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Haemato-biochemical study of free ranging gaur

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ABSTRACT

To support the health monitoring and care for the endangered gaur species, 18 apparently healthy, free-ranging gaurs (*Bos gaurus gaurus)* of either sex were immobilized with etorphine HCl and azaperone. The haematological values, viz. total erythrocyte count, haemoglobin, packed cell volume, erythrocyte sedimentation rate, mean corpuscular volume, mean corpuscular haemoglobin, mean cell haemoglobin concentration, total leukocyte count, neutrophils, lymphocytes, monocytes, eosinophils, and basophiles, were encountered. The principal biochemical constituents of blood serum were revealed as glucose, phosphorus, calcium, chloride, cholesterol, total proteins, albumin, creatinine, uric acid, blood urea nitrogen, total bilirubin, alanine aminotransferase, aspartate aminotransferase, and alkalinephosphatase. There was a significant difference with the advancing age in mean corpuscular volume, neutrophil, eosinophil, cholesterol and alanine aminotransferase levels.

Key words: Biochemical values, *Bos gaurus gaurus*, Gaur, Haemogram, Indian bison

Wild gaur (*Bos gaurus gaurus*: syn. Indian bison*)* is known as the largest member of the Bovidae family of Indian sub-continent and considered as habitat marker species of protected and non-protected forests of Peninsula (Schaller 1967). In the ancient past, the gaur population was spread over in 3 geographic zones of south-east Asia including Shri Lanka, India, Nepal, Bhutan, Cambodia, China, Malaysia, Myanmar, Thailand and Vietnam (Duckworth *et al*. 2010)· Habitat degradation and fragmentation together with poaching and occurrence of diseases are reasonable factors for declination in the gaur population as they have been extirpated from certain areas; despite they are apt for survival of big cats to balance the prey-predator relationship in the sylvatic cycle (Prater 2005). The baseline data on haematology and serum biochemistry is lacking in free-ranging gaur though ecology and behavioural studies were conducted by various workers (Sankar *et al.*2001, Gad and Shyama 2009).

Therefore, normal haematological and biochemical profiles of free-ranging gaur would be helpful to establish the reference values for interpretation of clinical manifestations and physiological status of the species together with strengthening the scientific data.

MATERIALS AND METHODS

Apparently healthy gaurs (18) of either sex were immobilized using etorphine hydrochloride (98 –9.8 mg/ml) @ 0.009 mg/kg body wt that was supplemented with 100 mg of azaperone (40 mg/ml). The drug mixture was remotely injected at the upper hind quarter muscles of the gaur from a distance of 15–20 m using a 3.0 ml nylon dart propelled through special projector model JM from saddle fitted back of captive elephant. The animals were left undisturbed till proper sedation safe for handling and translocation was achieved. After 10–20 min of immobilization, 2–5 ml of blood was aseptically collected in ethylene diamine tetra acetate coated vaccutainer and serum tube by jugular puncture using 18-gauge needle. Following radio-collaring and collection of biological samples, the animals were shifted onto transport vehicles and administered naltrexone (50 mg/ml) in the ratio of 1mg naltrexone for every 20 mg of etorphine for smooth recovery of the animal.

The blood smears were prepared soon after the blood collection and stained with Romanowsky stain for examination of blood protozoa as well as for carrying out differential leukocyte count for interpretation of infectious manifestations. The harvested serum samples were stored

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at 4°C until further analysis. Haematological parameters were conducted within 12 h of collection of blood and included total erythrocyte count (TEC), haemoglobin concentration (Hb), packed cell volume (PCV), total leukocyte count (TLC), erythrocyte sedimentation rate (ESR), differential leukocyte count (DLC) and mean corpuscular haemoglobin (MCH), mean corpuscular volume (MCV), and mean corpuscular haemoglobin concentration (MCHC) were calculated (Jain 1986, Shrivastav *et al.* 2011).

