Hematobiochemical Changes in Crossbred Cattle Infected with *Theileria annulata* in Banaskantha District of Gujarat

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Abstract- Theileriosis in crossbred cattle is caused by *Theileria annulata* and is known as 'Bovine Tropical Theileriosis' in tropics. The chief vector responsible for transmission is *Hyalomma anatolicum anatolicum* and other ticks species belonging to the said genera. The disease is now reported more frequently and is of major economic importance due to losses associated with morbidity, mortality, decreased production as well as lowered working efficiency of affected animals. The present study was undertaken to evaluate hematological as well as biochemical alterations in crossbred cattle infected with *Theileria annulata* in Banaskantha district of Gujarat state, India.

Index Terms- Crossbred cattle, Theileriosis, *Hyalomma anatolicum anatolicum*, hematological and biochemical alterations, Gujarat

I. INTRODUCTION

Theileria annulata causes 'Bovine Tropical Theileriosis', a term used for disease occurring in tropical countries. *Hyalomma anatolicum anatolicum* is the chief vector tick responsible for disease transmission in tropical areas. The transmission of theilerial particles - from one stage to another stage takes place which is termed as transtadial transmission. One of the major impacts of the disease is significant reduction in milk production. Early diagnosis based on blood smear examination, hematology and serology as well as early treatment measures can prevent high mortality rates (Modi and Bhadesiya, 2014).

II. MATERIALS AND METHODS

A total of one hundred seventeen (N=117) crossbred cattle of Banaskantha district, Gujarat state (India) were tested for presence of *Theileria annulata* during October 2011 to March 2012. Diagnostic confirmation was performed by demonstration of cytoplasmic inclusions in Giemsa stained peripheral blood smear examination Twenty crossbred cattle (n=20) reported positive for *Theileria annulata* infection were considered as diseased group while a group of ten (n=10) clinically healthy and negative for *Theileria annulata* crossbred cattle served as control. Two blood samples were collected from the each animal, one in a tube containing tri-potassium ethylene diamine tetraacetate (K_3EDTA) for evaluation of hematological parameters and the other in a container without anticoagulant for evaluation of serum biochemical parameters. Hematological analysis of samples was performed on Medonic CA 620 (Merck) blood by autoanalyzer (Abacus Junior Vet.5) and serum biochemical parameters were analyzed by using standard assay Kits (Merck Specialties Pvt. Ltd.) with the help of clinical chemistry analyzer (Junior Selectra, Vital Scientific, Netherlands). Statistical analysis of data was performed by Students' "t" test described by Snedecor and Cochran (1994) to establish hematological and serum biochemical alterations.

III. RESULTS AND DISCUSSION

The mean value for hematological parameters of crossbred cattle is presented in Table-1. The mean values of red blood corpuscles (RBC), packed cell volume (PCV) and hemoglobin (Hb) decreased significantly (P<0.01) in infected crossbred cattle as compared to control group of crossbred cattle. This decline in levels of Hb, PCV and RBC count is attributed to lysis of erythrocytes by piroplasms which infects and replicate in it and erythrophagocytosis. In case of theileriosis, RBC infection is high and low RBC count is attributed to the removal of infected erythrocytes by spleen and liver and not due to the destruction of erythrocytes by the parasite. The alteration in hematological indices observed during the infection were consistent with the findings of Muraleedharan *et al*. (2005), Aulakh and Singla (2006), Ananda *et al*. (2009), Masare *et al*. (2009) and Qayyum *et al*. (2010). In contrast to present study, Vahora *et al*. (2009) recorded normal values of PCV in along with decrease in RBC count and Hb levels.

Table-1: Hematological and serum biochemical alteration in crossbred cattle suffering from *Thrileria annulata* infection (Mean±S.E.)

Parameter (units)	Infected group (n=20)	Control healthy (n=10)
Hematological parameters		
Hb (g/dl)	6.18**±0.14	10.03±0.31
RBC $\times10^{6}$/µl	4.70**±0.11	5.94±0.26
PCV (%)	21.99**±0.36	27.82±0.93
WBC $\times10^{3}$/ µl	9.88**±0.25	7.56±0.86
Lymphocytes %	42.79**±0.28	59.95±1.65
Neutrophils %	51.47**±0.81	31.86±1.35
PLT $\times10^{3}$/µl	181.20±12.41	181.70±23.34
MCV (fl)	53.24**±0.32	47.02±0.83
MCH(pg)	18.04**±0.13	16.07±0.18
MCHC (g/dl)	31.86**±0.22	35.04±0.16
Serum biochemical parameters		
TP (g/dl)	4.94**±0.12	6.90±0.17
Creatinine (mg/dl)	1.53±0.08	1.52±0.12
BUN (mg/dl)	10.17±0.31	10.87±0.56
SGOT (IU/L)	124.74**±0.56	96.01±2.63
SGPT (IU/L)	42.38**±0.34	32.30±1.62

Means in different columns differ significantly (**=P<0.01)

