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Haematological and Plasma Biochemical Parameters in Response to Natural Coccidian Infection in Barbari and Jamunapari Goat Breeds in Semi-arid Tropics

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ABSTRACT

Background: Small ruminants like goats are considered the most resourceful and efficient animal all over the world. *Eimeria* species causes disease in goats associated with poor growth, diarrhoea and decrease in production, high morbidity and mortalities. The present study was conducted to analyse the haematological and biochemical parameters in response to natural coccidian infection in Barbari and Jamunapari goat breeds in semi-arid tropics.

Methods: A total of 474 goats were examined; 96 goats were selected (48 Barbari and 48 Jamunapari) and divided on the basis of high (12 males and 12 females) and low (12 males and 12 females) oocyst per gram (OPG) counts of both Barbari and Jamunapari goats. The blood was aseptically collected from the jugular vein, using a 22-gauge needle for each animal separately in 5 ml blood for the haematological and biochemical estimations.

Result: In haematological parameters of Barbari goats there were no significant (P>0.05) differences in males and females. Although significantly higher values of RBC were observed in low OPG females, similar results were also observed in Hct, Mcv, Hb, MCH and MCHC. Whereas, in WBC, Lymphocyte, Monocyte and Granulocyte statistically had no significant (P>0.05) differences among all the groups. In haematological parameters of Jamunapari goats no significant (P>0.05) differences was seen in males and females of both the groups. The same group of Barbari goats were also selected for biochemical parameters and high OPG females had significantly (P<0.05) higher blood glucose values. The blood potassium concentration was found to be significantly (P<0.05) higher in low OPG males compared to high OPG males. The same group of Jamunapari goats were selected for biochemical parameters and ALT, total protein and globulin had significantly (P<0.05) higher values in high OPG females than others. A/G ratio had significantly (P<0.05) higher value observed in high OPG males.

Key words: Biochemical, Coccidia, Goat, Haematological, OPG, Semi-arid tropics.

INTRODUCTION

The goat is considered one of the most resourceful and efficient ruminants in the world (Mussman, 1982). Modest feeding requirements, easy handling, adaptability and independence to living free, better tolerance to climatic conditions and effective conversion of limited resources into production such as milk, meat and hides are desired factors for counting the goat as a stock animal for small rearing farmers, Balicka-Ramisz (1999); Harper and Penzhorn (1999); Singh *et al*. (2014).

The genus *Eimeria* is classified in the family Eimeriidae under the phylum Apicomplexa (Bush *et al*., 2001). Many *Eimeria* species have been capable of establishing clinical disease in goats associated with poor growth performance, diarrhoea, decrease in production, high morbidity and depending on which species is dominant, high mortality rates as well by Radostits *et al*. (1994); Singla *et al*. (2018). Stressors such as dietary changes, weaning, adverse weather, travelling and regrouping play important roles in caprine coccidiosis (Cox, 1998). *Eimeria ninakohlyakimovae* is the most pathogenic species in goats by Chartier and Paraud (2012). There is scanty literature available about the hematological and biochemical changes in caprine

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coccidiosis. Therefore, the present study was designed to observe the hematological and biochemical changes in response to natural coccidian infection in Barbari and Jamunapari goat breeds in the semi-arid tropics.

MATERIALS AND METHODS

The Study was carried out at the ICAR-Central Institute for Research on Goats (CIRG) and College of Veterinary Science and Animal Husbandry, DUVASU, Mathura, Uttar Pradesh, India, during 2014-15.

Collection of blood samples

The blood was aseptically collected from the jugular vein, using a 22-gauge fine needle for each animal separately, in 5 ml blood collection vials containing sodium ethylene diamine tetraacetic acid (EDTA) as an anticoagulant @ 1 mg/ml.

Recognition of high and low opg count

The OPG 0 and 100 were considered as low and OPG> 100 were considered as high for infection.

Haematological study

The blood collected from the animal was subjected to various parameters such as WBC (/mm^3), RBC (M/mm^3), Hct (%), Mcv (fl), Hb (g/dl), MCH (pg), MCHC (g/dl), Lymphocyte (%), Monocyte (%) and Granulocyte (%) were assessed with the help of model number Ms4Se, Haematology auto analyzer (MeletSchloesing Laboratories, France).

