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Effect of tick infestation on haematological parameters of calves

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Abstract

In the present study, haematological estimation of blood parameters of naturally infested cattle from North and South zones of the study area was carried out to gather information on the effect of tick burden on cattle haematology. The results of the haematological studies of tick infested/ non-infested cattle indicate that there is significant reduction in most of the haematological parameters of cattle i.e Hb ($P < 0.001$), PCV ($P < 0.05$), TEC ($P < 0.05$), TLC ($P < 0.01$), DLC ($P < 0.05$), and Platelets ($P < 0.01$). However, difference in MCV, MCHC, MCH and monocytes of infected and non-infected calves was non-significant ($P > 0.05$).

Keywords: Tick infestation, blood parameters, anemia etc

1. Introduction

Health issues of livestock caused by ecto-parasitic infestations may be accompanied by a decrease in some blood parameters including blood trace elements, mineral levels and other biochemical parameters [1]. A reduction in haematocrit and haematological values are reported in infested cattle as compared to those calves which were free from tick infestation [2, 3]. An increase in number of eosinophils and lymphocytes in ticks infested cattle was reported by some workers [4, 5], however, a decrease in neutrophils and monocytes in tick-infested cattle was also reported by other researcher [6]. Lower Hb, TEC and marked leucocytosis is due to anaemia because of the blood sucking ability of parasites and hemorrhage [7].

Hematological and sero-biochemical alterations are the indicators of severity of disease and are considered to be good tools for the diagnosis, prognosis for effective therapy [8, 9]. Anemia is classified as normocytic when erythrocytes that have a normal size or volume (normal MCV); macrocytic, when the MCV is high; microcytic, when the MCV is low; normochromic, when erythrocytes containing the normal amount of hemoglobin (normal MCHC), hypochromic, when the MCHC is abnormally low; and hyperchromic, when the MCHC is abnormally high [10, 12].

It is reported that macrocytic hypochromic anemia appeared in babesiosis (caused by *Babesia*) and a normocytic normochromic anemia is characteristic of theileriosis (caused by *Theileria*) [13]. The macrocytic hypochromic anemia observed in cattle with babesiosis could be attributed to intravascular haemolysis of red blood cells [14]. The normocytic normochromic anemia may be attributed to the toxic metabolites of *Theileria* sp. which have a suppressing effect on the bone marrow and interfere with the process of erythropoiesis [13].

Keeping in view the importance of blood profile of cattle as an indicator of its good health and diseased condition, the present study is designed to investigate the effect of tick infestation on the hematological parameters of naturally infected calves in the selected area.

2. Materials and Methods

2.1 Study Period and Study Area

The study was performed during March 2016 to September, 2016. The seasons studied included summer (March, April, May, June) and rainy (July, August and September). Study areas include the North and South Zone of Lucknow, Uttar Pradesh, India (Fig. 1).

2.2 Study Animals

A total of hundred cross bred cattle of <4 years age, with high tick burden were selected for the study. A group of non-infested cattle of the same age was taken to serve the control group.

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2.3 Methodology

Blood samples were collected from jugular vein with the help of 18 gauge sterilized needle in vials containing ethylenediamine tetra-acetic acid (EDTA) for estimation of the various haematological parameters [15]. The vials were sealed and labelled properly. The blood sample of non-infested cattle was also taken for comparison. The collected blood was brought to the Parasitology laboratory, Babasaheb Bhimrao Ambedkar University, Lucknow for conducting standard haematological tests which included:

2.3.1 Total erythrocyte count (TEC) (millions per μ l)

Total erythrocytes count (TEC) (RBCs) were estimated by hemocytometer, the red cells diluted using isotonic Hayem's solution [16].

2.3.2 Total leukocyte count (TLC) (thousands per μ l)

Total leukocytes count (TLC) (WBCs), were estimated by hemocytometer using Turke's solution as diluting fluid [17].

2.3.3 Haemoglobin level (mg/100 ml)

The hemoglobin concentration (Hb) was estimated by the acid hematin method (Sahli method) [18].

2.3.4 Differential leukocytes count (DLC) (%)

It is the differential count of different leucocytes viz., Neutrophils, Lymphocytes, Monocytes and Eosinophils. All are expressed in percentage (%) [17].

2.3.5 Packed Cell Volume (PCV)

The percentage of packed red cells in a given volume of blood after centrifugation is known as hematocrit. The packed cell volume (PCV), was estimated by Microhematocrit method using a capillary hematocrit tube approximately 7.5 cm in length and having a bore about 1 mm centrifuged in a special speed centrifuge (Micro-Hematocrit, Taiwan) [19].

