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PHYSIOLOGICAL AND HAEMATO-BIOCHEMICAL PROFILING OF DOMESTIC GEESE (*Anser anser domesticus)* OF KASHMIR

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ABSTRACT

Area-specific profiling of physiological and biochemical parameters in different species is prerequisite for establishing reference values valid for clinical practice. The present study was aimed at physiological, haemato-logical and biochemical profiling of domestic geese of Kashmir. The study was conducted on 30 adult domestic geese comprising of 12 male and 18 female (procured locally) which were maintained at Centre of Research on Poultry, SKUAST-Kashmir. The average body temperature, respiration rate and heart rate in geese were 40.05 ± 0.15^{o}C, 17.16 ± 0.75 breaths min^{-1} and 60.57 ± 5.09 beats min^{-1}, respectively. Electrocardiogram (ECG) showed presence of P, QRS and T waves. The mean electrical axis/ instantaneous mean vector ranged from -86 to -95^{o} indicating its orientation along the long axis of body and superior to frontal plane. The amplitude of QRS wave was almost similar and highest in lead II and III, whereas lead I could hardly represent voltages of QRS wave. The voltage in QRS wave ranged from 0.9 to 1.3 mv. The mean hemoglobin, ESR, PCV, TEC, MCV, MCH, MCHC and TLC was 11.5 ± 0.2 mg dL^{-1}, 0.1 ± 0.17 mm hr^{-1}, 50.08 ± 1.81%, 3.06 ± 0.78 x 10^{6} mm^{3}, 166.13 ± 5.35 μm^{3}, 38.25 ± 1.26 pg, 23.14 ± 0.50% and 67.01 ± 4.08 x 10^{3} mm^{3}, respectively. The differential leukocyte count revealed overall mean of 89.27 ± 1.36, 7.77 ± 1.30, 2.95± 0.45 and 0.0% heterophils, lymphocytes, monocytes and basophils, respectively. The blood glucose, total protein, cholesterol-LS and HDL-cholesterol levels were 216.3 ± 5.5 g dL^{-1}, 21.59 ± 1.29 g L^{-1}, 123.0 ± 10.4 mg dL^{-1} and 29.04 ± 2.24 mg dL^{-1}, respectively. Gender-wise, only heart rate and body temperature showed a significant difference. The present study established basic physiological and haemato-biochemical indices of Kashmir geese.

Key words: Biochemistry, electrocardiogram, geese, haematology, Kashmir, physiology

INTRODUCTION

The poultry sector has witnessed a spectacular growth worldwide which has mostly been chicken centric. Continued selection for fast growth and high egg production among broiler and layer type birds, respectively, has narrowed down the chicken genetic diversity. Alternate production systems offer an opportunity to widen resource base for the growing poultry sector and at same time provide

alternatives both to the poultry producers and consumers. Alternate poultry species include duck, geese, turkey, guinea fowl, quail, ostrich and emu. Amongst these, geese have interesting biological characteristics such as high juvenile growth rate, good adaptation to free range and grazing, high dietary quality of meat (Romanov, 1999) and disease resistance (NRC, 1991). Besides supplying nutritious meat, large eggs and rich fat for cooking; they also provide soft down and feathers for bedding and clothing which makes them appropriate for providing farmers with supplementary income and much-needed animal protein to the family. In spite of these advantages, domestic geese have remained a neglected species in many countries including Indian subcontinent to the extent that not even basic statistics is available. Lack of scientific knowledge on various aspects of geese production is one of the major impediments in the development of geese sector. Perusal of literature has revealed that meager information is available on various aspects of domestic and wild geese across the world including India (Kumar *et al.*, 2009; Upadhyaya and Saikia, 2010, 2011, 2012; Banerjee, 2013). Although the basic physiological and clinical indices are well established for most of the economically important avian species (Whittow, 2000), and even area-specific clinical, haematological and blood biochemical profiling has been done in domestic chicken (Pampori and Iqbal, 2007), yet the information related to Kashmir geese is lacking. In order to generate baseline information on domestic geese, a study was undertaken to assess physiological, haematological and blood biochemical indices of domestic geese (*Anser anser domesticus*) of Kashmir.

