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BIOCHEMICAL AND HAEMATOLOGICAL PROFILES OF BLACK BENGAL GOAT IN MYMENSINGH SADAR OF BANGLADESH

Kanika Samaddar¹, Md. Mizanur Rahman^{1*} and Ziaul Haque²

¹Department of Surgery and Obstetrics, and ²Department of Anatomy and Histology, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

*Corresponding author: Dr. Md. Mizanur Rahman; E-mail: saidurhiv.covid@gmail.com

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ABSTRACT

The aim of the present study was to know the normal haemato- biochemical profiles of black Bengal goats in Bangladesh. Blood samples were collected from Jugular vein of 20 Black Bengal goats which were divided into 5 groups (4 goats in each group) on the basis of age, sex, nutritional and feeding status. The whole blood was analyzed for hematology, plasma and serum samples for biochemical analysis. The results of the present study demonstrate the normal haemato-biochemical values of the Black Bengal goat breeds with their age specificity. Total RBC (15.15 ± 1.29 million/cumm), haemoglobin (7.04 ± 1.02 g/dl), total WBC (11.64 ± 1.12), differential leukocyte counts of neutrophils ($70.89 \pm 2.06\%$), lymphocyte ($23.79 \pm 1.69\%$), eosinophil (2.1%), basophil (2.3%), MCV (35.04 ± 0.47) and PCV ($26.98 \pm 1.49\%$). This study also reveals the normal bio-logical profile counts as total protein (69.47 ± 2.31 g/L), Albumin (42.47 ± 2.31 g/L), Globulin (27.32 g/L), Phosphorus (3.46 ± 1.19), blood Urea (22.97 ± 0.58), Creatinine (0.645 mg/dl), ALT (20.32 U/L), ALP (91.59 U/L), GGT (37.46 U/L), IgG (18.91 ± 1.14 g/L), IgM (2.87 ± 0.18 g/L), gA (0.031 ± 0.12 g/L) and IL-6 (1.69 ± 0.15 g/ml). The study found higher number of RBC (million/cumm), WBC (Thousands/cumm), and PCV% in the goats of age 3 years and above (18.02 ± 1.27 , 14.72 ± 1.19 , and 28 ± 3.2), respectively. Besides, Neutrophils% and total protein was found higher ($76.289 \pm 14.5\%$, 77.52 ± 8.43 g/L), respectively in the Black Bengal goats of 6 months to 1 year age. Present results stated some significant variation of parameters between goats of various ages; on the other hand, some shows no significant variation at all.

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INTRODUCTION

Livestock has been an important component of the mixed farming system practiced in Bangladesh. The magnitude of contribution of the livestock sub-sector to the GDP is about 6.5% in Bangladesh. The goat provides meat, milk, and skin and contributes 38.0%, 23.0% and 28.0%, respectively (Devendra, 2007). Goat rearing is one of the most important sources of income for majority of rural families in Bangladesh. Goats are considered as ideal animals to keep for their high ability to survive under severe conditions and their ability to produce high-quality meat and milk (Silanikove, 2010). The Black Bengal goats are dwarf goats and are known to be famous for its adaptability, fertility, fecundity, delicious meat, superior skin, extreme disease resistance and wide range of acceptability under adverse agro-climatic condition (FAO, 2008). Higher reproductive efficiency, capacity to subsist on harsh nutritional regime and low risk of death make a viable proposition for increasing the productivity of Black Bengal goats in Bangladesh (Hassan et al., 2011). Blood is an important and reliable medium for assessing the health status of individual animal (Ramprabhu et al., 2010). Variations in blood parameters of animals are due to several factors such as altitude, feeding level, age, sex, breed, diurnal and seasonal variation, temperature and physiological status of animals (Mbassa and Poulsen, 2003). Hematological and serum biochemical tests are widely used for the diagnosis of serious animal diseases which can lead to economic losses in animals like reduced fur, wool and milk production (Bani et al., 2008).

The haematological and biochemical profiles test of blood can be used to monitor and evaluate health, nutritional and physiological status of ruminants (Al-Eissa et al., 2012). Furthermore, Mohammed et al., (2016) reported that blood constituents are markers to determine the efficacy of feed nutrient content and its utilization. Al-Seaf and Al-Harbi (2012) observed that biochemical and haematology profiles can also be used to assess the immunity status of goats while they can also be an index of transportation stress (Ambore et al., 2009). Among other factors, nutrition, stress, reproductive status, age, sex, genetics, management, housing and other environmental factors have been reported to have profound effects on the haematological and biochemical profiles of small ruminants (Mohammed et al., 2016).

