RESEARCH ARTICLE

Haemato-biochemical Profile of Haemoprotozoan Infected Cows, Buffaloes, and Horses

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Abstract

The present study was conducted to evaluate haematological and biochemical alterations in haemoprotozoan infected animals (n = 60; cows 20, buffaloes 20 and horses 20) compared to healthy ones (n= 20, 20 & 20, respectively) in and around Junagadh region in Gujarat. There was a significant ($p<0.01$) decrease in Hb, PCV, TEC, MCHC, platelet count, and lymphocyte % with the increase in TLC and neutrophils in all three species of animals affected with haemoprotozoan diseases as compared to healthy counterparts. Similarly, blood glucose, total protein, albumin, and SOD decreased significantly ($p < 0.01$). At the same time, serum AST, BUN, and LPO increased significantly in infected than the healthy cows, buffaloes and horses, except for DLC and ALT in cows and buffaloes, where the values did not differ significantly between healthy and infected groups. The results, in general, revealed that the haemoprotozoan infection in cows, buffaloes, and horses causes anemia, negative energy balance, liver impairment, oxidative stress, and oxidative damage.

Keywords: Biochemistry, Haemoprotozoan, Haematology, Horses, Oxidative stress, Ruminants

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Introduction

Haemoprotozoan diseases, especially Babesiosis, Anaplasmosis, Theileriosis, and Trypanosomiasis, are considered some of the major impediments in animals' health and productive performance. Tick-borne diseases cause substantial losses to the livestock industry throughout the world (Ananda *et al.,* 2009) as they have got a severe economic impact due to obvious reasons of death, decreased productivity, lowered working efficiency (Uilenberg, 1995), and increased cost for control measures (Makala *et al.,* 2003). Haemoprotozoan diseases cause devastating losses to the livestock industry and thus pose major constraints to the dairy industry worldwide. Ticks as vectors are mostly responsible for the initiation of many haemoprotozoan diseases. A hot and humid climate is highly favourable for the development and survival of ticks (Kohli *et al.,* 2014). The agro-ecological and geo-climatic conditions of the area are highly favourable for the growth and multiplication of ticks which act as natural vectors of Theileriosis, Babesiosis, and Anaplasmosis. Prevalence of blood protozoa such as *Babesia bigemina*, *Theileria annulata*, *Theileria mutans* and blood rickettsia such as *Anaplasma marginale*, *Anaplasma centrale* has been reported in animals of India (Ananda *et al*., 2009; Vahora *et al.,* 2012). Haematological, pathological, and serum biochemical deviations are the characteristics of trypanosomosis in domestic animals and man, the severity of which is often determined by the strain of the infecting trypanosomes and host (Anosa, 1988). Haematological and biochemical parameters provide precious information about the severity of the infection and its diagnosis; therefore, changes in these parameters were determined in the present study.

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Materials and Methods

The study was carried out on clinical cases of cows, buffaloes, and horses presented at the Veterinary Clinical Complex of the College in Junagadh, Gujarat. Blood samples from twenty haemoprotozoan positive cows, buffaloes, and horses (n= 20, 20 & 20, respectively) were collected after screening around

400 animals through blood smears. Blood samples were also collected from 60 healthy control cows, buffaloes, and horses (n= 20, 20 & 20, respectively) for comparison of haemato-biochemical profile. Blood samples collected in K3 ethylenediaminetetraacetic acid were analyzed by an automatic hematology analyzer (Abacus Juniro Vet. 5, India) for hematological parameters, viz., hemoglobin (Hb), packed cell volume (PCV), total erythrocyte count (TEC), total leucocyte count (TLC), differential leucocyte count (DLC), and platelet count including MCV, MCH, and MCHC indices.

