

Original Research Article

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## Estimation of Haematological Changes in Crossbred Cattle Infected with *Theileria annulata*

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### ABSTRACT

*Theileria annulata* is an important tick-borne haemoprotozoan organism affecting dairy animals worldwide including India. It causes enormous economic losses in cattle and buffaloes in terms of reduced milk production, increased infertility and high mortality rate. The present study was undertaken to estimate the various haematological changes in cattle infected with *T. annulata*. Haematological examination revealed a significant ( $P < 0.05$ ) decrease in haemoglobin concentration ( $6.28 \pm 0.42$  g%), packed cell volume ( $19.14 \pm 1.20$  %), total erythrocytic count ( $3.98 \pm 0.21 \times 10^6/\mu\text{l}$ ) and increase in total leucocyte count ( $9.31 \pm 0.37 \times 10^3/\mu\text{l}$ ) were recorded in infected animals. However, it was  $10.29 \pm 0.38$  g%,  $31.19 \pm 1.09$  %,  $6.02 \pm 0.19 \times 10^6/\mu\text{l}$  and  $8.37 \pm 0.24 \times 10^3/\mu\text{l}$ , respectively in infected group. Significant ( $P < 0.05$ ) lymphopenia ( $51.90 \pm 4.30$  %) and neutrophilia ( $36.00 \pm 4.89$  %) were observed in infected cattle. However, differential leucocytes count revealed  $60.90 \pm 1.52$  % lymphocytes and  $34.80 \pm 1.58$  % neutrophils in control animals. The increase in monocytes ( $5.50 \pm 1.00$  %) and eosinophils ( $6.60 \pm 2.50$  %) were observed in infected cattle as compared with uninfected control monocytes ( $1.80 \pm 0.40$  %) and eosinophils ( $2.50 \pm 0.57$  %). A decrease in MCV ( $48.04 \pm 1.81$  fl) and MCH ( $15.73 \pm 0.54$  pg) were observed in infected group as compared to control (MCV- $51.81 \pm 0.77$  fl and MCH  $17.08 \pm 0.26$  pg) which revealed microcytic RBC's and low average quantity of haemoglobin present in single erythrocyte, respectively. However, no changes was observed in MCHC ( $32.78 \pm 0.37$  g%) in infected group.

#### Keywords

*Theileria annulata*,  
cattle, haematology

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### Introduction

*Theileria annulata* is an apicomplexan pleomorphic haemoprotozoan organism found in lymphocytes and erythrocytes for completion of their life cycle in mammalian

hosts. The organism causes Bovine Tropical Theileriosis in tropical and subtropical region of the country. In India the disease causes a serious problem in exotic and cross bred cattle (Kohli *et al.*, 2014). The prevalence of *T. annulata* has been reported from different

geographical regions of India including Uttarakhand by the several workers (Rialch *et al.*, 2014; Maharana *et al.*, 2016; Kariyappa *et al.*, 2017 and Acharya *et al.*, 2017; Arun *et al.*, 2019). *T. annulata* causes enormous economic losses in cattle and buffaloes in terms of reduced milk production, increased infertility and high mortality rate. The assessment of economic losses due to theileriosis has been reported worldwide including India. Devendra (1995) estimated an annual loss of US \$ 800 million in India. The early diagnosis of the disease is based on blood smear examination but sometimes organism may not be detected. However, haematological changes give indication of the disease which is helpful to start early treatment and also prevent death of the animals (Modi and Bhadesiya, 2004). Keeping in view these facts, the present study was conducted to estimate the haematological changes in cattle infected with *T. annulata*.

## **Materials and Methods**

A total of 524 blood samples of cattle were collected from the villages of various tehsils of district Udham Sing Nagar, Uttarakhand and Teaching Veterinary Clinical Complex, College of Veterinary and Animal Sciences, Pantnagar during July, 2017 to June, 2018. Microscopically thin blood smear were examined using Giemsa stain for the demonstration of organism. A total of 10 crossbred cattle found positive and 10 found negative for *T. annulata* were selected for the estimation of haematological parameters and grouped as GI infected and GII (uninfected control), respectively. Analysis of various haematological parameters *viz.* haemoglobin (Hb), total erythrocyte count (TEC), total leukocyte count (TLC), differential leukocyte count (DLC), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) were estimated as per method

described by Jain, 1964. Statistical analysis of data was performed by Student 't' test described by Snedecor and Cochran (1994).