MATERIALS AND METHODS

A total of 30 apparently healthy, sexually mature (adult) domestic geese (*Anser anser domesticus*), including 12 male and 18 female birds, were procured from different geese rearing areas of Kashmir. The birds were maintained at the Centre of Research on Poultry, SKUAST-Kashmir for one week before investigation. During this period, they were provided night shelter and grazed in a fenced natural pasture over the banks of a water channel. The birds were regularly handled by same attendant for acclimatization and handling/restraining without inducing stress. Physiological parameters were recorded during morning and blood sampling performed for laboratory investigation. The birds were restrained manually in a comfortable position, and observations recorded 15 min. after the birds were calm. The physiological studies involved recording heart rate, respiratory rate, rectal temperature and the electrocardiogram. Respiration rate was recorded by observing the raising of abdomen per minute. The heart rate was recorded by auscultation method, by placing the chest piece of a stethoscope on the left side of the chest and counting the beats per minute. Rectal temperature was recorded using a clinical thermometer correct up to 0.1^{o}C. Its bulb was placed about 1.5 cm deep into the cloaca and positioned such as to remain in contact with the mucosa, for 2 min. Electrocardiogram was recorded using BPL Cardiart 108T electrocardiograph. Only standard bipolar and augmented unipolar limb leads were used in a mammalian fashion, attached to the recording sites with alligator teeth clips and ECG jelly was applied at the attachment sites (Whittow, 2000). Electrocardiogram was recorded 3-5 min. after attaching the leads, with speed set at 50 mm s^{-1} and voltage 1 mv = 10 mm. Mean electrical axis of QRS was determined from bipolar standard limb leads (Arthur, 1991).

Blood samples, 5 mL from each bird, were collected from the wing vein following standard techniques. Two milliliter blood was transferred to vials containing EDTA as anticoagulant for haematological studies. The haematological parameters studied included haemoglobin (Hb) concentration by Sahli's acid haematin method, packed cell volume (PCV) by microhaematocrit method, total erythrocyte count (TEC) and total leukocyte count (TLC) by Neubaur haemocyto-meter method using Natt and Herick's diluent (Natt and Herrick, 1952). Besides, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin

concentration (MCHC) were estimated as per standard techniques (Jain, 1986). Blood smears were also prepared without anticoagulant, air dried and stained with Wrights-Giemsa stain to study differential leukocyte count (DLC) and for cytological observations. The rest of blood was transferred into tubes without anticoagulant and serum harvested following centrifugation @ 5000 rpm for 5 min. The serum was stored in multiple aliquots at -40°C until use. The biochemical indices studied included blood glucose, total protein, cholesterol-LS and HDL-cholesterol using diagnostic kits (Piramal Healthcare Limited, Mumbai, India) and colorimeter (ELICO CL 157) following manufacturer's instructions. Tests were performed in triplicate and their average was taken as final estimate. The data was analyzed by Student's t-test (Snedecor and Cochran, 1980) using a statistical software SPSS 15.0.

RESULTS AND DISCUSSION

Physiological studies

The overall mean body temperature, respiration rate and heart rate recorded in the geese revealed that gender-wise there was no significant difference in respiration rate of geese but heart rate was significantly more in males than females whereas reverse was the case with respect to body temperature (Table 1). These findings are in concordance with the reports by other workers in geese (Olsen, 1994; Forbes and Richardson, 1996).

Table 1: Physiological parameters of domestic geese (mean±SE)

Parameter	Male	Female	Overall mean	Range
Body temperature (^oC)	39.76 ± 0.30^a	40.22 ± 0.14^b	40.05 ± 0.15	38.56 - 41.44
Respiration rate (breaths min^{-1})	16.50 ± 2.06	19.80 ± 0.96	17.16 ± 0.75	12 - 24
Heart rate (beats min^{-1})	77.00 ± 12.72^b	54.00 ± 7.34^a	60.57 ± 5.09	44 - 108

Male and female means bearing different superscripts in a row differ significantly (P>0.05).