Hematological and biochemical profiles of blood are important to be determined because they provide valuable information about the breed, sex and animals' health status (Madan et al., 2016). There is considerable information about the normal parameters of blood of the domestic animal species, but the values are expected to vary according to the breeds, different environmental factors and the different methods of management (Sharma and Kataria, 2012). The physiological adaptation and the systemic relationship are widely determined using the hematological values (Shah et al., 2007). The biochemical profile shows some changes and the blood plasma components which varies according to the growth requirements, breed, ages (Piccione et al., 2007), environmental factors, management conditions (Arfuso et al., 2016), sexual maturity (Piccione et al., 2012) and the productivity of the animals (Madan et al., 2016). Therefore, this research was conducted to know the normal hematological and biochemical profiles with their standard values of blood in Black Bengal goat in Bangladesh and also the changes of values according to age.

MATERIALS AND METHODS

Ethical approval

The experiments on animals were approved by Animal Welfare and Experimentation Ethics Committee (AWEEC), Bangladesh Agricultural University, Mymensingh-2202.

Animal sampling

A total of 20 Black Bengal goats of different ages were collected randomly from local market, Mymensingh sadar, Bangladesh. All of the Black Bengal goats were considered clinically healthy animals at the time of sampling and all of them were fed on the same diet.

Blood sampling

Blood samples were collected from the jugular vein into two tubes (Guangzhou Improve Medical, China), in which one contained anticoagulants (ethylene di-amine tetra acetic acid) for blood hematology and the other tube contains no anticoagulants (Becton Dickinson, Franklin Lakes, USA) for the biochemical analysis. All of the samples were transferred into the laboratory as quick as possible in ice.

Blood hematology

Blood hematology prepared by using a special blood lysing buffer approved for goat hematology (Concentrated Lysing Reagent, SEAC, Florence, Italy). All the samples were analyzed within 45 min after collection by using CELL-DYN 3700 analyzer for the total red blood cells count (RBC), total and differential white blood cells count (WBC), hemoglobin (HGB), hematocrit (HCT), mean corpuscular volume (MCV), mean corpuscular HGB (MCH), MCH concentration (MCHC), red cell distribution width, and mean platelet volume.

Serum biochemistry

The samples were left to clot and then centrifuged at 3000 rpm for 15 min, and the serum is collected. Serum was kept frozen at -20°C until it was used for the biochemical analysis. Serum biochemistry was carried out by using Vet Scan VS2 analyzer (ABAXIS, USA) for the following parameters: Albumin (ALB), alanine aminotransferase (ALT), alkaline phosphatase (ALP), gamma glutamyltransferase (GGT), and blood urea nitrogen (BUN). Serum Immunoglobulins were analyzed by ELISA method, using auto AnalyzerMachine (BN Prospect, Siemens Healthcare) for humoral immune responses at different ages in Black Bengal goat.

Statistical analysis

For the statistical analysis, GraphPad Prism 7/ GLM of SAS (2010) version 9.3 software is used to calculate the minimum and maximum values to determine the range, mean, standard deviation of the mean also Shapiro–Wilk normality test was used to evaluate the normal distribution of the values. All the resulting data for the blood metabolites was checked for normality using the PROC UNIVARIATE of SAS (2010). A repeated measures analysis of SAS (2010) was used to assess the effect of time on blood metabolites and haematological parameters.

RESULTS

The values of blood haematological parameters of Black Bengal goats are presented in Table 1 and Figure 1 in this experiment with the determination of the significance values ($p < 0.05$), mean \pm SE values and the results were compared with the reference values mentioned by Feldman et al. (2002). Normal haematology of Black Bengal goats revealed total RBC (15.15 ± 1.29 million/cumm), haemoglobin (7.04 ± 1.02 g/dl), and total WBC (11.64 ± 1.12). Differential leukocyte counts like the percentage of neutrophils ($70.89 \pm 2.06\%$), Lymphocyte ($23.79 \pm 1.69\%$), Monocytes ($5.14 \pm 0.21\%$), (Eosinophil (2.1%), Basophil (2.3%), MCV (35.04 ± 0.47) and PCV ($26.98 \pm 1.49\%$) of Black Bengal goat are also analyzed in this experiment. These values were in normal ranges and are supported by the results observed by Bulushi et al. (2017) and Shaikat et al. (2013). There was slight variation among some values of present study with the results observed by Bulushi et al. (2017).

