

Research Article



Haemato- Biochemical and Electrolyte Alterations in Naturally Occurring Theileria Associated Bovine Anaemia (Taba)

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Abstract | The aim of this study was to ascertain the changes in haematology and serum electrolytes in the cows naturally infected with theileriosis. A total of 102 cross bred cows of age 2-5 years were screened and examined in the study. Among those, twelve were found naturally infected by theileria. Another twelve of the same age and apparently healthy animals were kept as control. Haematological values of haemoglobin, packed cell volume, total erythrocyte count, mean corpuscular volume and mean corpuscular haemoglobin concentration were significantly ($p < 0.05$) lower in anaemic cattle compared to non-anaemic (healthy) cattle. Comparisons of electrolyte balance in this study showed significant decrease at the level of $p < 0.05$ in sodium and ionized calcium concentrations of anaemic animals when compared to the control group. However, differences in blood potassium and total calcium levels were not significant ($p > 0.05$). Comparisons of biochemical values indicated a significant increase ($p < 0.05$) in blood urea nitrogen (BUN) and creatinine level, while decrease ($p < 0.05$) in total protein and albumin concentration in anaemic animals as compared to control group. These results indicated an overall poor picture of circulating blood in animals suffering from theileria associated bovine anaemia.

Keywords | Anaemia, Alterations, Hematology, Electrolytes, Theileria

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INTRODUCTION

Theileriosis is tick-borne diseases of domestic ruminants which is caused by various species of *Theileria* including *Theileria annulata* and *Theileria parva*. It resulted in reduced milk production, reduced weight, blood loss, damages to hides and skins, stress and irritation and depression of immune function (Tehrani et al., 2013). Bovine anaemia occurs in three forms viz, haemorrhagic anaemia, haemolytic anaemia and anaemia due to reduced or defective erythropoiesis (Singh et al., 2014). In the field, tentative diagnosis of theileriosis is mainly based on clinical signs and tick infestation on the infected animals. However, confirmation of the diagnosis depends on microscop-

ic examination of Giemsa-stained thin blood smears. The demonstration of Koch's blue bodies in the lymphocytes and monocytes of the lymph node smear or peripheral blood film is pathognomonic of the disease. From 1980 to till now, Buparvaquone is the most specific drug used against theileriosis (Muller et al., 2015).

In their mammalian hosts, they have complex life cycle. Infection is initiated by transmutation of microschizont infected the cell in the lymph nodes draining the site of inoculation of sporozoites by ticks, the sporozoite transformation into schizont in the lymphocytes, the schizont undergoes further differentiation to merozoites, which are released upon lysis of the infected cells. This is followed

by the development of piroplasms in erythrocytes and the parasite becomes infective for the vector. It results alterations in the blood quality (Singh et al., 2014). So the present study was undertaken to obtain the clinical appraisal and haemato-biochemical alterations in cattle suffering from theileria associated bovine anaemia (TABA).

MATERIALS AND METHODS

A total of 102 cross bred cows of age 2-5 years were included in the study during the period of April 2015 to March 2016. Twelve animals of same age were kept as healthy controls. Cattle were screened for anaemia on the basis of packed cell volume (Al-Robayi, 1999). Clinical and parasitological observations were recorded from all the animals showing symptoms of acute clinical theileriosis. The conjunctiva and vaginal mucous membranes were examined. Animals showing a rectal temperature above 39°C were considered to be suffering from fever. Biopsies were taken from enlarged nodes (Al-Robayi, 1999). Thin blood smears were prepared from sick cattle, fixed with methanol, and stained with Giemsa dye. For estimating parasitaemia, the percentage of piroplasm-infected erythrocytes was calculated in 100 cells. The results were recorded in percentages (Ramazan and Ugur, 2007). Similarly, lymph node biopsy smears were stained with Giemsa stain and examined for schizonts according the procedure of Al-Robayi (1999).

Relevant clinical materials were collected at the time of admission. Five ml of whole blood was collected from jugular vein of the selected cattle in vials containing EDTA as anticoagulants (Benjamin, 1985). About 5 ml of blood was collected in another vial on the day of admission to separate serum for biochemical examination. Sera thus separated were stored at -20°C till further analysis. Total erythrocyte count (TEC), haemoglobin (Hb), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) and total white blood cell count were estimated as per the method described by Schalm et al. (1975).

Blood urea nitrogen (BUN), serum creatinine, serum total proteins and serum albumin were estimated using semi-automatic analyzer, as per the manufacturer's instructions and using standard kits. Whereas ionized calcium, sodium, chloride, total calcium and potassium were analyzed by using automatic electrolyte analyzer.

Data were analysed wherever indicated as per Snedecor and Cochran (1994). The significant levels were based on $p < 0.05$ unless otherwise stated.