Serum biochemicals such as glucose, total protein, albumin, cholesterol, total bilirubin, creatinine, blood urea nitrogen, uric acid, calcium, phosphorus, chloride concentration and enzymes activities of alanine aminotransferase (ALT), aspartate aminotransferase (AST) and alkaline phosphatase (AP) were determined using standard kits. The statistical analysis of recovered baseline data were tested as per Payne *et al.* (1974) and used SPSS software 13.0 version for analysis of variance (ANOVA) to achieve the significant (P<0.05) values for interpretation and conclusion.

RESULTS AND DISCUSSION

Comprehensive outcomes of obtained haemogram are presented in Table 1. Statistically significant (P<0.05) differences were encountered in erythrocyte sedimentation rate, mean corpuscular volume, mean corpuscular haemoglobin, neutrophils and eosinophils with the advancing age and sexually matured gaurs. Erythrocytes exhibited less rouleaux formation and it appeared only in uniform staining. Platelets were abundant and usually distributed in small clumps. Individual platelets were pleomorphic with rounded to elongated shape, small and large lymphocytes were encountered in varying number. Some lymphocytes contained a few azurophilic granules in their cytoplasm. Monocytes were usually larger than lymphocytes. The nuclei were ameboid in shape. The cytoplasm stained moderately blue and appeared foamy and vacuolated. Neutrophils had coiled and multi-lobed and some time mono-lobed nuclei and pale to slight pink foam distinct cytoplasm granules. The multi-lobed nuclei had two 3- lobes. Eosinophils contained small uniformly round bright pink granules almost filling the clear or orange to pale cytoplasm. Their nuclei were generally smoother and less lobulated than those of neutrophils. A remarkable increase with the advancing age in mean corpuscular volume, neutrophils and eosinophils was encountered (Table 1).

Comprehensive outcomes of obtained serum biochemical constituents in different groups of gaur are presented in Table 2. Significant (P<0.05) differences were found in cholesterol, blood urea nitrogen, uric acid and alanine aminotransferase levels as compared to American bison. However, there were no significant differences (P>0.05) based on sex or sex by age interaction except for creatinine and bilirubin that found high with the advancement of age in male and female gaurs (Table 3).

The haematological parameters including erythrocytes, lymphocytes, haemoglobin of gaurs found within the range similar to blood profile of American bison (Keith *et al*. 1978, Sikarskie *et al*. 1990). Significant (P<0.05) differences were measured in adult and sub-adult gaurs for neutrophils, eosinophils, mean corpuscular volume and mean corpuscular haemoglobin and presumed might be owing to advancement in age and rate of destruction of red blood corpuscles. Similar observations were also recorded in haematological parameters in American Bison (Vestweber *et al.* 1991, Zimmerman *et al.* 2010). Low ESR in gaurs might be attributed with higher contents of some of the blood constituents that commonly occur in *Bovidae* (Benjamin 1978). Similar observations were also encountered in Gayal (Nath *et al*. 1983) and American Bison (Sikarskie *et al*. 1990,Vestweber *et al.* 1991, Zimmerman *et al.* 2010). However, high rise of packed cell volume (43–60 %) and lymphocytes (61–73 %) in Gayal (*Bos gaurus*