The blood samples collected without anticoagulant in serum activator tubes were centrifuged at 3000 g for 10 minutes and serum separated was stored at –20°C till analyzed. Serum was analyzed for glucose, total protein, albumin, alanine aminotransferase (ALT), aspartate aminotransferase (AST), and blood urea nitrogen (BUN) on an automatic biochemistry analyzer (Dia-chem 240 plus, Diatek, China) by using standard procedures and assay kits procured from Randox Laboratories India Pvt Limited, Bengaluru. Red blood cell (RBC) haemolysate was used for the analysis of oxidative stress parameters like superoxide dismutase (SOD) measured as per the method of Madesh and Balasubramanian (1998), while lipid peroxidation (LPO) was determined in terms of Malondialdehyde (MDA) production by the method of Rehman (1984). The data for all the hematological and biochemical parameters were analyzed by using the 't' test to compare the mean values of haemoprotozoan infected animals with those of apparently healthy animals.

Results and Discussion

The mean ± SE values of different hematological and biochemical parameters observed in cows, buffaloes, and horses affected with haemoprotozoan infection and their healthy contemporaries are shown in Table 1. There were significant ($p<0.01$) differences in almost all hematological parameters between the control and haemoprotozoan infected groups, except MCV, eosinophils, monocytes, and basophils count in all the three species of animals studied. Similarly, all the serum biochemical parameters, except serum ALT, showed highly significant ($p<0.01$) differences between the healthy group and haemoprotozoan infected group in all the three species, with few exceptions in horses or buffaloes (Table 1).

A significant ($p<0.01$) decrease in Hb, PCV, TEC, MCHC, platelet count, and lymphocyte % with the increase in TLC and

Table 1: Hematological and biochemical parameters (Mean ± SE) associated with haemoprotozoan infection in animals (n=20**)**

	Cows		*Buffaloes*		*Horses*	
Parameters	*Healthy (n=20)*	*Infected (n=20)*	*Healthy(n=20)*	*Infected (n=20)*	*Healthy (n=20)*	*Infected (n= 20)*
			Haematological parameters			
Haemoglobin (g/dL)	10.56 ± 0.21	6.31 ± 0.34**	10.71 ± 0.22	6.51 ± 0.41**	10.99 ± 0.15	7.76 ± 0.31**
PCV (%)	34.80 ± 0.93	21.78 ± 0.93**	33.69 ± 1.16	24.16 ± 1.52**	34.10 ± 1.07	27.76 ± 0.77**
TEC (*10^6/µL)	7.75 ± 0.16	5.17 ± 0.26**	7.52 ± 0.17	5.18 ± 0.30**	8.51 ± 0.23	6.00 ± 0.42**
MCV (fL)	40.52 ± 0.77	41.64 ± 0.97	39.96 ± 0.78	44.75 ± 3.76	42.27 ± 0.80	40.75 ± 2.53
MCH (pg)	13.79 ± 0.21	12.70 ± 0.38*	14.14 ± 0.25	14.06 ± 0.76	15.06 ± 0.20	14.80 ± 0.91
MCHC (g/dL)	33.52 ± 0.51	31.12 ± 0.47**	36.03 ± 2.24	30.11 ± 0.61**	36.03 ± 0.24	31.47 ± 0.92**
Platelet count (*10^5/µL)	2.26 ± 0.07	1.74 ± 0.19*	2.52 ± 0.10	1.64 ± 0.20**	2.10 ± 0.06	1.67 ± 0.24
TLC (/µL)	9080 ± 458.05	11949 ±113.73*	8572 ± 284.09	11530 ± 388.02**	8471 ± 326.16	10448 ± 603.22**
Neutrophils (%)	35.00 ± 0.69	39.10 ± 0.68**	36.70 ± 1.96	40.35 ± 0.89	58.20 ± 1.67	59.40 ± 1.68
Lymphocytes (%)	57.50 ± 0.83	53.45 ± 0.82**	56.90 ± 1.98	52.20 ± 0.92*	35.20 ± 1.63	36.70 ± 2.06
Monocytes (%)	3.75 ± 0.24	3.40 ± 0.34	3.50 ± 0.37	3.40 ± 0.34	4.15 ± 0.42	3.80 ± 0.39
Eosinophils (%)	3.24 ± 0.25	3.45 ± 0.21	2.40 ± 0.32	2.25 ± 0.25	1.95 ± 0.32	3.40 ± 0.26**
Basophils (%)	0.45 ± 0.13	0.50 ± 0.13	0.50 ± 0.13	0.55 ± 0.13	0.50 ± 0.10	0.40 ± 0.13
			Biochemical parameters			
Glucose (mg/dL)	62.14 ± 0.80	54.91 ± 1.21**	67.66 ± 0.80	59.46 ± 0.66**	104.00 ± 5.28	84.05 ± 3.55**
Total protein (g/dL)	6.11 ± 0.13	5.44 ± 0.13**	7.51 ± 0.28	6.32 ± 0.06**	6.47 ± 0.11	4.67 ± 0.13**
Albumin (g/dL)	3.66 ± 0.13	3.11 ± 0.09**	4.38 ± 0.12	3.85 ± 0.12**	3.50 ± 0.10	2.63 ± 0.11**
AST (U/L)	73.15 ± 3.77	104.80±5.36**	58.65 ± 2.76	89.60± 4.64**	132.30 ± 6.12	207.80±14.52**
ALT (U/L)	23.60 ± 2.72	29.50 ± 2.78	18.65 ± 1.66	22.60 ± 1.78	20.05 ± 1.55	31.90 ± 2.34**
BUN (mg/dL)	12.30 ± 1.14	17.40 ± 0.74**	10.85 ± 0.83	13.00 ± 0.81	14.05 ± 0.66	23.10 ± 1.63**
SOD (U/mL)	6.11 ± 0.24	4.95 ± 0.08**	5.29 ± 0.05	3.04 ± 0.10**	3.23 ± 0.12	1.70 ± 0.11**
LPO (nM of MDA/ml)	1.71 ± 0.11	2.63 ± 0.15**	3.43 ± 0.09	6.19 ± 0.28**	0.93 ± 0.05	1.56 ± 0.10**