2.3.6 Mean Corpuscular/Cell Volume (MCV) (fl)

The mean cell volume is a measure of the volume of the average red cell in a sample. It is expressed in femtoliters (fl). It is calculated by the following formula [19]:

$$\text{MCV (fl)} = \text{PCV} \times 10 / \text{RBCs count}$$

2.3.7 Mean Corpuscular Haemoglobin (MCH) (pg)

It is a measurement of the average amount of haemoglobin per cell. It is expressed in picograms per cell (pg/cell) and calculated by using the following formula [19]:

$$\text{MCH (pg)} = \text{Hb} \times 10 / \text{RBCs}$$

2.3.8 Mean Corpuscular Haemoglobin Concentration (MCHC) (%)

It is a measure of the average concentration of haemoglobin per red blood cell. It is expressed in grams per deciliter (g/dL). It is calculated by the following formula [19]:

$$\text{MCHC (\%)} = \text{Hb} / \text{PCV} \times 100$$

2.3.9 Platelets count

Platelet Count was done using hemocytometer with ammonium oxalate as diluting fluid [19].

2.4 Statistical analysis

The student t-test was done to show significant differences in haematological parameters between infested and non-infested cattle [20].

3. Results and Discussion

Haematological estimation of blood parameters of naturally infested cattle from North and South zones of the study area was carried out to gather information on the effect of tick burden on cattle haematology. The haematological parameters studied were Hb, PCV, TEC, TLC, DLC, MCV, MCHC and Platelets. The results of the haematological studies of tick infested/ non-infested cattle have been shown in Table 1 and Fig. 2.

The mean values of these parameters recorded in the naturally infested group were Hb: 8.225 ± 0.43 gm/dl, TLC: $13.27 \pm 0.59 \times 10^3 / \mu$ l, Neutrophils: $34.25 \pm 2.18\%$, Lymphocytes: $62.125 \pm 5.17\%$, Monocytes: $0.5 \pm 0.26\%$, Eosinophils: $3.375 \pm 0.46\%$, TEC: $3.79 \pm 0.75 \times 10 / \mu$ l, PCV: $24.3125 \pm 4.52\%$, MCV: 41.625 ± 5.3 fl, MCH: 16.625 ± 2.1 picogm, MCHC: 28.7875 ± 0.70 gm/l, Platelet Count: $265 \pm 46.6 \times 10^5 / \mu$ l. However, in the non-infested cattle the mean values recorded were Hb: 12.2 ± 0.50 gm/dl, TLC: $10.38 \pm 0.67 \times 10^3 / \mu$ l, Neutrophils: $46.8 \pm 2.41\%$, Lymphocytes: $46.4 \pm 2.85\%$, Monocytes: $1.2 \pm 0.8\%$, Eosinophils: $1.2 \pm 0.8\%$, TEC: $7.822 \pm 1.25 \times 10 / \mu$ l, PCV: $41.62 \pm 1.63\%$, MCV: 44.04 ± 1.32 fl, MCH: 12.82 ± 0.49 picogm, MCHC: 29.2 ± 0.26 gm/l, Platelet Count: $516 \pm 64.03 \times 10^5 / \mu$ l.

The haematological findings revealed differences between infested and control group of cattle in all the blood parameters studied. There is highly significant reduction ($P < 0.001$) in the haemoglobin (Hb) levels of infested cattle (8.225 ± 0.43 gm/dl) as compared to non-infested cattle (12.2 ± 0.50 gm/dl). It was also observed that the lower haemoglobin level in infested cattle was accompanied by lower erythrocyte count (TEC). A significant lower ($P < 0.05$) TEC was observed in infested cattle ($3.79 \pm 0.75 \times 10 / \mu$ l) as compared to non-infested group of cattle ($7.822 \pm 1.25 \times 10 / \mu$ l). However, MCV, MCH and MCHC were not found to be significantly variable in the infested and non-infested cattle. This may be attributed to the normocytic normochromic anaemia in the infested cattle of the study area.

The reduction in the RBC counts occurred due to blood sucking by the ticks as well as due to destruction of RBC's by the protozoan parasites (*Theileria*, *Babesia*) transmitted by ticks. Lower Hb and TEC are due to anaemia because of blood sucking ability of parasites and haemorrhage [7]. The results in the present study support the findings of other workers who have also reported lowered TEC along with lowered Hb [2, 6, 21].

In the present study, Total Leucocyte Count (TLC) of the naturally infested cattle were found to be significantly higher ($P < 0.01$) when compared to non-infested cattle. A significant decrease in TLC is also reported by other researchers in their respective studies [22-24]. However, a significantly higher ($P < 0.05$) eosinophils and lymphocytes count were found in infested cattle than non-infested, which may be due to inflammation caused by tick bite which leads to migration of white blood cells as a response toward the tick bite. Neutrophils counts in non-infested cattle was observed to be significantly higher ($P < 0.01$) than in the infested cattle. In the present study, although no significant difference ($P > 0.05$) observed in the counts of monocytes.

