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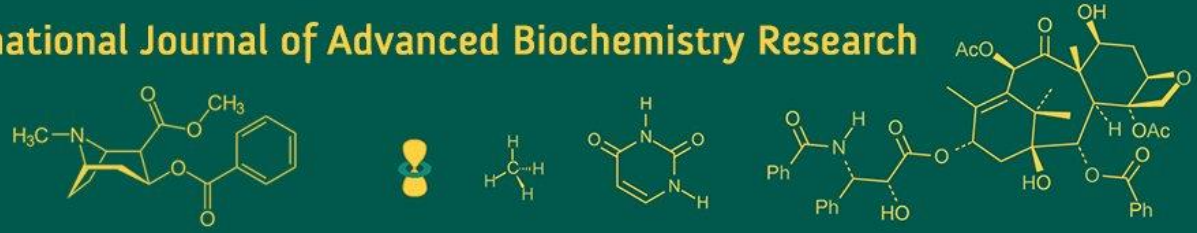

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Haematobiochemical alterations in cattle infected with Bovine tropical theileriosis in and around Tirupati district

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Abstract
Bovine tropical theileriosis is the tick borne Haemoprotozoan disease caused by the *Theileria annulata*. which is transmitted by Ixodid ticks of the genus *Hyalomma anatolicum anatolicum.* Bovine tropical theileriosis is having major economic importance in India as it caused higher mortality, decreased productivity and draught power in infected animals. Bovine tropical theileriosis is considered as serious problem for livestock in tropical countries affecting millions of animals, especially in crossbred and exotic cattle and posing a major challenge to livestock improvement programmes. Hence, the present study was undertaken to evaluate hematobiochemical alterations in the theileriosis infected cattle in and around Tirupati district.

Keywords: Haematobiochemical alterations, Bovine tropical theileriosis, *Theileria annulata*, *Hyalomma anatolicum anatolicum*, cross bred population, Mortality, Economic impact

Introduction
Bovine tropical theileriosis is the tick borne haemoprotozoan disease caused by the *Theileria annulata*, which is transmitted by Ixodid ticks of the genus *Hyalomma anatolicum anatolicum* (Charya *et al.*, 2021) [4]. In India, bovine tropical theileriosis caused an estimated loss of US$384.3 million per year (Muniraja *et al.*, 2021) [10]. Indian cross breeding programmes focussed to reduce the gap between the demand and supply of milk to the growing population, but main hindrance was the ticks which transmits the haemoprotozoan diseases easily among the crossbred progeny (Kolte *et al.*, 2017) [7]. Early diagnosis of theileriosis was through the blood smear examination, haematological and serological examination and early treatment helps in controlling the mortality associated with Bovine tropical theileriosis. hence, the present study was undertaken as the Tirupati district has greater number of cross bred and exotic population.

Materials and Methods
A total of 524 blood samples were collected from the theileriosis suspected cattle and apparently healthy animals in and around Tirupati district for a period of one year (from December 2022 to November 2023). Thin blood smears were prepared and stained with Giemsa's stain. Examination was done under 100X oil immersion magnification in a compound microscope for the examination for *Theileria* piroplasms in red blood cells. Blood samples were collected in two vials, one in tri potassium ethylene diamine tetraacetate (k3EDTA) vial for haematological examination and other in a vial without anticoagulant for examination of serum. Haematological parameters like to Red Blood Cells (RBC), White Blood Cells (WBC), Haemoglobin (Hb), Lymphocytes, Monocytes, Eosinophils, Neutrophils, Basophils, Packed Cell Volume (PCV), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC) were examined by using Auto haematology analyser (Mindray Shenzhen Monday Biomedical electronics Co. Ltd., China). Biochemical parameters like SGOT, SGPT, Total Protein, Albumin, Globulin, Albumin: Globulin were analysed using Biochemical semi auto-analyser (Mindray).

Results

Red Blood Cells (10^6/µL)

Discussion

The haematological alterations in the theileriosis infected and healthy cattle were presented. Significant decrease in the levels of haemoglobin, red blood cells, packed cell volume observed in the theileriosis infected animals in the present study. This might be due to replication of piroplasms in the infected RBC causing erythrolysis and blood loss caused by blood sucking ticks. These observations were in accordance with the findings of Patel *et al.,* (2022) [13], Tripathi *et al.,* (2022) [19], Singh *et al.,* (2017) [17], Brahmbatt *et al*., (2022) [3], Prajapati *et al*., (2022) [13], Bhosale *et al.,* (2020) [2], Somu *et al*., (2017) [18]. In contrast to the current study, Vahora *et al.* (2009) [21] reported normal PCV values associated with a decline in Hb levels and RBC count.

