobin (g/dl) | 11.46±0.223 | 9.500±0.147*** | 8.788±0.335*** | 8.012±0.101*** |
| TEC (million/mm$^3$) | 7.176±0.179 | 6.044±0.158*** | 5.612±0.140*** | 5.016±0.213*** |
| PCV (%) | 40.80±1.830 | 35.43±1.254* | 28.81±0.680*** | 24.66±0.823*** |
| MCV (fL) | 44.52±1.701 | 43.47±2.118N.S | 42.23±1.561N.S | 41.19±1.283N.S |
| MCH (pg) | 13.78±0.409 | 15.80±0.125*** | 15.92±0.140*** | 16.05±0.188*** |
| MCHC (g/dl) | 30.83±0.256 | 29.24±0.957N.S | 28.74±0.770N.S | 27.85±1.134** |
| Platelets ($10^9$/µL) | 507.6±1.412 | 317.3±19.785*** | 303.4±20.341*** | 270.9±17.267*** |
| TLC ($10^3$/mm$^3$) | 9.668±0.102 | 11.35±0.199** | 11.56±0.625** | 13.04±0.211** |
| Neutrophils (%) | 47.32±0.504 | 45.00±0.238N.S | 42.92±0.411* | 36.96±1.577*** |
| Lymphocytes (%) | 47.96±0.472 | 51.64±0.310N.S | 52.92±0.482** | 58.52±1.590** |
| Monocytes (%) | 2.920±0.172 | 1.640±0.151*** | 1.800±0.173*** | 1.520±0.142*** |
| Eosinophils (%) | 1.880±0.159 | 1.960±0.135N.S | 2.360±0.113N.S | 3.000±0.200*** |

Data is represented in Mean±SEM, where * P<0.05, **P<0.001; ***P<0.0001

# DISCUSSION

The two tick's species: *H. anatolicum and R. microplus* were major tick-species. *H. anatolicum with the prevalence of 66.03% was dominant species in the findings and* next most common tick species *with 33.97% prevalence was R. microplus*. Similar findings of *H. anatolicum dominance was* recorded in Balochistan. In previous studies, It was found that in Balochistan, *H. anatolicum* and *R. (B) annulatus* were found to be the dominant tick species (13). Similarly *the studies of other researchers revealed that the two major tick species isolated from livestock were R. microplus* and *H. anatolicum. These are predominant vectors of hematoparasites of* babesiosis, theileriosis, and anaplasmosis. *H. anatolicum* (82%) and *R. microplus* (81%) were detected while *R. microplus* species distribution was 47% from Punjab, 46% from Khyber Pakhtunkhwa, and 4% from Balochistan (14). *H. anatolicum* found in cows and buffaloes were recorded as the major tick species in Quetta district, Balochistan. It chiefly infested domestic animals mainly cattle (15). In Quetta, 33% of *H. anatolicum* and 9% of *B. microplus* were identified, remaining were *H. aegyptium* and *D. andersoni* species (16). Nymphs and larvae of *H. anatolicum* commonly were found in the regions of neck, ear, and tail while adults were distributed in the regions of udder, axilla (armpit), and groin (17). The prevalence and distribution of ticks and their seasonal occurrence along with dynamics of tick-borne diseases are affected by climatic conditions (18). Tick prevalence increases in summer as compared to winter (19). Seasonal changes have influential effect on the number of ticks (20). Throughout world, distribution of *Rhipicephalus microplus* is mostly tropical and sub-tropical (21). However *H. anatolicum* mostly found in dry and warmer climatic regions (22).

A significant difference was observed in the hematological parameters of tick infested cattle and non-infested cattle. A decline in the RBCs, Hb, PCV, MCV, MCHC, Platelets, Neutrophils, and Monocytes was recorded while MCH, TLC, Lymphocytes, and Eosinophils found to be increased. The declined blood parameters of infested-cattle were due to heavy blood loss and blood cells destruction which clearly showed that ticks and ticks borne diseases causes huge loss. Ticks massively stuck to and feed on animal's blood. Low hemoglobin level, low TEC, and low PCV occurred due to consistent blood loss by ticks (23). Lowered RBCs count was due its destruction by blood parasites transferred by tick's bite. Erythrocytes destruction caused by tick-borne hematoparasites of Theileria and Babesia (24). Blood profile of infested cattle also revealed a significant decline in MCV, PCV, Hb, and RBCs count by theileriosis a tick-borne hemoparasitic disease (25).

A decrease in the Hb level, RBCs count, PCV, MCHC, neutrophils and an increase in lymphocytes was found (26). A significant decrease in RBCs, Hb, and PCV was also reported in theileria infected cattle. Decline in Platelets count was recorded in infested cattle. Theileria caused the destruction of platelets (27). A lowered percentage of monocytes was recorded in cattle with tick infestation (28). Hematoparasites caused the destruction of blood cells leading to a decline in erythrocytes and hemoglobin count, lowered PCV, MCV, MCHC, Platelets, Neutrophils, and Monocytes. The rise in blood parameters of TLC, Lymphocytes, and Eosinophils is due to immune response. An increase in MCH was observed in infested cattle (29). In response to immunity an increase in Lymphocytes and eosinophils occurred (30). These results were consistent with the current findings.

# CONCLUSION

Ticks are potential agents to cause the alteration of the hematological parameters in cattle. *H. anatolicum* and *R. microplus* were identified from parasitized cattle having significantly different hematological parameters as compared to non-parasitized cattle. A significantly decreased level of RBCs, Hb, PCV, MCV, MCHC, Platelets, Neutrophils, and Monocytes was recorded however a significant increase was found in the level of MCH, TLC, Lymphocytes, and Eosinophils in tick infested cattle. This study showed the correlation between tick-infestation and hematological alteration in cattle. Current study also revealed that ticks and tick-borne diseases are highly responsible in bringing changes in the blood profile of the infested cattle. These findings would help in cattle health management. Moreover it emphasizes on the need of further research on tick control strategies.

## Conflict of interest:

The authors declare no conflict of interest.

## Authors' contribution:

NU conceived study; MN supervised and conceptualized the study; KK & AU data interpretation and statistical analysis; MK drafted the manuscript; NR & MI critical analysis.

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