

Alterations of Serum Biochemical Parameter in Cattle Naturally Infected with Tick-Borne Haemoparasitic Diseases in West Bengal, India

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How to cite this paper:

Debbarma, A., Pandit, S., Jas, R., Baidya, S., Batabyal, S., & Bachan, M. (2020). Alterations of Serum Biochemical Parameter in Cattle Naturally Infected with Tick-borne Haemoparasitic Diseases in West Bengal, India. *International Journal of Livestock Research*, 10 (9), 91-95. doi: <http://dx.doi.org/10.5455/ijlr.20200615095610>

Received : Jun 15, 2020
Accepted : Aug 23, 2020
Published : Sep 30, 2020

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Abstract

The present study was conducted to detect the alterations of serum biochemical profile of cattle infected with tick-borne haemoparasitic diseases i.e. theileriosis, Babesiosis and anaplasmosis etc. A total of 310 cattle from 7 different districts and 2 cattle farms of West Bengal were screened randomly for the presence of haemoparasites from July, 2015 to June, 2016. Serum samples from both infected and healthy cattle were collected for estimation of aspartate transaminase (AST), alanine transaminase (ALT), alkaline phosphatase, bilirubin, creatinine, blood urea nitrogen (BUN), glucose, calcium and phosphorus using spectrophotometer. Serum biochemistry of infected cattle revealed significantly increased levels of AST, ALT, alkaline phosphatase (ALP), bilirubin, creatinine and BUN. Serum glucose and mineral levels were found significantly decreased when compared with healthy group. Serum biochemical alterations should be considered in order to achieve prognosis and initiation of appropriate therapeutic regimen for a favourable outcome of the tick-borne haemoparasitic diseases.

Keywords: Biochemical, Cattle, Haemoparasitic, Serum, West Bengal

Introduction

Cattle husbandry an integral part of Indian livestock contributes food security, employment generation, supplying draught power, transportation and manure for fertilizer and environmental conservation in different ways and to different degrees within smallholder dairy, crop–livestock and livestock-dependent systems (ICAR, 2014). But profitable cattle husbandry is at risk due to tick and tick-borne haemoparasitic diseases (TBHD) as more than 80% of world cattle population is at risk of tick and TBHDs (Uilenberg, 1995). Among various diseases, tick and TBHDs are one of the major constraints to the cattle husbandry throughout the world including India because of its adverse effect on the productivity (Minjauw and McLeod, 2003). TBHDs namely theileriosis, babesiosis and anaplasmosis still remain as important diseases in cattle throughout the world (OIE, 2008a and b). These diseases cause considerable financial losses to farmers in the form of mortality, decrease milk, meat, hide production and lower animal draft power (Radostits *et al.*, 2000). In India, tropical theileriosis due to *Theileria annulata* alone is responsible for the loss of US\$ 800 million per year (Devendra, 1995). Much of the pathology in TBHDs is associated with alteration in biochemical parameters. Serum biochemical parameters provide information on involvement of specific organ function in the progression of disease which ultimately helps in appropriate therapeutic approach towards a favourable clinical outcome (Modi *et al.*, 2014). Though few reports are available in other parts of India in respect of biochemical changes due to haemoprotozoan diseases in cattle but there is no previous published report available in West Bengal. Thus, the present study was undertaken to evaluate serum biochemical alterations in cattle infected with TBHD in West Bengal, India.

Materials and Methods

Place and Period of the Study

A total of 310 cattle was randomly selected from seven districts of West Bengal *viz.* Paschim Midnapur, Purulia, Howrah, Hooghly, Kolkata, South 24 Parganas, Nadia, and two organized cattle farm *i.e.* Cattle farm under ILFC, F/O- VAS, WBUAFS, Mohanpur and Dairy Farm of Ramkrishna Mission, Narendrapur. This entire study was conducted in the laboratory of the Department of Veterinary Parasitology with existing facilities. The investigation was carried out for a continuous period of one year, *i.e.* from July, 2015 to June, 2016.

Tick and Blood Sampling

Tick and blood samples were collected from the above-mentioned areas. Ticks were identified according to keys and description given by Soulsby (1982) and Wall & Share (1996). While blood samples were examined for determination of TBHD from different districts and farms of West Bengal by making thin blood smear and staining with Giemsa's stain. The animals were divided in to two groups based on positive as infected group and negative as healthy group.

Collection and Processing of Serum Samples

About 10 ml of blood samples from both groups were carefully drawn by jugular vein puncture and poured into sterilized plastic vial each without using any anticoagulant. The samples were brought to the laboratory by maintaining proper cold chain and sera were separated and kept in -20°C until analyzed. Serum samples were analyzed for different biochemical profile *viz.* Serum alkaline phosphatase (ALP), Serum aspartate amino-transferase (AST), Serum alanine amino-transferase (ALT), total bilirubin, Blood urea nitrogen (BUN), creatinine, glucose (Glu.), calcium and phosphorus (P) and were determined by Biospectrometer (Eppendorf) by using standard diagnostic kits (Span Diagnostics Ltd).

Statistical Analysis

All the data were statistically analyzed (Analyze - Compare Means) for the mean value along with standard error (SE) by Duncan method (One way ANOVA) and the significance (P value) was recorded at 5% level ($p < 0.05$) and 1% level ($p < 0.01$). The complete statistical analysis was made by Statistical Package for Social Scientists (SPSS), Windows Version 20.0.