There was significant increase in the TLC (Leucocytosis) in the present study, this might be due to proliferation of leucocytes in response to invaded protozoans in lymphoid organs causing leucocytosis and which is in accordance with the findings of Modi *et al.* (2015) [9], Friedhoff (1999) [6], Muraleedharan *et al.* (2005) [11], Aulakh and Singla (2006) [1] and Ugalmugle *et al.* (2010) [20]. In contrast to the above study Omer *et al.* (2002) [12] and Qayyum *et al.* (2010) [15], *et al.* Tripathi (2022) [19] had reported lower WBC counts in their research.

In the present study significant decrease in the lymphocytes were observed which was similar with the findings of Patel *et al.,* (2022) [13], Tripathi *et al.,* (2022) [19], Brahmbatt *et al*., (2022) [3], Prajapati *et al*., (2022) [13], Modi *et al.,* (2015) [9]. In contrast to the present study Aulakh and Singla (2006) [1], Ugalmugle *et al.* (2010) [20]. Omer *et al.,* (2002) [12] reported increased levels of the lymphocytes in theileria infected cattle blood. There was decreased levels of neutrophils, eosinophils observed in the present study agreed with the findings of Shimpi Kumari *et al*., (2022) [16], Omer *et al.* (2002) [12]. In contrast to these, increased levels of neutrophils, eosinophils were recorded by Prajapati *et al*., (2022) [13]. Ugalmugle *et al.* (2010) [20] stated that an acute illness or stress in theileriosis affected cattle triggers the release of endogenous corticosteroids which may lead to neutrophilia in cattle.

However, as compared to the control group of crossbred cattle, a substantial (p<0.01) increase was noticed in the mean corpuscular volume (MCV) and mean corpuscular haemoglobin (MCH) levels in the infected crossbred cattle in the present study. Infected crossbred cattle showed a substantial (p<0.01) drop in mean corpuscular haemoglobin concentration (MCHC) values as compared to the control group in the present study. These erythrocytic indices of my study are in consistent with the results of Misraulia *et al.* (1988) [8], Omer *et al*. (2002) [12], and Durani and Kamal (2008) [5].

Biochemical alterations in infected and apparently healthy cattle were presented. Biochemical changes of present study showed a significant increase in SGOT, SGPT levels and there was significant decrease in the total protein levels which was in accordance with the findings of Patel *et al.* (2022) [13], Brahmbatt *et al*. (2022) [3], Modi *et al.* (2015) [9]. An increase in the SGOT level observed in the present study indicates hepatic tissue injury caused with significant lymphocyte infiltration. Whereas increased SGPT levels observed in my study indicates hepatic necrosis caused due to leakage of blood cytoplasmic enzymes. Cattle naturally infected with *Theileria annulata* may have had low serum total protein concentrations because of hypoalbuminemia and hypoglobulinemia due to the liver failure. There was significant decrease in the albumin levels in the infected animals which was similar to that of Charaya *et al*. (2021) [4], Somu *et al*. (2017) [18]. This might be due to reduced albumin production due to reduced feed consumption and impaired liver function in infected cattle of the study area. In contrast to these nonsignificant decrease in albumin levels was noticed by Tripathi *et al.,* (2022) [19], Prajapati *et al*. (2022) [13]. There was decrease in the levels of globulin levels observed in the present study was in accordance with that of Brahmbatt *et al*. (2022) [3], Charaya *et al*. (2021) [4].

Conclusion

Crossbred cattle infected with *Theileria annulata* showed hematological changes that included neutrophilia, leukocytosis, lymphopenia, and macrocytic hypochromic anemia. *Theileria annulata*-infected crossbred cattle's biochemistry showed hypoproteinemia, with lower serum total protein levels and higher levels of SGOT and SGPT, suggesting that the disease is primarily affecting the liver. For a good prognosis of tropical theileriosis, hematological and serum biochemical changes should be considered to enable early diagnosis and to start the right treatment plan in time.

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