Table 1. Age and sex wise haematological values of gaurs

Haematology	Range	Group 1	Group 2	Group 3	Group4
Total erythrocyte count (10^6/µl)	4.0 –9.81±0.35	6.98±0.35	7.58±0.35	6.71±0.35	7.31±0.35
Haemoglobin (g/dl)	8.8 –13.8±0.27	11.37±0.27	11.64±0.27	11.28±0.27	11.51±0.27
Packed-cell volume (%)	31.0 –43.0±0.67	36.92±0.67	37.40±0.67	38.60±0.67	36.46±0.67
Erythrocyte sedimentation rate (mm/h)	0 –3.0±0.18	0.38±0.18	0.20±0.18	0.20±0.18	0.31±0.18
Mean corpuscular volume (fl)	13.3–60.7±4.62	36.42±4.62	31.80±4.62	42.08±4.62	32.47±4.62
Mean corpuscular haemoglobin (pg)	13.5–59.0±4.26	31.98±4.26	27.85±4.26	23.05±4.26	33.83±4.26
Mean corpuscular haemoglobin concentration (g/dl)	12.9 –39.4±1.28	29.53±1.28	31.52±1.28	29.36±1.28	30.36±1.28
Total leukocyte count (10^3/µl)	6.1–16.8±0.80	8.90±0.80	11.04±0.80	9.39±0.80	9.53±0.80
Neutrophils (%)	30.0–67.0±2.64	30.0±2.64	45.20±2.64	39.20±2.64	46.23±2.64
Lymphocytes (%)	27.0–57.0±2.00	45.54±2.00	45.20±2.00	48.60±2.00	44.23±2.00
Monocytes (%)	2.0–8.0±0.42	4.69±0.42	4.80±0.42	4.80±0.42	4.69±0.420
Eosinophils (%)	2.0–10.0±0.60	6.31±0.60	4.80±0.60	7.40±0.60	5.31±0.60
Basophiles (%)	0–0±0	0	0	0.00	0.00

Group 1, gaurs (13) of 18–36 months of age (sub-adult); group 2; gaurs (5) of above 36 months of age (adult); group 3, gaurs (5) male; group 4, gaurs (13) female; data are expressed as mean±SE; P<0.05; significant difference; P>0.05, no significant difference.

Table 2. Age and sex wise biochemical analysis of gaurs

Biochemistry	Range	Group 1	Group 2	Group 3	Group 4
Glucose (mg/dl)	31.4–160±7.55	98.08±7.55	67.56±7.55	67.56±7.55	98.08±7.55
Phosphorus (mg/dl)	4.2–13.4±0.63	7.09±0.63	7.64±0.63	7.64±0.63	6.93±0.63
Calcium (mg/dl)	3.6–8.4±0.34	4.52±0.34	4.08±0.34	4.08±0.34	4.50±0.34
Chloride (mg/dl)	82.9–88.9±0.53	84.48±0.53	83.38±0.53	83.38±0.53	85.35±0.53
Cholesterol (mg/dl)	118–205±5.05	169.77±5.05	185.60±5.05	185.60±5.05	164.00±5.05
Total protein (g/dl)	5.3–11.0±0.31	7.69±0.31	7.32±0.31	7.32±0.31	7.75±0.31
Albumin (g/dl)	2.3–5.0±0.12	3.38±0.12	3.70±0.12	3.70±0.12	3.32±0.12
Creatinine (mg/dl)	0.2–3.1±0.22	1.46±0.22	1.08±0.22	1.08±0.22	1.85±0.22
Uric acid (mg/dl)	1.6–3.0±0.09	2.10±0.09	2.16±0.09	2.16±0.09	2.22±0.09
Blood urea nitrogen (mg/dl)	20.1–54.1±1.96	32.81±1.96	40.82±1.96	40.82±1.96	31.43±1.96
Total bilirubin (mg/dl)	0.4–3.3±0.22	1.98±0.22	1.58±0.22	1.58±0.22	1.83±0.22
ALT (U/L)	19.1–45.9±1.44	24.56±1.44	27.42±1.44	27.42±1.44	26.05±1.44
AST (U/L)	18–124±9.02	64.06±9.02	53.56±9.02	53.56±9.02	77.16±9.02
AP (U/L)	49–264±14.56	141.54±14.56	149.18±14.56	149.18±14.56	116.70±14.56

Group 1, gaurs (13) of 18–36 months of age (sub-adult); group 2, gaurs (5) of above 36 months of age (adult); group 3, gaurs (5) male; group 4, gaurs (13) female; data are expressed as mean±SE; P<0.05, significant difference; P>0.05, no significant difference.

frontalis) of either sex might be associated with the habitat, management, physiological status, plan of nutrition and environmental factors (Sankar *et al*. 2001, Gad and Shyama 2009). Apart from that, stress, excitement, and circadian and diurnal rhythms are prime factors as they are responsible for variation in blood physiological parameters (Benjamin 1978).

