

Abstract

Hematological and biochemical measures have to be used to evaluate the clinical states of animals and are reliable indicators of the physiological status of animals. A total number of 8 clinically healthy dogs were brought under the study (6 exotic dogs from dog squad, Border Guard Bangladesh and 2 local dogs). Information about management (feeding, vaccination, deworming) were collected through face to face interview. Samples of blood were collected from dogs for analysis hemato-biochemical indices using automated hematoanalyzer (Celtech α ®) and spectrophotometer (Hematological analyzer 3000®) respectively. The collected data were organized in Excel 2010 and analyzed using SPSS (version 26.0). Descriptive studies were performed including Percentage, Mean and SD.. The study recorded marked sex related differences in PCV (Packed cell volume) which was $26\pm 7.12\%$ in male and $41.33\pm 7.64\%$ in female, ESR was 45.0 ± 23.84 mm in 1st hour vs. 5.67 ± 2.89 mm in 1st hour in male & female. Total protein level (90.92 ± 9.22 mg/dl vs. 69.75 ± 23.97 mg/dl) and imbalance of lipid profiles like Cholesterol (73.57 ± 21.65 mg/dl vs. 57.10 ± 26.72 mg/dl), Triglycerides (54.77 ± 21.64 mg/dl vs. 37.40 ± 5.57 mg/dl), LDL (183.27 ± 293.25 mg/dl vs. 0 mg/dl) and HDL (115.67 ± 29.78 mg/dl vs. 32.25 ± 10.67 mg/dl) levels were found higher in exotic dog breeds than local dogs. Current study revealed that the exotic dog breeds in a dog squad of BGB were suffering from metabolic disorder specially dyslipidemia. In conclusion, we may say that periodic assessment of hemato-biochemical parameters especially lipid profiles are very much important for the dogs, of particular those are used in professional activities

Keywords: Hematology, Biochemical analysis, Exotic breed, Dog squad, Indices

Chapter 1

Introduction

Blood evaluation is very much important tool for monitoring the Health status of animals (Babeker and Elmansoury, 2013). Haemato-biochemical parameters are good indicators for the assessment of health condition of wild, captive and domestic animals (Bezerra et al., 2017; Khan et al., 2011; Kaneko et al., 2008). Both are important tools for clinicians to diagnose the pathological conditions, and monitoring the progress and prognosis of diseases (Ariyibi et al., 2002; Fielder, 2019).

Dogs are popular companion animal for human being. They can serve people in many ways. For example, there are guard dogs, hunting dogs, herding dogs, guide dogs for blind people, and police dogs. Dogs also have some certain inherent traits such as having a sniffing power almost a hundred times greater than that of humans, for having ultrasonic hearing and natural night vision, and for being ready to function in any geo-climatic environment (Management of dog squads standing order no. 84)). These are considered as a part of security forces in modern times.

Likewise the Border Guard Bangladesh rear exotic dog breeds for various purposes. (Examples: protection against enemy, searching any harmful objects, hunting, or parade in national day etc.). However, there are limited facilities for assessment of general health parameters of dogs by hematological and biochemical analysis to support clinical diagnosis (Sharma and Singh, 2000) especially in developing countries. Moreover, a number of factors including breed, sex, age, nutrition and climate affect the hemato-biochemical parameters of clinically healthy dogs (Dash et al., 2013; Simsek et al., 2015). In a previous study in clinically affected dogs shows that decreased hematological values (TEC 2.1-2.5 million/cmm, Hb. 3.4-5 g% and PCV 12-13%) in anaemic dogs (Alam et al., 2005), but biochemical analyses were not done. Later on another study revealed that hematology and serum biochemistry values of stray dogs except LDL and HDL values (Khan et al., 2008). So far we know, the general health assessment of exotic dog breeds in a specialized setting like BGB were not carried out

till to date in the context of Bangladesh. Considering the above backgrounds, the present study was under taken with the following objectives:

1. To study the demographic information of exotic dog breeds in BGB;
2. To assess the general health status of exotic dog breeds in a dog squad by analyzing the hemato-biochemical parameters;

Chapter 2

Materials and Methods

2.1 Study type, area and period

A cross-sectional study was carried out in 8 dogs of two categories: (i) exotic dogs (n=6) (German Shepherd and Labrador Retriever) in dog squad of Border Guard Bangladesh (BGB) and Local dogs (n=2) (Stray dog) in Chattogram Veterinary and Animal Sciences University, Chattogram for a period of 1 month in August, 2022.

2.2 Clinical history

A dog had died in a dog squad and they did the postmortem examination of dog by a Veterinarian. Due to lacking's of laboratory facilities , they didn't find out the actual cause of death. Later on ,the authority decided to check out the general health parameters of remaining dogs. For that reason they collected the blood sample and transferred to the Department of Physiology, Biochemistry & Pharmacology laboratory , Faculty of Veterinary Medicine at CVASU.