Table 1. Haematological profiles of Black Bengal goats with normal ranges (Mean \pm SE)

Parameters	Concentrations	Normal Ranges
RBC (Million/cumm)	15.15 ± 1.29	14.75 to 22.34
WBC (Thousand/cumm)	11.64 ± 1.12	6.5 to 28.4
Haemoglobin (gm/dl)	7.04 ± 1.02	5.2-9.2
Neutrophil (%)	70.89 ± 2.06	57.3-83.4
Lymphocytes (%)	23.79 ± 1.69	10.3-38.5
Monocytes (%)	5.14 ± 0.21	4.2-10.6
Eosinophil (%)	2.1 ± 0.14	1.5-4.3
Basophil (%)	2.3 ± 0.31	0-3.4
MCV (U/L)	35.04 ± 1.49	33-39
PCV (%)	26.98 ± 1.34	24.5-30.4

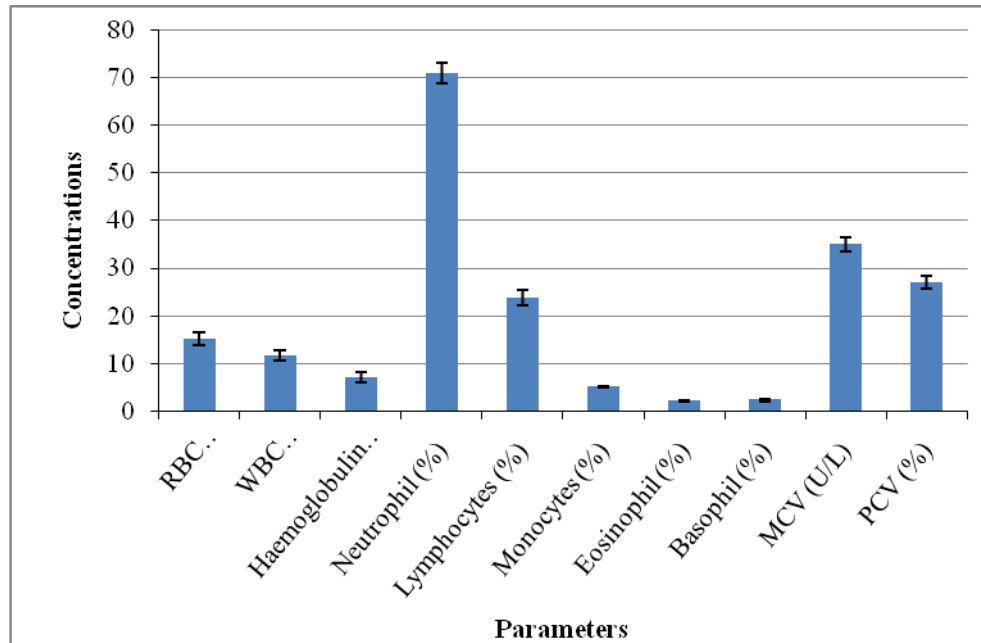


Figure 1. Haematological profiles of Black Bengal goats with normal ranges (Mean±SE)

The study found higher number of RBC (million/cu mm), WBC (Thousands/cu mm), and PCV% in the goats of age 3 years and above (18.02 ± 1.27 , 14.72 ± 1.19 , and 28 ± 3.2), respectively. Besides, Neutrophils% and MCV (U/L) was found higher ($76.289 \pm 14.5\%$, 35.38 ± 8.43 g/L), respectively in the Black Bengal goats of 6 months to 1 years. These results are supported by previous study (Shaikat et al., 2013; Kaneko et al., 1997). No statistically significant variation in most hematological and biochemical parameters was found among the Black Bengal goat breed (Table 2).