The platelet count of cattle parasitized by ticks was observed to be significantly higher ($P < 0.01$) as compared to that in the non-parasitized cattle. Other researchers have also diagnosed thrombocytopenia (lower platelets count) due to tick infestation in their respective studies [23, 25, 27].

Ectoparasitic infestation by ticks in other livestock viz. goats has also shown alterations in the blood parameters. In a study

on goats in India, lower red blood cell count, packed cell volume, haemoglobin concentration and platelets counts in infested cattle than non-infested ones is reported [28]. The changes in haematological parameters as well as reduction in live weight gain due to tick infestation in calves have also been reported [29].

It is also a fact that poor nutrition produces a fall in haematocrit and haemoglobin levels in any animal including cattle [3-30]. The nutritional depression in the values of the blood parameters was clearly demonstrated by researchers in

the tick-free animals but they have also reported a significantly greater effect in the tick-infested group of cattle. They also observed that the combined effect of tick and poor nutrition resulted in a significant depression in the plasma concentration of total cholesterol as compared to the effect of inadequate nutrition alone. Their investigation clearly demonstrated that even an adequate diet cannot counter balance the depression in growth rate and certain blood parameters caused by heavy tick burdens in the livestock [31].

Table 1: Haematological parameters of tick-infested and non-infested cattle

S.No	Parameter	Average Value±sem	Average Value±sem	Significance level
		Infested Cattle	Non-Infested	
1	Hb gm/dl	8.225 ±0.43	12.2±0.50	*** (P<0.001)
2	TLC X 10 ³ / µl	13.27±0.59	10.38±0.67	** (P<0.01)
3	Neutrophils %	34.25±2.18	46.8±2.41	** (P<0.01)
4	Lymphocytes%	62.125±5.17	46.4±2.85	* (P<0.05)
5	Monocytes%	0.5±0.26	1.2±0.8	N.S (P>0.05)
6	Eosinophils%	3.375±0.46	1.2±0.8	* (P<0.05)
7	RBC millions/cm	3.79±0.75	7.822±1.25	* (P<0.05)
8	PCV%	24.3125±4.52	41.62±1.63	* (P<0.05)
9	MCV fl	41.625±5.3	44.04±1.32	N.S (P>0.05)
10	MCH picogm	16.625±2.12	12.82±0.49	N.S (P>0.05)
11	MCHC gm/l	28.7875±0.70	29.2±0.26	N.S (P>0.05)
12	Platelet Count X 10 ⁵ / µl	265±46.6	516±64.03	** (P<0.01)