2.3 General management practices of dogs in dog squad

2.3.1 Feeding of dogs in dog squad

The dogs are offered two meals/day, morning and evening. In the morning meal, each dog intake the following items: 150 gm flour as bread, one boiled egg, and 500 ml milk. The evening meal composed of 250 gm rice, 250 gm vegetables, and 500 gm chicken except Sunday. On Sunday 300 gm boneless meat of cow and 200 gm liver are offered.

2.3.2 Vaccination and deworming:

2.3.2.1 Deworming schedule

At the age of 4 months of dog, 1st dose of anthelmintic is given, and this dose is repeated every 4 months interval.

2.3.2.2 Vaccination schedule

Table 1: Vaccination schedule of dog

Vaccine name	1 st dose	Subsequent dose
Eurican LR	6-8 weeks	6 months/1 year later
TT (Tetanus toxoid)	6 weeks	1 year later

2.4 Sample size

The study was carried out on 6 exotic dogs (4 male & 2 female) of dog squad where 4 German Shepard and 2 Labrador retriever breeds and 2 local dogs (1 male & 1 female) which were brought for blood test at Physiology, Biochemistry ,Pharmacology Laboratory at CVASU and the author also collected samples from two local dogs (Stray dog) from CVASU campus.

2.5 Sample processing and analysis

We had received the 6 blood samples from exotic dogs & 2 another samples from local dogs. Approximately 5ml of blood samples were collected from the Jugular or Cephalic vein of each animal and immediately dispensed in two tubes, one with EDTA and other was plain to obtain serum. Then samples were transported to the laboratory in the ice-box.

2.5.1 Complete blood count analysis

Complete blood count including RBCs (Red Blood Cells) & WBCs (White Blood Cells) count, Hb (Hemoglobin Concentration), Packed Cell Volume was estimated using automated hematology analyzer (Celtech α ®), Erythrocyte Sedimentation Rate was done by Wintrobe tube method and Differentiate leukocyte count was performed by direct smear method using Wright's stain.

2.5.1.2 Biochemical evaluation

After receiving the blood samples in vacutainer tube, the tube was centrifuged at 3000 rpm for 10 minutes (Digisystem laboratory Instruments INC.®). Serum biochemical parameters including Glucose, Total protein, Albumin, Bilirubin, SGOT, SGPT,

Creatinine, Cholesterol, Triglyceride, High Density Lipoprotein, Low Density Lipoprotein using commercial kits by Spectrophotometer (Humalyzer 3000®).

2.6 Statistical analysis

All data were recorded, sorted out and imported in spreadsheets Microsoft Excel 2010 and exported to Statistical Package for Social Sciences (SPSS version, 26.0). Following that, descriptive statistics were run, including percentage, Mean \pm SD. P value <0.05 was considered as significant.

Chapter 3

Results

3.1 Demographic characteristics of dog

In this study, two types of dog mainly Exotic (dog squad) and local dogs are presented where 55.6% male and 33.3% female and 55.6% animal age of 2-4 years ,33.3% animal age of >4-9 years (Table 2).

Table 2: Demographic characteristics of dog

Variables	Category	Number	Percentage
Breed	Exotic(Dog squad)	6	66.7
	Local(Stray dog)	2	22.2
Sex	Male	5	55.6
	Female	3	33.3
Age	2-4 years	5	55.6
	>4-9 years	3	33.3

3.2 Overall characteristics of hematological and biochemical parameters of dogs

In the following table overall hematological and biochemical parameters are enlisted with reference value. All examined values were within the normal range except higher values of Cholesterol, HDL and LDL.

Table 3: Overall characteristics of hemato-biochemical parameters of dogs (N=8)

Category	Variables	Mean \pm SD	Reference value
Hematological	WBC($\times 10^3$)	10.34 \pm 2.31	5.9-16.6
	RBC($\times 10^6$ cells/ μ l)	5.80 \pm 1.83	5.5-8.5
	Hb (g/dl)	11.39 \pm 3.51	14.2-19.2
	PCV (%)	31.75 \pm 10.42	29-55
	ESR (mm in 1 st hour)	30.25 \pm 27.23	0-6
	Lymphocyte (%)	40.75 \pm 14.40	8-38
	Neutrophil (%)	50.50 \pm 15.37	60-70
	Eosinophil (%)	4.38 \pm 1.68	0-9
	Monocyte (%)	5.00 \pm 2,0	1-9
Biochemical	Glucose (mg/dl)	103.44 \pm 11.67	80-120
	Total Protein (mg/dl)	85.63 \pm 15.45	52-78
	Albumin(mg/dl)	31.73 \pm 5.04	23-31
	Bilirubin(mg/dl)	0.20 \pm 0.11	0.1-0.5
	SGOT (U/l)	35.55 \pm 18.04	23-66
	SGPT (U/l)	32.28 \pm 13.91	21-102
	Creatinine(mg/dl)	1.41 \pm 0.93	0.5-1.5
	Cholesterol(mg/dl)	69.45 \pm 22.25	110-330
	TG(mg/dl)	50.43 \pm 20.08	20-112
	HDL	94.81 \pm 46.27	----
	LDL	183.27 \pm 293.26	-----