Table 2. Haematological properties of Black Bengal goats among different group according to age (Mean+/-SE)

Parameters	Concentrations				
	Group A (Control)	Group B (+3 Year)	Group C (2-3year)	Group D (1- 2 year)	Group E (6m-1year)
RBC (Million/cumm)	17.96 ± 1.29	18.02 ± 1.28	15.89 ± 1.31	12.18 ± 1.30	11.72 ± 1.27
WBC (Thousand/cumm)	14.67 ± 1.12	14.92 ± 1.10	12.39 ± 1.14	9.37 ± 1.11	6.84 ± 1.12
Haemoglobin (gm/dl)	6.92 ± 1.02	8.98 ± 1.04	6.13 ± 1.02	6.59 ± 1.03	5.38 ± 1.01
Neutrophil (%)	68.48 ± 2.06	69.63 ± 2.36	69.72 ± 2.08	71.37 ± 1.09	76.28 ± 4.01
Lymphocytes (%)	25.62 ± 1.70	24.96 ± 1.62	26.02 ± 1.58	23.61 ± 1.79	18.74 ± 1.76
Monocytes (%)	5.90 ± 0.20	6.31 ± 0.22	4.26 ± 0.21	5.02 ± 0.19	4.98 ± 0.23
Eosinophil (%)	2.15 ± 0.17	2.23 ± 0.16	2.10 ± 0.14	2.13 ± 0.15	2.05 ± 0.18
Basophil (%)	2.39 ± 0.31	2.47 ± 0.34	2.15 ± 0.29	2.27 ± 0.29	1.98 ± 0.33
MCV (U/L)	35.0 ± 1.51	35.12 ± 1.48	35.24 ± 1.46	35.36 ± 1.47	35.38 ± 1.53
PCV (%)	26.72 ± 1.34	29.87 ± 1.32	28.57 ± 1.33	24.48 ± 1.35	23.96 ± 1.36

The values of Biochemical profiles of Black Bengal goats are presented in Table 3 in this experiment with the determination of the significance values ($p < 0.05$), mean±SE values and the results were compared with the reference values mentioned by Feldman et al. (2002). Normal Biochemical parameters of Black Bengal goat revealed total protein (69.47 ± 2.31 g/L), Albumin (42.47 ± 2.31 g/L), Globulin (27.32 g/L), Phosphorus (3.46 ± 1.19), blood Urea (22.97 ± 0.58), Creatinine (0.645 mg/dl), ALT (20.32 U/L), ALP (94.59 U/L), GGT (37.46 U/L,) and IL-6 (1.69 ± 0.15 g/ml).

Table 3. Biochemical Properties of Black Bangla Goat (Mean \pm SE)

Parameters	Concentrations	Ranges of Reference Values
Total Protein (g/L)	72.67 \pm 4.41	54.5-74
Albumin (g/L)	42.32 \pm 2.05	40.4-61.4
Globulin (g/L)	27.32 \pm 1.02	22.7-60
Phosphorus (mg/dl)	3.15 \pm 0.67	2-5.1
Urea (mg/dl)	24.86 \pm 0.58	21.1-48.4
Creatinine (mg/dl)	0.569 \pm 0.109	0-1
ALT (U/L)	18.30 \pm 1.72	12.4-19.3
ALP (U/L)	94.02 \pm 2.55	93-387
GGT (U/L)	37.32 \pm 1.69	20-56
IL-6 (pg/ml)	1.69 \pm 0.15	1.56-100

The study found higher number of Albumin (g/L), Phosphorus (mg/dl), Blood Urea and IL-6 (pg/dl) in the goats of 3 years age and above (31.96 ± 1.02 , 3.46 ± 1.19 , 31.47 ± 3.98 , and 1.78 ± 0.17 respectively). Besides, total protein (77.52 ± 8.43 g/L) and Globulins (47.89 ± 2.72 g/L) were found higher in the Black Bengal goats of 6 months to 1 year age. No statistically significant variation in most hematological and biochemical parameters was found among the Black Bengal goat breeds (Table 4)

Table 4. Biochemical parameters of Black Bengal Goat according to age (Mean \pm SE)