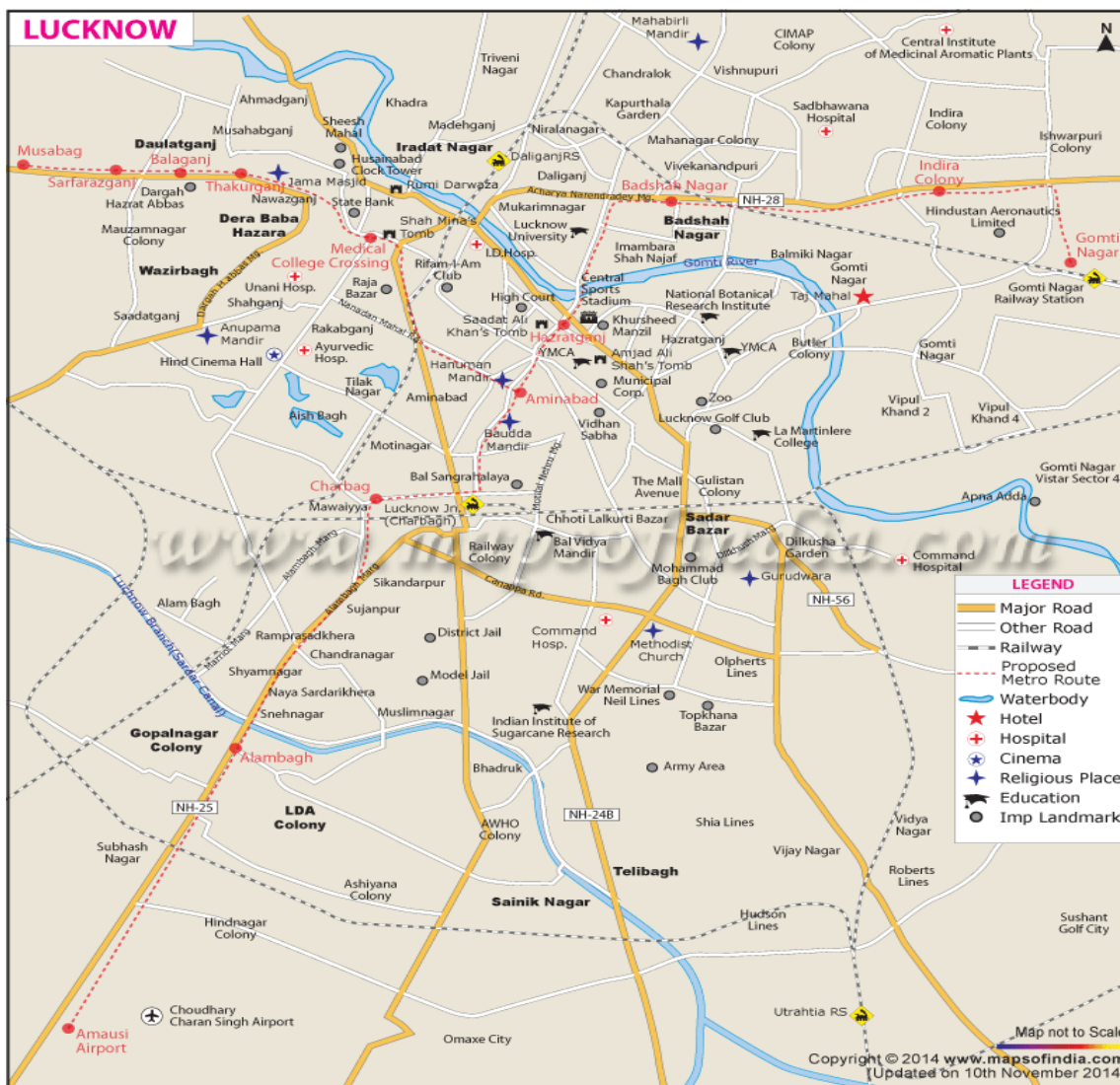


Fig 1: Study Area

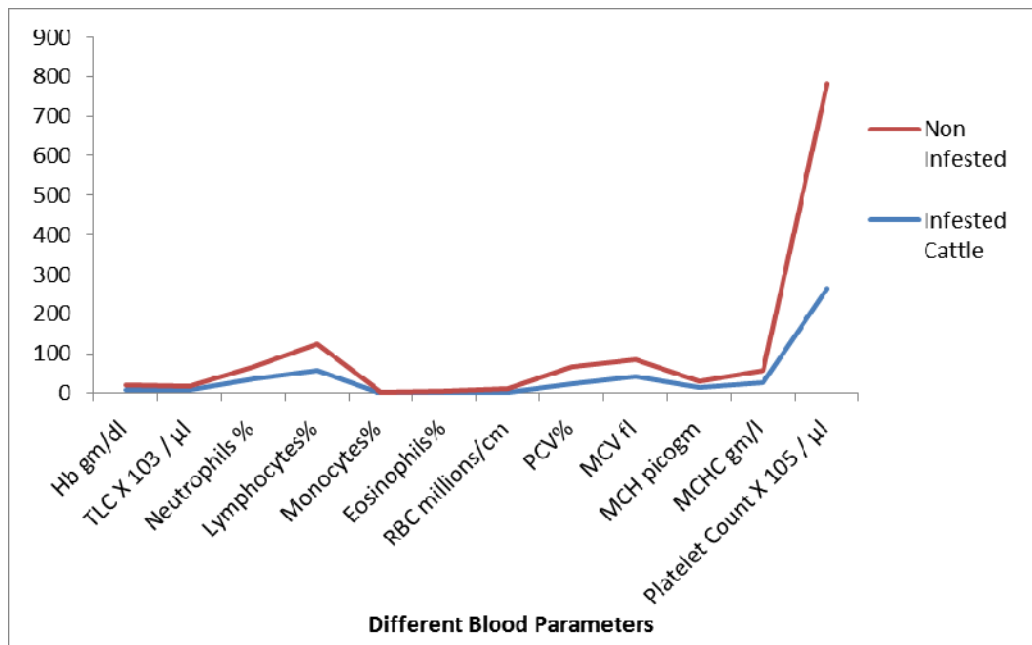


Fig 2: Comparison of haematological parameters of infested and non-infested cattle

4. Conclusion

The results of the present study indicate that there was significant reduction in the haematological parameters of cattle following heavy tick burdens. The results also revealed out that normocytic and normochromic type of anaemic conditions may occur in the cattle in the study area. Further studies are recommended to be carried out in different parts of the country, in order to further establish the effects of tick infestation on haematological and pathological parameters in cattle and other domestic animals. The observations made by the present study as well as other related studies assume significance and importance as changes in blood parameters brought about by tick infestation severely affect the health and productivity of animal.

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