Biochemical study

The blood and plasma required for biochemical estimations were collected in a 2 ml capacity eppendorf tubes with anticoagulant and mixed properly. The necessary precaution was taken to prevent haemolysis. The samples were centrifuged at 6,000 rpm, 15°C for 10 minutes and supernatant (plasma) was collected and stored in a deep freeze at -20°C in eppendorf tubes, which were properly capped and labeled until analysis. Various biochemical parameters like plasma total proteins (g/dl), albumin (g/dl), creatinine (mg/dl), BUN (mg/dl), Phosphorus (mg/dl), Sodium (mEq/L), Potassium (mEq/L), Chloride (mEq/L), Albumin (g/dl), Globulin (g/dl) and the enzymatic activities like alanine amino transferase (units/L), aspartate amino transferase (units/L), alkaline phosphatase (units/L) were done with the help of model number BS-120, Biochemistry auto analyzer (2007- 2010 Shenzhen Mindray Biochemical Electronics Co. Ltd., China) using Span diagnostic kits (Span Diagnostics Ltd., Sachin, Surat, India). Blood glucose (mg/dl) was estimated with the help of a Glucometer using blood glucose test strips (GlucoChek, Aspen Diagnostics Pvt. Ltd., Delhi-33, India).

Analysis of data

Data were analyzed by using SPSS (version 17.0, SPSS Inc., Chicago). The one way analysis of variance (ANOVA) and t-test were used for comparison of different parameters. $P<0.05$ was accepted as statistically significant.

RESULTS AND DISCUSSION

Forty eight (48) Barbari goats were selected for haematological values (Table 1) on the basis of high (12 males and 12 females) and low (12 males and 12 females) OPG counts. No significant ($P>0.05$) differences were observed between males and females. Significantly higher values of RBC were observed in low OPG females. Similar results were also observed in Hct, Mcv, Hb, MCH and MCHC. Whereas, in WBC, Lymphocyte, Monocyte and Granulocyte statistically had no significant ($P>0.05$) differences among all the groups.

Forty eight (48) Jamunapari goats were selected for haematological parameters (Table 2) on the basis of high (12 males and 12 females) and low (12 males and 12 females) OPG counts. No significant ($P>0.05$) differences were observed in males and females of both the groups.

The same 48 Barbari goats were also selected for biochemical values (Table 3) on the basis of high (12 males and 12 females) and low (12 males and 12 females) OPG counts. The high OPG females had significantly ($P<0.05$) higher blood glucose values. The blood potassium concentration was found to be significantly ($P<0.05$) higher in low OPG males compared to high OPG males. No significant differences in other parameters were observed.

The same 48 Jamunapari goats were also selected for biochemical parameters (Table 4) on the basis of high (12 males and 12 females) and low (12 males and 12 females) OPG counts. ALT, total protein and globulin had significantly ($P<0.05$) higher values in high OPG females than others. A/G ratio had significantly ($P<0.05$) higher value observed in high OPG males. No significant differences were observed in other parameters.

The goat coccidiosis results from complex interactions between coccidia and host, with several factors influencing the severity of the disease Jubb *et al*. (2007). Age, genetic susceptibility, physical condition, stress and the degree of immunity are important factors in pathogenesis. In coccidiosis, the damage to tissue is dependent on the different *Eimeria* species as well infective dose of oocysts ingested as described by Dougschies and Najdrowski (2005); Jolley and Bardsley (2006); Jubb *et al*. (2007). The present study did not include the identification of different *Eimeria* species in goats.

The results showed a rise in haematological parameters such as RBC, Hb, Hct, Mcv, MCH and MCHC, while alteration in serum biochemical parameters such as ALT, total protein, globulin, A/G ratio, glucose and potassium occurred in both Jamunapari and Barbari goats.

RBC, Hct and Hb levels were found to be higher in the current study. Hashemnia *et al*. (2014) conducted an experimental study on caprine coccidiosis and observed an increased mean value of Hct and Hb but were unable to find alterations in RBC count. Tambuwal *et al*. (2002)

Table 1: Haematological values in response to natural coccidial infection in Barbari goats.