* Significant at $p < 0.05$, ** Significant at $p<0.01$ between groups.

neutrophils was recorded in all the three species of animals affected with haemoprotozoan diseases as compared to healthy counterparts. Similarly, blood glucose, total protein, albumin, and SOD decreased significantly ($p < 0.01$), while serum AST, BUN, and LPO increased significantly in infected than the healthy cows, buffaloes, and horses. However, in cows and buffaloes, DLC (monocytes, eosinophils, basophils) and ALT values did not differ significantly between healthy and infected groups (Table 1).

The findings of the present study agreed with the marked anemic condition, liver dysfunctions, and rise in immunoglobulin level with *Anaplasma marginale* infections in dairy cattle (Sharma *et al*., 2013), with Babesia infection in cattle calves (Salem *et al*., 2016) and with theileriosis and *B. bigemina* in crossbred cows (Abdel-Hamied *et al*., 2020[a]; 2020[b]). Other species like horses and donkeys affected with *Theileria equi* (Bhojani *et al*., 2021; Zaeemi *et al*., 2016); equine piroplasmosis (Singla and Sumbria, 2019), and buffaloes affected with trypanosomosis (Gangwar *et al*., 2019), and babesiosis (Ramadevi *et al*., 2017) had shown a marked decrease in oxidant parameters. The antioxidant mechanism of erythrocytes that prevent them against oxidative damage may be disturbed by haemoprotozoan infection in these animals. The resulting imbalance between oxidants and antioxidants may play a central role in pathological conditions associated with haemoprotozoan infections.

Conclusion

From the study, it could be concluded that the haemoprotozoan infection in cows, buffaloes, and horses causes anemia and negative energy balance with liver impairment and oxidative stress as indicated by significant ($p < 0.01$) changes in the haemato-biochemical profile and oxidative markers.

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