## **Results and Discussion**

The mean haematological value of cattle infected with *T. annulata* is presented in Table 1. In the present study, increased total leukocyte counts ( $9.31 \pm 0.37$ ) was recorded as compared to uninfected control ( $8.37 \pm 0.24$ ). The finding is in consonance with the findings of Modi *et al.*, 2015; Ganguly *et al.*, 2015 and Goyal *et al.*, 2017. However, after increase in TLC, significant decrease within several days in *Theileria* affected cattle was recorded by Sandhu *et al.*, (1998).

Significant ( $P < 0.05$ ) lymphopenia ( $51.90 \pm 4.30$  %) and neutrophilia ( $36.00 \pm 4.89$  %) were observed in infected cattle. However, differential leucocytes count revealed  $60.90 \pm 1.52$  % lymphocytes and  $34.80 \pm 1.58$  % neutrophils in control animals. Similar findings were also reported by Tehrani *et al.*, 2013 and Goyal *et al.*, 2017. In contrast to present study, Aulakh *et al.*, (1998) observed lymphocytosis and neutropenia in infected cattle, while Omar *et al.*, (2002) found lymphocytopenia and neutropenia. Muraleedharan *et al.*, (2005) found lymphocytosis and neutrophilia in infected cattle. In the present study, the increase in monocytes ( $5.50 \pm 1.00$  %) and eosinophils ( $6.60 \pm 2.50$  %) were observed in infected cattle while it was as recorded  $1.80 \pm 0.40$  % and  $2.50 \pm 0.57$  %, respectively in uninfected control animals.

A decrease in MCV ( $48.04 \pm 1.81$  fl) and MCH ( $15.73 \pm 0.54$  pg) were observed in infected group as compared to control (MCV-  $51.81 \pm 0.77$  fl and MCH  $17.08 \pm 0.26$  pg) which revealed microcytic RBC's and low average quantity of haemoglobin present in single erythrocyte, respectively.

**Table.1** Mean haematological values in cattle infected with *Theileria annulata* and control animals

S. No.	Parameters	Infected	Control	't' value
1	Hb g%	6.28±0.42	10.29±0.38	-7.43
2	PCV (%)	19.14±1.20	31.19±1.09	-7.78
3	TEC (×10 <sup>6</sup> /μl)	3.98±0.21	6.02±0.19	-7.43
4	MCV (fl)	48.04±1.81	51.81±0.77	-2.01*
5	MCH (pg)	15.73±0.54	17.08±0.26	-2.36
6	MCHC (g%)	32.78±0.37	32.98±0.25	-0.44*
7	TLC (×10 <sup>3</sup> /μl)	9.31±0.37	8.37±0.24	2.19
8	Neutrophil (%)	36.00±4.89	34.80±1.58	0.25*
9	Lymphocyte (%)	51.90±4.30	60.90±1.52	-2.12
10	Monocyte (%)	5.50±1.00	1.80±0.40	3.58
11	Eosinophil (%)	6.60±2.50	2.50±0.57	1.68*

However, no changes was observed in MCHC (32.78±0.37 g%) in infected group as compared to control (32.98±0.25 g%) which clearly indicated that RBCs were normochromic in animals (Ugalmugle *et al.*, 2010). Hence, infected cattle had suffered with microcytic normochromic anaemia.

The reduction in Hb (6.28±0.42), PCV (19.14±1.20) and TEC (3.98±0.21) values were observed in infected cattle which could be attributed to intravascular haemolysis by piroplasms of *T. annulata* which infects and replicate in erythrocytes.

The erythrophagocytosis also favours the reduction of Hb, PCV and TEC and it may be immune mediated. The high parasitemia and low RBC count is ascribed to the removal of infected RBCs by spleen and liver and these variations were consistent with the finding of Qayyum *et al.*, 2010; Tehrani *et al.*, 2013 and Bahera, 2016. Leucocytosis occurs due to proliferation of lymphocytes and leucopenia is not a characteristic feature of *T. annulata* (Modi *et al.*, 2015). Lymphopenia may occur due to lymphoid hyperplasia followed by exhaustion of the lymphoid tissues in later stage of infection as observed in the present study (Soulsby, 1982).

Haematological changes in cattle infected with *T. annulata* revealed lymphopaenia and neutrophilia. The increase in monocytes and eosinophils were observed in infected cattle as compared with uninfected control. A decrease in MCV was observed in infected group which revealed microcytic RBCs and low average quantity of haemoglobin present in single erythrocyte, respectively.

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