Parameters	Low OPG		High OPG		Overall
(Unit)	Male (n=12)	Female (n=12)	Male (n=12)	Female (n=12)	(n=48)
WBC (/mm^3)	16.93±1.83	16.64±1.11	16.94±1.92	18.39±1.99	17.22±0.85
	(7.75-28.94)	(9.34-34.21)	(11.92-22.91)	(13.05-37.40)	(7.75-37.40)
RBC (M/mm^3)	12.52^{c}±0.41	15.05^{a}±0.43	12.84^{abc}±0.54	14.07^{ab}±0.63	13.62±0.28
	(8.59-14.00)	(8.88-16.48)	(11.83-17.49)	(9.45-16.24)	(8.59-17.49)
Hct (%)	18.00^{b}±0.63	21.70^{a}±0.79	17.53^{b}±0.65	20.72^{a} ±0.57	19.49±0.41
	(13.00-21.30)	(13.70-21.70)	(15.80-25.70)	(17.00-24.00)	(13.00-25.70)
Mcv (fl)	14.46^{ab}±0.36	14.42^{ab}±0.20	13.74^{b} ±0.24	15.00^{a} ±0.57	14.41±0.19
	(13.10-17.20)	(12.60-15.50)	(13.40-20.50)	(13.40-20.50)	(12.60-20.50)
Hb (g/dl)	6.42^{b}±0.23	7.6^{a}±0.28	6.4^{b}±0.30	7.1^{ab}±0.25	6.90±0.15
	(4.30-7.20)	(4.40-8.60)	(5.40-8.40)	(5.40-8.40)	(4.30-9.40)
MCH (pg)	5.05±0.07	5.00±0.07	4.95±0.06	5.06±0.10	5.02±0.03
	(4.80-5.60)	(4.60-5.30)	(4.50-5.50)	(4.70-6.00)	(4.50-6.00)
MCHC (g/dl)	35.62^{ab}±0.61	35.02^{ab}±0.33	36.56^{a}±0.59	34.37^{b}±0.72	35.39±0.30
	(32.80-38.50)	(32.10-39.60)	(32.50-36.70)	(29.50-37.70)	(29.50-39.60)
Lymphocyte (%)	10.08±2.67	14.59±3.32	8.79±2.14	14.74±3.32	12.05±1.45
	(2.40-29.60)	(2.60-24.60)	(4.70-44.20)	(3.90-35.70)	(2.40-44.20)
Monocyte (%)	1.87±0.29	2.02±0.51	1.87±0.24	2.00±0.31	1.94±0.12
	(1.00-4.30)	(0.70-3.50)	(1.30-2.90)	(1.10-4.30)	(0.70-4.30)
Granulocyte (%)	87.80±2.95	83.38±3.29	89.33±2.30	83.25±3.35	85.94±1.50
	(66.40-96.50)	(73.40-96.70)	(54.00-93.50)	(61.20-94.90)	(54.00-96.70)

Parentheses showed the range of observation.

The value (Mean±S.E.) having different superscript is significantly different P<0.05.

Abbreviation; WBC= White blood cell, RBC= Red blood cell, Hct= Haematocrit, Mcv= Mean corpuscular volume, Hb= Haemoglobin, MCH= Mean corpuscular haemoglobin, MCHC= Mean corpuscular haemoglobin concentration.

Table 2: Haematological values in response to natural coccidial infections in Jamunapari goats.

Parameters	Low OPG		High OPG		Overall
(Unit)	Male (n=12)	Female (n=12)	Male (n=12)	Female (n=12)	(n=48)
WBC (/mm^3)	22.81±1.91	20.35±1.91	22.54±2.85	21.37±1.87	21.77±1.06
	(13.16-35.22)	(11.47-39.13)	(14.47-34.44)	(12.00-35.17)	(11.47-39.13)
RBC (M/mm^3)	15.46±0.51	15.45±0.35	15.47±0.51	14.67±0.30	15.26±0.21
	(12.71-18.80)	(12.21-17.71)	(13.56-17.40)	(12.95-16.60)	(12.21-18.80)
Hct (%)	20.00±0.63	20.08±0.56	19.85±0.80	19.15±0.74	19.77±0.33
	(17.20-23.50)	(14.10-23.00)	(18.30-23.60)	(15.70-25.60)	(14.10-25.60)
Mcv (fl)	13.00±0.18	12.87±0.14	12.69±0.20	13.04±0.27	12.90±0.10
	(12.10-14.10)	(11.60-13.90)	(12.20-13.90)	(11.90-15.40)	(11.60-15.40)
Hb (g/dl)	8.31^{a}±0.32	8.00^{ab}±0.22	8.39^{a}±0.27	7.41^{b}±0.16	8.03±0.13
	(7.00-10.30)	(6.60-9.50)	(7.20-9.40)	(6.30-8.30)	(6.30-10.30)
MCH (pg)	5.32^{a}±0.05	5.06^{b}±0.08	5.33^{a}±0.06	5.00^{b}±0.05	5.18±0.03
	(5.00-5.60)	(4.90-5.80)	(4.60-5.70)	(4.80-5.40)	(4.60-5.80)
MCHC (g/dl)	41.01±0.49	39.90±0.70	40.38±2.50	39.01±0.83	40.07±0.68
	(37.50-43.80)	(14.50-48.70)	(34.90-43.90)	(32.00-41.60)	(14.50-48.70)
Lymphocyte (%)	21.21±3.34	15.39±2.73	14.10±3.47	20.29±3.79	17.75±1.68
	(4.80-36.30)	(3.00-39.10)	(4.30-33.50)	(5.50-39.70)	(3.00-39.70)
Monocyte (%)	2.74^{ab}±0.23	3.17^{a}±0.33	2.23^{b}±0.20	2.55^{ab}±0.24	2.67±0.13
	(1.60-4.20)	(1.40-3.50)	(1.60-5.20)	(0.80-3.70)	(0.80-5.20)
Granulocyte (%)	76.26±3.45	81.43±2.89	83.66±3.52	77.15±3.98	79.62±1.74
	(60.40-92.90)	(58.10-95.10)	(61.30-93.20)	(56.60-92.50)	(56.60-95.10)