Parameters	Concentrations				
	Group A (Control)	Group B (</+3Y)	Group C (2-3 Y)	Group D (1-2 Y)	Group E (< 1Y)
Total Protein (g/L)	69.79 \pm 2.31	71.23 \pm 2.92	71.68 \pm 4.32	73.16 \pm 2.96	77.52 \pm 8.43
Albumins (g/L)	30.35 \pm 1.02	31.96 \pm 1.02	30.89 \pm 1.32	29.97 \pm 1.92	29.63 \pm 1.92
Globulins (g/L)	40.47 \pm 1.35	39.27 \pm 1.52	40.79 \pm 1.57	43.19 \pm 1.62	47.89 \pm 2.72
Phosphorus(mg/dl)	3.15 \pm 0.67	3.46 \pm 1.19	3.12 \pm 1.12	2.73 \pm 1.07	2.49 \pm 1.02
Urea (mg/dl)	28.14 \pm 2.18	31.47 \pm 3.98	24.3 1 \pm 1.93	21.28 \pm 1.82	19.12 \pm 2.12
Creatinin (mg/dl)	0.569 \pm 0.76	0.645 \pm 0.32	0.591 \pm 0.19	0.547 \pm 0.81	0.509 \pm 0.29
ALT (U/L)	19.27 \pm 0.87	20.32 \pm 1.01	18.97 \pm 1.03	17.68 \pm 1.1	15.29 \pm 1.09
ALP (U/L)	91.59 \pm 2.69	93.62 \pm 2.91	91.87 \pm 2.19	90.48 \pm 2.09	87.56 \pm 2.30
GGT (U/L)	37.46 \pm 2.09	40.87 \pm 1.82	37.97 \pm 1.97	36.89 \pm 1.60	33.42 \pm 1.29
IL-6 (pg/ml)	1.69 \pm 0.16	1.78 \pm 0.17	1.65 \pm 0.12	1.59 \pm 0.14	1.57 \pm 0.16

In this study, it was found that Goat IgG (18.80 gm/L) is more significant than other immunoglobulins. IgG has 2 sub-type i.e. IgG1 (54.84%) and IgG2 (45.16%), (Micosan and Borduas; 1977). The conc. of IgA (0.32 gm/L) was lower value in serum. A very few conc. of IgD and IgE were found in goat blood serum. IgG (18.91 ± 1.14 g/L), IgM (2.70 ± 0.19 g/L), IgA ($.031 \pm 0.12$ g/L (Table 5)

Table 5. Immuno-Biochemical properties (Immunoglobulins (Igs) Conc.) of blood in serum of Black Bengal goat (Mean± SE)

Immunoglobulins	Absolute Concentrations (gm/L)	Relative Concentrations (%)
Immunoglobulin G1(IgG1, g/L)	10.31 ± 1.01	54.84%
Immunoglobulin G2(IgG2, g/L)	8.49 ± 0.71	45.16%
Immunoglobulin G(IgG, g/L)	18.80 ± 1.14	*86.19%
Immunoglobulin M(IgM, g/L)	2.70 ± 0.19	12.37%
Immunoglobulin A(IgA, g/L)	0.31 ± 0.12	1.42%
Immunoglobulin D(IgD, g/L)	0.063 ± 0.01	0.29%
Immunoglobulin E(IgE, g/L)	0.00063 ± 0.00010	0.0029%

The higher number of Immunoglobulin G (IgG, g/L), Immunoglobulin M (IgM, g/L) and Immunoglobulin A (IgA) (g/L) in the Black Bengal goats of age 3 years and above (20.87 ± 1.20 , 2.93 ± 0.21 and 0.35 ± 0.14 respectively) than younger (Table 6). This may be due to immaturity of the immune system and lymphoid system in young goats.

Table 6. Immuno-Biochemical parameters of Black Bengal goat according to age (Mean ± SE)

Parameters	Concentrations				
	Group A (Control)	Group B (<+3Y)	Group C (2-3 Y)	Group D (1-2 Y)	Group E (< 1Y)
Immunoglobulin G (IgG, g/L)	18.91 ± 1.14	20.87 ± 1.20	19.47± 1.11	17.86± 1.17	16.92 ± 1.08
Immunoglobulin M (IgM, g/L)	2.87 ± 0.19	2.93 ± 0.21	2.87 ± 0.17	2.65 ± 0.15	2.19 ± 0.16
Immunoglobulin A (IgA, g/L)	0.31 ± 0.12	0.35 ± 0.14	0.33 ± 0.11	0.31 ± 0.13	0.29 ± 0.10
Immunoglobulin D (IgD, g/L)	0.063 ± 0.01	0.066 ± 0.03	0.064 ± 0.01	0.062 ± 0.02	0.0604 ± 0.01
Immunoglobulin E (IgE, g/L)	0.00063	0.00066	0.00064	0.00063	0.0006

DISCUSSION

According to the current study, the hematological and biochemical values of Black Bengal goat were found within the normal ranges which were supported by earlier study (Shaikat et al., 2013; Kaneko et al., 1997). There was slight variation among some normal hematological values of present study with the results observed by Bulushi et al. (2017). The present finding of the number of RBC (11.72 ± 1.27 million/cu mm) in kids of under 1 year age. This study is agreed by Zumbo et al. (2011). The number of WBC (6.84 ± 1.12 Thousand/cu mm) of kids (under 1 year of age) in the present study was lower than the result of Zumbo et al. (2011). It might be due to difference in the rate of infection and immunological response.