RESULTS AND DISCUSSION

Radostits et al. (2010) stated that the anaemia in animals mainly occurs due to blood protozoa and endo- and ecto-parasites. The screening showed that 12 (11.76%) of 102 cattle were anaemic. Blood smear examinations revealed presence of theileria organism inside the red blood cells. It is one of the most important causes of anaemia among cattle in India. Clinical symptoms on TABA were fever, anorexia, enlargement of lymphnodes and lacrimation, occasionally episodes of diarrhoea. These symptoms are similar to those reported theileria in cows (Hosary et al., 2015; Ahmed, 2016). Haematological values of Hb, PCV, TEC, MCV and MCHC were significantly ($p < 0.05$) lower in theileria affected anaemic cattle when compared to non-anaemic healthy cattle (Table 1). Reduction of those above said values probably due to severe damage caused by organisms inside the erythrocyte during their multiplication (Ganguly et al., 2015). Blood indices showed microcytic, normochromic anaemia. Increased MCH value when compared to the normal animal showed animals were in haemolytic condition. Similar findings were obtained by Feldman et al. (2000). Toxic metabolites of theileria spp. which have harmful effect on bone marrow as they interfere with the process of erythropoiesis. Persistent loss of blood caused by permanent blood sucking ticks which play a role as well. This was in agreement with Durrani et al. (2008) who reported most of theileria affected animals had tick infestation. No statistically significant ($p > 0.05$) levels of leukocytes observed in the infected group. Furthermore relative increases in the number of lymphocytes observed in the present study reflect compensatory mechanism as target cells in response to invasion with Theileria spp. Yamaguchi et al. (2010) suggested that the lymphocytosis may be due to theilerial parasites which stimulate the host cells.

As shown in Table 2, the biochemical analysis in the present study showed statistically significant decrease ($p < 0.05$) in serum total protein and albumin concentration. The mean value of total plasma protein and albumin decreased significantly ($p < 0.05$) in anaemic cattle as compared to non-anaemic cattle. These results were in agreement with (Singh et al., 2001; Saber et al., 2008) who observed the hypoproteinaemia and hypoalbuminemia in theileria affected cattle which is possibly due to the harmful effect of toxic metabolites of theileria and due to liver failure.

The BUN and creatinine levels in the present study were increased statistically ($p < 0.05$) at significant level when compared to healthy cattle. This was in agreement with Sandhu et al. (1998) who suggested increased levels of BUN and creatinine in theileria associated cattle and suggested that these changes probably due to liver and renal damage.

On the other hand, comparisons of electrolyte balance in this study showed statistically significant decrease ($p < 0.05$) in sodium and ionized calcium concentrations of anaemic animals when compared to the control group. However, differences in potassium and total calcium levels were not significant ($p > 0.05$). In theileria infection of cattle, hypocalcaemia was probably due to the hypoproteinaemia, decreased dietary intake, intestinal malfunction, and kidney damage as suggested by Omer et al. (2008). Early detection and clinical management can help to resolve the condition of TABA. In our study, the alterations in blood picture were significantly improved by administration of buparvaquone (50mg/20kg bw IM).

Table 1: Comparison of haematological parameters of theileria infected cross bred cows with healthy cows

Parameters	Infected group (n=12)	Control group (n=12)
Hemoglobin (g/dl)	6.75±1.41*	10.65±2.06
Packed Cell Volume (%)	22.44±5.76*	32.74±1.12
Total Erythrocyte Count ($10^6/\mu\text{l}$)	4.46±1.13*	8.39±0.75
Mean Corpuscular Volume (fl)	51.56±13.34*	58.40±0.60
Mean Corpuscular Haemoglobin (pg)	60±3.66	13.17±2.17
Mean Corpuscular Haemoglobin Concentration (g/dl)	28.18±6.2*	31.24±1.56
White Blood Cell ($\times 10^3/\mu\text{l}$)	7.1±3.21	4-12

* Indicates significant level between groups ($p < 0.05$)

Table 2: Comparison of biochemical and electrolyte parameters of theileria infected cross bred cows with healthy cows

Parameters	Infected group (n=12)	Control group (n=12)
Sodium (Mmol/l)	121.32±10.81*	142.11± 2.7
Potassium (Mmol/l)	4.32±0.36	3.8-5.1
Chloride (Mmol/l)	103.38±15.26	96-109
Ionized Ca level (Mmol/l)	0.90±0.6*	1.02±0.08
Total calcium (Mmol/l)	2.5±1.5	2.8±0.8
Albumin (g/dl)	1.48±0.54*	3.61.56±1.14
Total protein (g/dl)	4.12±1.97*	6.38 ±0.68
Creatinine ($\mu\text{mol/dl}$)	1.34±0.08*	0.8±0.01
blood urea nitrogen (mmol/ml)	20.83±0.9*	18.4 ± 2.3

* Indicates significant level between groups ($p < 0.05$)

CONCLUSION

The current study revealed theileria associated bovine anaemia (TABA) in terms of changes in haematology, biochemistry and electrolyte values. The results indicated an overall poor picture of circulating blood in animals suffering from TABA. These changes are important as they may indicate the extent of tissue damage and help in better understanding the pathogenesis of the disease. The data obtained in this study might form an indicative basis for subsequent studies under natural and experimental field conditions, and it should be used as a useful tool for diagnosis, prognosis, and evaluation of the therapy applied.