Parentheses showed the range of observation.

The value (Mean±S.E.) having different superscript is significantly different P<0.05.

observed a significant effect on RBC in goats and suggested that the oxygen-carrying capacity of the blood was high in goats. Shumard (1957) observed changes in both Hct and Hb value; levels remained above those indicative of anaemia. Dai *et al.* (2006) reported that mean Hct and Hb significantly increased in ovine coccidiosis and the results were indicative of a decrease in circulation. Hayat *et al.* (1990) stated that coccidiosis could cause haemo concentration, indicated by an increase in Hct value. According to Tambuwal *et al.* (2002), the blood seemed to possess relatively high Hb values and this is an advantage in terms of the oxygen carrying capacity of the blood. Oni *et al.* (2012) also reported the same and suggested that the dietary treatments generally seemed to be capable of supporting high oxygen carrying capacity of blood in the goats. The higher values of MCV, MCH and MCHC, which help to determine and classify anaemia. As per the description by Jain, (1986). The mean Mcv, Mch and Mchc were also found significantly higher. Goats with microcytic hypochromic anaemia (low levels of Mcv, Mch and Mchc) might be Fe and Cu deficiency in serum and the present studies are in accordance with the observations of Anumol *et al.* (2012).

The increased ALT might be due to damage to the intestinal mucosa in concurrent infections, in accordance with Ghanem and Abd El-Raof (2005). The alteration in total protein level suggested that liver might be adversely affected with coccidiosis by Ghanem and Abd El-Raof (2005); Singh *et al*. (2016). The observed higher value of globulin is due to the humoral response to coccidian infection. The relationships between coccidia and goats are complex because previous exposure and age have effects on total protein due to albumin and globulin effects by Fitzgerald (1964). Changes in albumin-globulin (A/G)

Table 3: Biochemical values in response to natural coccidial infection in Barbari goats.