(Source: The Merck Veterinary Manual, 11th Edition and Clinical Biochemistry of Domestic Animals, 5th edition)

3.3 Hemato-Biochemical analysis of dogs on the basis of Sex

Male and female dogs showed significant differences in ESR (45.0 \pm 23.843, vs 5.67 \pm 2.887), total protein (92.30 \pm 9.234 vs 74.50 \pm 19.183mg/dl), Cholesterol

(73.90±26.596 vs 62.03±13.661mg/dl), HDL (106.54±48.15 vs 75.27±44.01) values. Other hematology and biochemical values didn't show significant differences (Table 4).

Table 4: Hemato- Biochemical analysis of dogs on the basis of Sex (N=8)

Category	Variables	Male (n=5)	Female(n=3)	P value
		Mean ± SD	Mean ± SD	
Hematological	WBC(× 10 ³)	9.34±2.37	12±0.88	0.12
	RBC(×10 ⁶ cells/μl)	4.86±1.61	7.37±0.77	0.05
	Hb (g/dl)	9.58 ±2.75	14.40 ±2.45	0.05
	PCV(%)	26±7.12	41.33±7.64	0.05
	ESR(mm in 1 st hour)	45.0±23.84	5.67±2.88	0.03
	Lymphocyte (%)	39.20±15.83	43.33±14.43	0.72
	Neutrophil (%)	51.80±16.69	48.33±16.07	0.78
	Eosinophil (%)	4.20±1.92	4.67±1.53	0.72
Monocyte (%)	4.80±2.38	5.33±1.53	0.74	
Biochemical	Glucose(mg/dl)	100.34±9.24	108.60±15.55	0.37
	Total protein(mg/dl)	92.30±9.23	74.50±19.18	0.12
	Albumin(mg/dl)	33.16±5.20	29.33±4.58	0.33
	SGOT(U/L)	34.68±23.41	37.0±6.18	0.88
	SGPT(U/L)	33.64±17.91	30.00±4.81	0.75
	Creatinine(mg/dl)	1.74±1.06	0.87±0.12	0.22
	Cholesterol(mg/dl)	73.90±26.59	62.03±13.66	0.52
	HDL(mg/dl)	106.54±48.15	75.27±44.01	0.39
LDL(mg/dl)	245.35±357.57	59.10±13.29	0.53	

3.4. Hemato-biochemical examination based on Breeds of dog

Dogs of exotic breeds showed markedly imbalance in ESR (37.33 ± 28.23 mm in 1st hr.), Lymphocytes ($43.50 \pm 15.85\%$) and imbalance lipid profiles (cholesterol 73.57 ± 21.659 mg/dl, TG 54.77 ± 21.642 mg/dl, LDL 183.27 ± 293.258 mg/dl). Other parameters were more or less similar in different dog breeds (Table 5).

Table 5: Hemato-biochemical examination based on Breeds of dog (N=8)

Category	Variables	Exotic (Dog squad) (n=6)	Local (Stray dog) (n=2)
		Mean \pm SD	Mean \pm SD
Hematological	WBC($\times 10^3$)	10.23 \pm 2.51	10.65 \pm 2.33
	RBC($\times 10^6$ cells/ μ l)	5.57 \pm 2.10	6.50 \pm 0
	Hb(g/dl)	11.32 \pm 4.14	11.60 \pm 00
	PCV(%)	32.17 \pm 12.18	30.50 \pm 3.54
	ESR(mm in 1 st hour)	37.33 \pm 28.23	9.00 \pm 00
	Lymphocytes (%)	43.50 \pm 15.85	32.50 \pm 3.54
	Neutrophil(%)	46.50 \pm 15.85	62.50 \pm 3.53
	Eosinophil(%)	4.50 \pm 1.87	4.0 \pm 1.41
	Monocyte(%)	5.50 \pm 1.87	3.50 \pm 2.12
Biochemical	Glucose(mg/dl)	101.42 \pm 10.69	109.50 \pm 16.83
	Total protein(mg/dl)	90.92 \pm 9.22	69.75 \pm 23.97
	Albumin(mg/dl)	31.07 \pm 5.77	33.70 \pm 0.72
	Bilirubin	0.20 \pm 0.11	0
	SGOT(U/L)	37.18 \pm 19.36	30.65 \pm 18.45
	SGPT(U/L)	35.42 \pm 14.47	22.85 \pm 8.42
	Creatinine(mg/dl)	1.50 \pm 1.05	1.15 \pm 0.49
	Cholesterol(mg/dl)	73.57 \pm 21.65	57.10 \pm 26.73
	TG(mg/dl)	54.77 \pm 21.64	37.40 \pm 5.57
	LDL(mg/dl)	183.27 \pm 293.25	0
	HDL(mg/dl)	115.67 \pm 29.78	32.25 \pm 10.67