In this study, the kids possesses hemoglobin content (5.32 ± 1.01 gm/dl) is nearly similar with the results observed by Saikat et al., (2013) but less than the results of the study conducted by Zumbo et al. (2013). The MCV value of the current study was very much higher observed by Zumbo et al. (2013). However, there was no significant variation in biochemical parameters with some micro-minerals haematological parameters of dogs among the age were needed to establish a final reference values except RBC (Khan et al., 2011).

The number of RBC (15.15 ± 1.12 million/cu mm) in the current study is agreed by Saikat et al. (2013) and but does not agreed by Rice and Hall (2007) who conducted similar study on mountain goats. It might be due to variation in magnitude of their position. In the present study, the number of WBC (11.64 ± 1.12 thousand/ cumm) was lower than the finding of Bulushi et al. (2017) but higher than the findings of Rice and Hall (2007) and Piccione et al. (2010). It might be due to frequency of exposure of different pathogens and other environmental factors. The hemoglobin content (gm/dl) in the present finding was agreed by Shaikat et al. (2013) and Kiran et al. (2012). But the Hb contents (gm/dl) of the study conducted by Rice and Hall (2007) and Piccione et al. (2010) on Girgentana goats were higher than the present findings. It might be due to nutritional variation of these two kinds of goats. The result of MCV content was nearer to Rice and Hall, (2007) study. In the present study the lymphocyte percentage was lower than the findings of Rice and Hall (2007) for mountain goats but higher than Piccione et al. (2010). It may be due to altitude variation and other factors. The monocyte percentage of adult goats was higher in the present study than the findings of Rice and Hall (2007) for mountain goats and Piccione et al. (2010) for Girgentana goat. It might be due to more prevalence of exposure of chronic infection in plain land than those of mountain. The haemato-biochemical parameters also varied sometimes based on management practices and nutritional status in chicken (Islam et al., 2012) and production stages of ducks (Khan et al., 2013)

In the present study, the total protein content (gm/dl), albumin (gm/dl) and urea (mg/dl) were closely related the result observed by Shaikat et al. (2013) but significantly higher than the observed result of Rice and Hall. The phosphorous content (mg/dl) of the present study was lower than the result observed by Rice and Hall, (2007). It might be due to difference in feed intake & nutritional difference between the goats of two studies. In the present study the RBC content was higher than the findings of Piccione et al. (2010) of the same age group (+3 years). It might be due to geographical variation.

In the present study, the IL-6 (1.69 pg/dl) was closely related with the result observed by Effros et al. (1997) but significantly lower than the observed result of Roubenoff et al. (1998). In the present study the quantities of IL-6 in serum was increase with age and represented the higher concentration in the age group (+3 years). Similar findings were reported by previous study (Roubenoff et al., 1998 and Effros et al., 1997). In the present study, the IgG (18.80g/L), IgG1 (10.31g/L), and IgG2 (8.49 g/L), were closely related with the result observed by Micusan and Borduas, (1997). In the present study the quantities of IgG, IgM and IgA in serum were increases with age and represent the higher concentration in the age group (>3 years). Significant ($p < 0.01$) variation was observed in WBC, lymphocytes, monocyte, RBC, PCV, total protein, albumin, urea, ALT and AST among different age group of the Black Bengal. This statement partially support by Addass et al. (2010).

CONCLUSION

The haematological and biochemical profiles test of blood can be used for monitoring and evaluating the health condition, nutritional and physiological status of Black Bengal goats. Now-a-days, it is very much essential to know the conditions of haemato-biochemical profiles of of Black Bengal goats before any surgery perform successfully. The Present study represents the normal values of haemato-biochemical profiles of Black Bengal goat breeds of Bangladesh. The study results show the significant variation in some of the haemato-biochemical parameters. Moreover, variation was also observed based on sex and age. However, further investigation is required to verify the values depending on seasons and other climatic conditions.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest in the publication of this manuscript.

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