Amongst the biochemical constituents i.e. glucose, calcium, chloride, cholesterol and blood urea nitrogen levels were significantly higher in adults as compared to sub-adults gaurs (Table 2). High rise of cholesterol (75–170 mg/dl) and AP (125.72±11.78) levels were recorded in American bison (Zimmerman *et al.* 2010). Liver specific enzymes like alanine aminotransferase and aspartate aminotransferase always elevate when acute pathological damage occurs to the liver, but these enzymes were found within the range in the present study indicating the healthiness of gaurs used for sampling. However, alkaline phosphatase, an enzyme associated with osteoblastic activity and an index of growth, decreased with advancing age (Benjamin 1978) and the values obtained from gaurs showed remarkable differences in sub-adult and adult animals. Differences of certain values in the blood constituents of gaur from the American bison may be attributed with control diet in captivity, reproductive status and measuring techniques. However, data from greater number of animals is needed to generate reference baseline values that would describe the range of normal variations between age and sex variations.

It was concluded from analysis of haematological values of free ranging gaurs showing significant (P<0.05) differences in adult and sub- adult gaurs for neutrophils, eosinophils mean corpuscular volume and mean corpuscular haemoglobin and similarly amongst the biochemical constituents i.e. glucose calcium, chloride, cholesterol and blood urea nitrogen levels also found significantly higher (P<0.05) in adults as compared to sub-adults gaurs presumed changes might be owing to advancement in age,

Tables 3. Significance test of haematology and biochemical parameters between age and sex of gaurs

Parameter	Between sub-adult and adult		Between male and female	
	F (MS)	P	F(MS)	P
Haematology				
TEC (10^6/µl)	0.573	0.460	0.573	0.460
Hb (g/dl)	0.190	0.668	0.134	0.719
PCV (%)	0.095	0.762	2.158	0.161
ESR (mm/h)	0.942	0.346	0.070	0.795
MCV (fl)	0.191	0.668	0.861	0.367
MCH (pg)	0.180	0.677	1.306	0.370
MCHC (g/dl)	0.467	0.504	0.116	0.738
TLC (10^3/µl)	1.490	0.240	0.008	0.938
Neutrophils (%)	0.044	0.836	1.456	0.245
Lymphocytes (%)	0.005	0.942	0.956	0.343
Monocytes (%)	0.013	0.912	0.013	0.912
Eosinophils (%)	1.268	0.277	2.636	0.124
Basophils (%)	0.000	0.000	0.000	0.000
Biochemistry				
Glucose (mg/dl)	0.058	0.812	0.007	0.976
Phosphorus (mg/dl)	0.008	0.931	0.243	0.629
Calcium (mg/dl)	0.382	0.545	0.297	0.593
Chloride (mg/dl)	0.959	0.342	3.164	0.094
Cholesterol (mg/dl)	0.005	0.944	4.398	0.052
Total protein (g/dl)	0.091	0.767	0.387	0.543
Albumin (g/dl)	0.321	0.579	2.092	0.167
Creatinine (mg/dl)	1.620	0.221	2.629	0.124
Uric acid (mg/dl)	4.197	0.057	0.092	0.765
Blood urea nitrogen (mg/dl)	1.032	0.325	5.973	0.026
Total bilirubin (mg/dl)	2.867	0.110	0.257	0.619
Direct bilirubin (mg/dl)	1.063	0.318	0.409	0.513
ALT (U/L)	5.583	0.031	0.172	0.684
AST (U/L)	1.402	0.254	1.408	0.253
AP (U/L)	3.522	0.079	0.998	0.333

F (MS): Degree of freedom (Mean sum of square); P, Significance level (P<0.05) in bold letters.

diet and rate of destruction of red blood corpuscles.

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