Results and Discussions

In the present study a total of 310 cattle blood smears samples were examined throughout the study period, altogether 108 samples were found to harbour different haemoparasites with overall prevalence rate of 34.84%, out of which *Theileria* sp. 22.9%, *Babesia* sp. 5.8% and *Anaplasma* sp. 11.93% and 5.8% mixed infection were present in the study population. (Data not shown). The results of serum biochemical profiles of healthy and infected cattle were summarized in Table 1. A significant increase in the activity of ALT (32.30 ± 3.697), AST (95.96 ± 4.263), ALP (33.93 ± 6.762), BUN (23.05 ± 1.07), creatinine (1.78 ± 0.213) and total bilirubin (0.44 ± 0.046) was observed in infected cattle in comparison to healthy cattle. On other hand, concentration of serum glucose (57.94 ± 2.111), serum Ca (7.04 ± 0.203) and serum P (4.86 ± 0.225) were found significantly decrease in infected group comparison to healthy group.

Table 1: Values of serum biochemical changes in tick-borne haemoparasites infected and uninfected groups of cattle of West Bengal (MEAN \pm SE)

Parameters/ Group	ALP (IU/L)	AST (IU/L)	ALT (IU/L)	Glucose (g/dl)	Total Bili. (mg/dl)	BUN (mg/dl)	Creatinine (mg/dl)	Ca (mg/dl)	P (mg/dl)	P-Value
Infected	33.93 ^{cx} \pm 6.762	95.96 ^{ax} \pm 4.263	32.30 ^{cy} \pm 3.697	57.94 ^{by} \pm 2.111	0.44 ^{ax} \pm 0.046	23.05 ^{dx} \pm 1.07	1.78 ^{ax} \pm 0.213	7.04 ^{ay} \pm 0.203	4.86 ^{ay} \pm 0.225	P<0.01
Non-infected	18.35 ^{dy} \pm 2.421	62.34 ^{ay} \pm 6.257	21.99 ^{cy} \pm 2.446	65.15 ^{ax} \pm 1.263	0.27 ^{iy} \pm 0.019	14.10 ^{dey} \pm 0.717	1.05 ^{iy} \pm 0.024	9.87 ^{efx} \pm 0.194	6.52 ^{ghx} \pm 0.184	P<0.01
P Value	P<0.05	P<0.01	P<0.05	P<0.01	P<0.01	P<0.01	P<0.01	P<0.01	P<0.01	N = 9

N.B. Values bearing different superscripts viz., x, y... in a column and a, b, c... in a row differ significantly at 1% ($P<0.01$) and 5% ($P<0.05$); N = Number of replicates; P = Significant value

In the present study, liver specific enzymes like AST, ALT and ALP were found significantly ($P<0.01$) increased in infected cattle as compared to uninfected group. Similar observations were also reported by Sandhu *et al.* (1998), Saber *et al.* (2008); Khan *et al.* (2011); Ganguly *et al.* (2015) and Modi *et al.* (2014) in theileriosis; Hussein *et al.* (2007); Zulfqar *et al.* (2012) in babesiosis. Increase of AST level in affected animals indicated hepatic tissue damage along with coagulative necrosis, distortion of hepatic cords and heavy infiltration of lymphocytes in the periportal areas due to hypoxia resulting from anemia and jaundice. While increased ALT level highlighting either hepatic necrosis or an alteration in cell membrane permeability leading to leakage of these cytoplasmic enzymes in the blood (Ashuma *et al.*, 2013). On other hand, elevation of ALP indicates organ necrosis as this enzyme is present in high concentration in muscle and liver (Choudhury *et al.*, 2015).

Serum bilirubin concentration was found increased in infected cattle compared to healthy cattle. The findings were in accordance with the findings of Col and Uslu (2007), Khan *et al.* (2011) and Ashuma *et al.* (2013) etc. The increased serum bilirubin concentration may be attributed to haemolysis of parasitized erythrocytes in reticulo-endothelial system and lymph nodes. Furthermore, it has been reported that the increase in serum bilirubin concentration may be due to haemolytic anaemia and hepatic dysfunction (Omer *et al.*, 2003). Mean values of serum creatinine and blood urea nitrogen (BUN) were found significantly increased in TBHD cattle as compared to uninfected group. Similar findings were also observed by Sandhu *et al.* (1998), Ganguly *et al.* (2015) and Modi *et al.* (2014). It may be due to because of renal damage associated to the increase in haemoglobin catabolism (Dede *et al.*, 2014). The serum glucose concentration in infected cattle was found decrease compared to healthy group in the present study. The findings were in line with the findings of Col and Uslu (2007) and Khan *et al.* (2011). They reported that the decreased serum glucose concentration could be due to hepatic dysfunction and utilization of glucose by *Theileria* sp present in the blood. Similarly, decreased serum calcium and phosphorus concentrations were found in the infected cattle which could be due to hypoproteinemia, decreased dietary intake, intestinal malfunction, kidney damage (Khan *et al.*, 2011), diarrhoea and renal wasting (Col and Uslu, 2007).

Conclusion

Based on the present observations, it can be concluded that TBHD is associated with severe alteration in serum biochemistry which results in heavy production loss. These alterations should be considered in order to understand pathogenesis, as a diagnostic tool, prognosis and evaluation of treatment.

Acknowledgement

The authors acknowledge their cordial thanks to the Dean, Faculty of Veterinary and Animal sciences, W.B.U.A.F.S. and the HOD, Veterinary Parasitology for their support to carry out the entire research work.

Conflict of Interests

There is no conflict of interest.

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