Chapter 4

Discussions

Dogs are very popular companion animal for human being. Their cooperative behaviour with human being and working activities in Army, Police, and BGB are the main reasons for choosing them as a pet animal. In this study, two types of dog mainly exotic and local dogs are presented where 55.6% male and 33.3% female and 55.6% animal age of 2-4 years ,33.3% animal age of >4-9 years (Table 2). One third of the dogs in this study were in older age which might be a risk factor for developing metabolic diseases specially diabetes and dyslipidemia (TvariJonaviciute *et al.*, 2012).

In this study, the majority of the hematological indices were recorded, and most of them were within the defined ranges for canine species. Significant variation from the existing ranges was recorded for lymphocytes, total protein and cholesterol levels in exotic dogs than local dogs which was consistent with findings of earlier study of Nigerian local dogs (Adebiyi *et al.*, 2014). Similar findings have been reported by Ariyibi *et al.* (2002) for clinically healthy Alsation and local dogs and Adebiyi *et al.* (2014) for Rottweiler dogs in Nigeria.

According to the CBC results (Table 5), significant differences were observed in the ESR and Lymphocytes count of the different breeds. That could be an infection present in exotic dogs such as parasitic infections, autoimmune disease, cancer or kidney disease, anemia etc. Dogs affected by a Canine leishmaniosis (CanL) showed to have the highest ESR level compared with exposed and healthy dogs (Cavalera *et al.*, 2022).

Meanwhile, in our present study (Table 5), an increasing in the concentration of lymphocytes was observed in the exotic dogs than local dogs. It might be Lymphocytosis. The possible causes of lymphocytosis are stimulation of the immune system by infections, leukemia, arthritis etc.

In the present study, significant elevations of biochemical parameters in different breeds are shown. Total protein in exotic dogs of dog squad (90.92 ± 9.21 mg/dl) was higher than local dogs (69.75 ± 23.97 mg/dl). Hyperproteinemia which can be a sign of many illness such as infection, dehydration, lymphocytic leukemia etc.. Salem *et al.*, (2020) reported that, marked elevations in total protein and globulin were recorded in generalized Demodecosis patients compared with control.

In the current study, imbalance of lipid values such as cholesterol (73.57 ± 21.65 vs 57.10 ± 26.72 mg/dl), triglycerides (54.77 ± 21.64 vs 37.40 ± 5.57 mg/dl), LDL (183.27 ± 293.25 vs 0 mg/dl) and HDL (115.67 ± 29.77 vs 32.25 ± 10.67 mg/dl) were observed which was higher in exotic dogs than local dogs, indicating dyslipidemia means imbalance of lipids in blood. This condition can result from physical inactivity, nutrition, high consumption of saturated fats, tobacco use and obesity (Pappan *et al.*, 2022). Dyslipidemia is considered as a key factor associated with the occurrence of a series of health problems which are always grouped together as metabolic syndrome (Y. Zhang *et al.*, 2012). Maugeais *et al.*, (2000) reported that, dyslipidemia is a key risk factor of cardiovascular diseases (CVD).

Strength and Weakness

There are some strengths in this study. For example:

- We compare the hemato-bichemical analysis between exotic dog breeds and local dogs.
- Exotic dog breeds are rearing in well-established settings

However, this study possess a limitation that we have no chance to examine the exotic dog breeds by physical examination (inspection, palpation and auscultation).

Conclusions

In summery, the exotic breeds were suffering from metabolic disorders like hyperproteinemia, and dyslipidemia is common. Despite being on a regular routine and health check-up, dogs might be develop dyslipidemia simply because of a lack of physical exercise , overconsumption of fats & carbohydrates etc. As a consequences of Dyslipidemia may be associated with the development of cardiovascular diseases and different metabolic diseases etc.

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Biography

I am Sanjida Ali an intern student of the Faculty of Veterinary Medicine at Chattogram Veterinary and Animal Sciences University. I completed my Secondary School Certificate (SSC) and Higher Secondary Certificate (HSC) in 2013 and 2015 respectively from Chattogram. As a future veterinarian after completing my DVM degree, I would like to be a researcher and pursue higher studies in the field of public health and one health and contribute to the world with my knowledge and skills.