CONFLICT OF INTEREST

Authors had no conflict of interest.

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AUTHORS CONTRIBUTION

Authors contributed equally and have read and approved the final manuscript.

REFERENCES

- Ahmed N.F. (2016). Hemato-Biochemical Alterations in Water Buffaloes Clinically Infected with Bovine Theileriosis Before and After Treatment by Buparvaquone. Bull. UASVM Vet. Med. 73(1):76-82
- Al-Robayi H. M. H. S. (1999). Epidemiology of Theileria annulata infection in with Al Ashaiki farm . Ph. D. Thesis., College of Veterinary Medicine, University of Baghdad. Pp:29-74.
- Benjamin M.M (1985). Outline of Veterinary Clinical Pathology. Third edition. Indian reprint. Kalyani Publishers, New Delhi. Pp.18-27.
- Buparvaquone is active against Neospora caninum in vitro and in experimentally infected mice. Int. J. Parasitol. Drugs Drug Resist. 5(1): 16-25.22.
- Durrani A. Z., Shakoori A. R., Kamal N. (2008). Bionomics of Hyalomma ticks in three districts of Punjab, Pakistan. J. Anim. Pi. Sci. 18:17-23
- Feldman B., Zinki J., Jain V (2000). Schalm's Veterinary Hematology. 5th ed, Lippincott Williams and Wilkins, Canada.
- Ganguly A., Bhanot V., Bisla R., Ganguly I., Singh H., Chaudhri S. (2015). Hematobiochemical alterations and direct blood polymerase chain reaction detection of Theileria annulata in naturally infected crossbred cows. Vet. World 8(1): 2428.

- <https://doi.org/10.14202/vetworld.2015.24-28>
- Generation of IFN- γ producing cells that recognize the major piroplasm surface protein in *Theileria orientalis* infected bovines. *Vet. Parasitol.* 171(3-4): 207-215. <https://doi.org/10.1016/j.vetpar.2010.03.038>
 - Hosary A., Sayed H., Ahmed L. (2015). Oxidative stress and hematological profile in *Theileria annulata* clinically infected cattle before and after treatment. *Assiut Vet. Med. J.* 6 (144): 123-129.
 - Müller J., Aguado-Martinez A., Manser V., Balmer V., Winzer P., Ritler D., Hostettler I., Arranz-Solis D., Ortega-Mora L., Hemphill A (2015).
 - Omer O. H., El-Malik K. H., Magzoub M., Mahmoud O. M., Haroun E. M., Hawas A., Omar H. M. (2003). Biochemical profile in Friesian cattle naturally infected with *Theileria annulata* in Saudi Arabia. *Vet. Res. Comm.* 27: 15-25. <https://doi.org/10.1023/A:1022054522725>
 - Radostitis O. M., Blood D. C., Gay C. C. (2010). *Text book of Veterinary Medicine*, 9th Ed. Baillier, Tindal & Cox. Pp: 1034-1051.
 - Ramazan C, Ugur U. (2007). Changes in selected serum components in cattle naturally infected with *Theileria annulata*. *Bull. Vet. Inst. Pulawy.* 51: 15-18.
 - Saber A. P. R., Khorrami M., Nouri M. (2008). Evaluation of Haematochemical Parameters in Crossbreed Cattle with *Theileria annulata* in Iran. *Inter. J. Dairy Sci.* 3: 205- 209. <https://doi.org/10.3923/ijds.2008.205.209>
 - Sandhu G., Grewal A., Singh A., Kondal J., Singh J., Brar, R. (1998). Hematological and biochemical studies on experimental *Theileria annulata* infection in cross-bred calves. *Vet. Res. Comm.* 27:15-25.
 - Schalm O. W., Jain N. C., Carrol E. J. (1975). *Veterinary hematology*. Leo and Febiger, ed. Philadelphia. 1st Ed. Pp: 140-152.
 - Singh A., Singh J., Grewal A. S., Brar, R. S. (2001). Study on some blood parameters of crossbred calves with experimental *Theileria annulata* infections. *Vet. Res. Comm.* 25: 289300. <https://doi.org/10.1023/A:1010678625336>
 - Singh J., Gupta S.K., Singh R, Hussain S.A. (2014). Etiology and haemato-biochemical alterations in cattle of Jammu suffering from anaemia. *Vet. World.* 7(2): 49-51. <https://doi.org/10.14202/vetworld.2014.49-51>
 - Snedecor G W, Cochran W G (1994). *Statistical Methods*. 8 th edn. Oxford, IBH
 - Tehrani A.A., Ehsan H, Ali Mohammad Bahrami (2013). Biochemical, Hematological studies in cattle naturally infected with *Theileria annulata*. *Bull. Env. Pharmacol. Life Sci.* 2(9): 07-10.
 - Yamaguchi T, Yamanaka M., Ikehara S., Kida K., Kuboki N., Mizuno D (2010).