White blood cell (WBC) counts increased significantly (P<0.01) in infected crossbred cattle as compared to control group which was in correlation with findings of Friedhoff (1999), Muraleedharan *et al*. (2005), Aulakh and Singla (2006) and Ugalmugle *et al*. (2010). However, Sandhu *et al.* (1998) demonstrated immediate increase in WBC counts followed by significant decrease within several days of theilerial infection. Findings were against the reported decreased in WBC counts by Omer *et al*. (2002) and Qayyum *et al*. (2010). Leucocytosis results from proliferation of lymphocytes in the lymphoid organs as a defensive response to invading protozoans. Leucopenia is not characteristic of the disease. There is progressive leucocytosis which is entirely due to lymphocytes. However, significant (P<0.01) lymphopenia and neutrophilia were found in affected crossbred cattle. In the same way lymphopenia and neutrophilia were also observed in infected crossbred cattle by Aulakh and Singla (2006) and Ugalmugle *et al*. (2010). However Aulakh *et al*. (1998) observed lymphocytosis and neutropenia in infected crossbred cattle. Omer *et al*. (2002) found lymphocytopenia and neutropenia. Muraleedharan *et al*. (2005) found lymphocytosis and neutrophilia in *Theileria annulata* infected crossbred cattle.

The difference between mean values of platelet count in infected crossbred cattle and control group was statistically non-significant. However, significant (P<0.01) increase in the mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH) values was observed in the infected crossbred cattle compared to control group of crossbred cattle. Mean corpuscular hemoglobin concentration (MCHC) values decreased significantly (P<0.01) in infected crossbred cattle as compared to control group. These findings on erythrocytic indices revealed macrocytic hypochromic anaemia in affected crossbred cattle, which correlate with findings of Misraulia *et al*. (1988), Omer *et*

al. (2002) and Durani and Kamal (2008). Aulakh and Singla (2006) and Ugalmugle *et al*. (2010) found normocytic hypochromic anemia in affected crossbred cattle and Muraleedharan *et al*. (2005) observed macrocytic normochromic anemia. MCHC is a better measurement than MCH in anemias.

The mean values for serum biochemical parameters of infected crossbred cattle are presented in Table-1. The difference between mean values of serum creatinine and blood urea nitrogen (BUN) was statistically non-significant in theileriosis infected crossbred cattle as compared to normal control group. Similar findings were also observed by Ugalmugle *et al*. (2010); however Sandhu *et al*. (1998) and Singh *et al*. (2001a) reported significant increase in serum creatinine and BUN. Aulakh and Singla (2006) reported significant increase in BUN with decreased levels of serum creatinine.

Levels of liver specific enzymes SGOT and SGPT increased significantly (P<0.01) in infected crossbred cattle as compared to control group. Similar observations were reported by Sandhu *et al*. (1998), Saber *et al*. (2008) and Ugalmugle *et al*. (2010). Col and Uslu (2007) reported significant increase only in SGOT level as compared to healthy group. Increase in SGOT level affected animals indicate the hepatic tissue damage that included coagulation necrosis, distortion of hepatic cords with heavy infiltration of lymphocytes in the periportal areas indicating severe damage to hepatobiliary system due to hypoxia resulting from anemia and jaundice. While SGPT level also increased in affected animals hinting either heptic necrosis or an alteration in cell membrane permeability leading to leakage of these cytoplasmic enzymes in the blood.

The total serum protein levels decreased significantly (P<0.01) in infected crossbred cattle as compared to control group. Similar observations were recorded by Yadav and Sharma (1986), Sahu *et al*. (1996), Sandhu *et al*. (1998), Singh *et al*.

(2001b), Omer *et al*. (2003), Aulakh and Singla (2006), Col and Uslu (2007), Saber *et al*. (2008) and Ugalmugle *et al*. (2010). Omer *et al*. (2003b) stated that low serum total protein concentration in cattle naturally infected with *Theileria annulata* was possibly due to hypoalbuminemia and hypoglobulinemia arising from liver failure. The existence of certain degree of liver insufficiency in theileriosis affected cattle of this study was evident through apparently elevated serum SGPT and SGOT level.

IV. CONCLUSION

Hematological alterations in *Theileria annulata* infected crossbred cattle revealed macrocytic hypochromic anaemia, leukocytosis, lymphopenia as well as neutrophilia. Serum biochemistry of *Theileria annulata* infected crossbred cattle revealed hypoproteinemia with decreased levels of serum total proteins as well as increased SGOT and SGPT level suggestive of hepatic tissue involvement in the disease progression. Hematological and serum biochemical alterations should be considered in order to achieve early diagnosis and initiation of appropriate therapeutic regimen for a favorable outcome of the disease.

AUTHORS CONTRIBUTION

Dr. Chirag M. Bhadesiya (Ph. D. Scholar, Department of Veterinary Medicine) assisted in sample collection and analysis as well as preparation of manuscript. Dr. G. C. Mandali (Ph. D., Associate Professor, Department of Veterinary Medicine) provided technical guidance for research work.

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