Parameters	Low OPG		High OPG		Overall
(Unit)	Male (n=12)	Female (n=12)	Male (n=12)	Female (n=12)	(n=48)
Glucose (mg/dl)	47.43^{b} ±3.59	53.75^{b}±9.92	52.17^{b}±2.41	65.02^{a}±4.47	54.59±1.90
	(30.60-65.40)	(33.10-62.60)	(46.30-81.10)	(50.50-96.80)	(30.60-96.80)
Creatinine mg/dl)	1.28±.08	1.29±0.11	1.20±0.13	1.30±0.08	1.27±0.05
	(0.80-1.60)	(06.0-1.80)	(04.0-1.80)	(0.70-1.80)	(0.40-1.80)
AST (IU/L)	53.17±0.64	55.03±2.60	51.50±1.06	56.79±2.44	54.12±0.96
	(48.80-56.30)	(43.20-56.00)	(43.60-73.10)	(43.50-66.40)	(43.20-73.10)
ALT (IU/L)	8.18±0.45	8.26±0.36	8.75±0.48	7.75±0.28	8.23±0.20
	(5.80-11.10)	(5.00-12.10)	(6.30-11.10)	(6.40-9.30)	(5.00-12.10)
ALP (IU/L)	9.58±0.80	8.00±0.31	8.09±0.44	9.10±0.55	8.69±0.28
	(6.80-15.30)	(6.10-11.40)	(6.30-10.30)	(6.90-13.20)	(6.10-15.30)
Total protein (g/dl)	5.84±0.25	5.87±0.93	6.01±0.34	5.77±0.28	5.87±0.14
	(4.60-6.90)	(4.20-8.30)	(4.20-7.30)	(4.30-7.80)	(4.20-8.30)
Albumin (g/dl)	2.70^{ab}±.08	3.03^{a}±0.08	2.48^{b}±0.16	2.90^{a} ±0.17	2.78±0.07
	(2.10-3.20)	(1.10-3.00)	(2.40-3.40)	(1.80-4.20)	(1.10-4.20)
Globulin (g/dl)	3.14±0.24	2.92±0.34	3.51±0.32	2.86±0.27	3.11±0.14
	(1.70-4.20)	(1.50-5.30)	(0.80-4.80)	(1.40-4.70)	(0.80-5.30)
A/G ratio (g/dl)	0.93^{ab}±0.10	0.80^{b}±0.11	1.36^{a}±0.29	1.14^{ab}±0.13	1.06±0.09
	(0.62-1.71)	(0.28-1.80)	(0.55-4.25)	(0.38-2.07)	(0.28-4.25)
Calcium (mg/dl)	7.28^{a}±0.07	6.72^{b}±0.15	7.36^{a}±0.06	6.86^{b}±0.08	3.11±0.14
	(6.87-7.85)	(7.08-7.73)	(5.15-7.17)	(6.27-7.30)	(0.80-5.30)
Phosphorus (mg/dl)	4.80±1.03	4.10±0.26	4.91±1.02	4.23±0.11	4.51±0.36
	(1.75-15.94)	(3.23-16.09)	(1.81-5.72)	(3.61-5.02)	(1.75-16.09)
Urea (mg/dl)	31.21±4.81	25.98±1.13	30.81±3.46	29.53±1.56	29.53±1.56
	(16.86-79.91)	(20.53-66.13)	(18.91-40.91)	(19.06-30.79)	(16.86-79.91)
Sodium (mEq/L)	144.26±6.54	142.87±4.72	148.71±6.88	143.18±4.81	144.76±2.84
	(88.52-170.29)	(114.96-178.28)	(125.41-172.75)	(111.27-170.29)	(88.52-178.28)
Potassium (mEq/L)	6.50^{a}±0.21	6.12^{ab}±0.22	5.55^{b}±0.28	5.76^{ab}±0.35	5.98±0.14
	(5.00-7.45)	(3.68-7.48)	(5.06-7.61)	(3.96-7.74)	(3.68-7.74)
Chloride (mEq/L)	87.94^{b}±7.20	98.38^{ab}±3.40	97.87^{ab}±4.71	105.90^{a} ±1.91	97.52±2.46
	(39.93-148.20)	(79.50-137.05)	(81.65-114.03)	(89.57-113.31)	(39.93-148.20)

Parentheses showed the range of observation. The value (Mean±S.E.) having different superscript is significantly different P<0.05. Abbreviation showed; AST= Aspartate aminotransferase; ALT= Alanine aminotransferase; ALP= Alkaline phosphatasee; A/G ratio= Albumin/Globulin ratio.

Table 4: Biochemical values in response to natural coccidial infection in Jamunapari goats.

Parameters	Low OPG		High OPG		Overall
(Unit)	Male (n=12)	Female (n=12)	Male (n=12)	Female (n=12)	(n=48)
Glucose (mg/dl)	61.11^{b}±3.54	75.01^{a}±3.41	63.91^{b}±3.67	70.49^{ab}±3.23	67.63±1.85
	(43.20-88.40)	(50.20-96.80)	(55.40-93.60)	(56.00-84.80)	(43.20-88.40)
Creatinine mg/dl)	1.27±0.10	1.27±0.17	1.26±0.15	1.15±0.17	1.24±0.07
	(0.60-1.80)	(0.20-2.10)	(0.60-2.60)	(03.0-2.30)	(0.20-2.60)
AST (IU/L)	51.93±1.75	55.17±2.25	54.54±2.33	53.15±1.59	53.70±0.99
	(42.80-63.70)	(40.70-64.80)	(43.80-63.50)	(46.10-63.80)	(40.70-64.80)
ALT (IU/L)	7.80^{bc}±0.24	7.19^{c}±0.22	8.15^{b}±0.26	9.38^{a} ±0.42	8.13±0.18
	(6.30-9.60)	(6.50-9.30)	(6.20-8.40)	(7.60-12.60)	(6.20-12.60)
ALP (IU/L)	8.54±0.63	8.83±0.85	9.68±0.76	8.29±0.33	8.83±0.33
	(6.40-14.60)	(96.70-15.30)	(6.30-16.50)	(6.20-16.50)	(6.20-16.50)
Total protein (g/dl)	5.80^{b}±0.20	6.08^{ab}±0.14	5.84^{b}±0.27	6.50^{a} ±0.16	6.05±0.10
	(4.80-7.10)	(4.60-7.58)	(5.30-7.10)	(5.40-7.40)	(4.60-7.50)
Albumin (g/dl)	3.25±0.12	3.39±0.12	3.25±0.05	3.10±0.05	3.25±0.04
	(2.60-4.40)	(3.00-3.60)	(2.80-4.40)	(2.60-3.40)	(2.60-4.40)
Globulin (g/dl)	2.54^{b}±0.23	2.69^{b}±0.23	2.50^{b}±0.24	3.40^{a}±0.18	2.78±0.12
	(1.60-4.20)	(1.40-4.20)	(1.20-4.00)	(2.20-4.30)	(1.20-4.30)
A/G ratio (g/dl)	1.42^{a} ±0.15	1.45^{a} ±0.14	1.46^{a}±0.24	0.95^{b}±0.07	1.32±0.08
	(0.69-2.44)	(0.78-3.67)	(0.71-2.29)	(0.63-1.45)	(0.63-3.67)
Calcium (mg/dl)	6.79±0.18	7.42±0.33	7.15±0.19	7.36±0.27	7.18±0.12
	(5.92-7.98)	(5.75-7.90)	(4.46-8.15)	(5.45-8.20)	(4.46-8.20)
Phosphorus (mg/dl)	2.88±0.20	3.30±0.17	3.09±0.21	3.41±0.26	3.17±0.10
	(1.89-4.23)	(2.25-4.48)	(2.44-4.31)	(2.22-5.56)	(1.89-5.56)
Urea (mg/dl)	32.02±2.34	32.31±2.68	33.46±2.00	32.16±2.12	32.49±1.11
	(17.01-42.67)	(25.37-49.12)	(23.02-48.97)	(21.70-44.57)	(17.01-49.12)
Sodium (mEq/L)	146.36^{a}±4.71	136.68^{ab} ±4.09	141.90^{a}±5.29	122.18^{b}±6.44	136.78±2.84
	(121.72-172.75)	(108.81-167.83)	(105.12-156.76)	(72.54-151.84)	(72.54-172.75)
Potassium (mEq/L)	4.79±0.41	4.70±0.30	5.17±0.46	5.20±0.39	4.96±0.19
	(2.80-7.48)	(2.67-8.58)	(3.43-6.64)	(3.52-7.58)	(2.67-8.58)
Chloride (mEq/L)	91.48±1.92	101.31±3.01	92.83±2.01	101.97±1.86	96.90±1.86
	(81.29-103.24)	(82.37-108.63)	(92.45-126.26)	(87.05-160.07)	(81.29-160.07)

Parentheses showed the range of observation.

The value (Mean±S.E.) having different superscript is significantly different P<0.05.

ratio followed an inverted non-monotonic response curve over time and this variation was largely due to changes in globulin and similar to those reported earlier by El Manyawe *et al.* (2010); Gwaze *et al.* (2010). The level of glucose was observed to be high, but we were unable to find the alteration in value. But on the contrary, Ghanem and Abd El-Raof (2005), reported a decrease in parameters that might be attributed to the suppression of appetite associated with coccidiosis. The higher value of Potassium observed might be due to changes in electrolytes (*i.e.* Na and K ions) which are usually related to diarrhoea with loss of Na^{+}, in good agreement with Ghanem and Abd El-Raof (2005).

CONCLUSION

The obtained results showed a rise in RBC, Hb, Hct, Mcv, MCH and MCHC and ALT, total protein, globulin, A/G ratio, glucose and potassium among both Jamunapari and Barbari goats. Therefore, haematological and serum biochemical parameters can be a suitable indicators for naturally infected coccidia infection in goats.

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Conflict of Interest

Authors have declared no conflict of interest.

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