Electrocardiogram (ECG) in geese under study revealed P, QRS and T waves (Fig. 1). Reports regarding the shape of typical avian ECG are inconsistent. Kisch (1951) reported the presence of P, QRS, and T waves in ECG of birds, whereas Mangold (1919) reported the absence of R component and instead found a deep S wave. Sturkie (1986) reported the presence of P, a dominant S, and T waves, a small R, but no Q wave. However, there is general agreement that Q wave is absent in the ECG of chicken (Goldberg and Bolnick, 1980), small in turkey (Sturkie, 1986) but prominent in some ducks (Cinar *et al.*, 1996). Further, unlike human ECG, in present study QRS complex was inverted. The heart rate calculated from the data obtained in ECG recordings averaged 83 beats min^{-1}. The mean electrical axis/ instantaneous mean vector in present study ranged between -86^o to -95^o indicating its orientation along the long axis of the body and superior to frontal plane. These results varied from those of Emre *et al.* (1994) who reported the heart rate of Romanov geese to be 107-214 beats min^{-1} with an average of 149.5 beats min^{-1} and the electrical axis of heart between -116° and -60° with an average of -90.8°. The amplitude of QRS wave was almost similar and highest in lead II and III, whereas lead I could hardly represent voltages of QRS wave. The voltage recorded in QRS wave ranged between 0.9 mv to 1.3 mv. The duration of various phases of cardiac cycle is presented in Table 2.

Haematological studies

The microscopic view (40X) of RBC's and WBC's of geese is given in Fig. 2. The overall mean hemoglobin, ESR, PCV, TEC, MCV, MCH, MCHC, TLC and DLC is given in Table 3. Haemoglobin

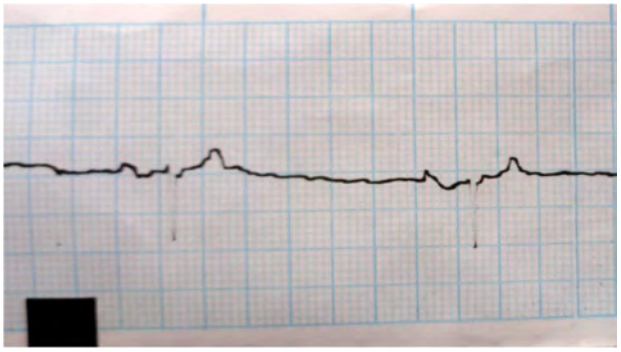

Fig. 1: Electrocardiogram of domestic geese

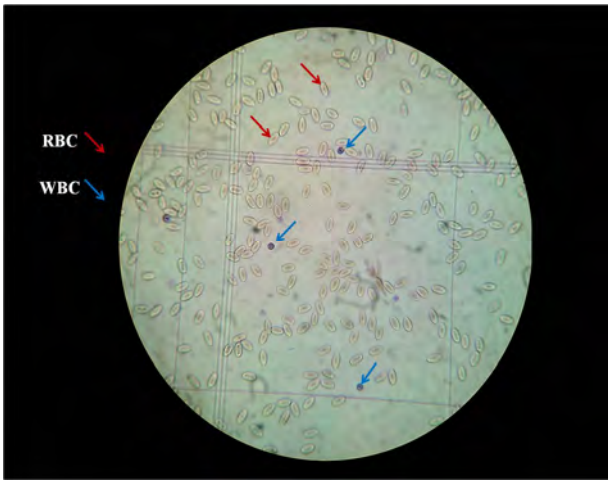

Fig. 2: Microscopic view (40X) of a Neubauer's chamber charged with Natt and Herrick's diluting fluid, showing red blood cells and white blood cells of domestic geese of Kashmir

Table 2: Duration of various phases of cardiac cycle

Phase	Duration
P wave	14.30 ms
QRS complex	20.00 ms
T wave	23.33 ms
RR interval	717.0 ms
PR interval	140.0 ms
QT segment	110.0 ms

Hemoglobin in Kashmir geese was lesser than the native Gray (15.43 ± 0.37 g dL^{-1}), White (15.23 ± 0.75 g dL^{-1}) and Piebald (15.58 ± 0.78 g dL^{-1}) geese of Kurdistan as reported by Ismael (2011), but higher than the reports of Al-Daraji *et al.* (2012) in local Iraqi geese. ESR in Kashmir geese was found to be lesser than the native Gray (1.67 ± 0.49 mL hr^{-1}), White (2.33 ± 1.15 mL hr^{-1}) and Piebald (1.67 ± 0.77 mL hr^{-1}) geese of Kurdistan by Ismael (2011) but PCV was higher in observed geese than all the 3 strains (46.0 ± 1.2, 45.83 ± 2.28 and 47.0 ± 2.17% in Gray, White and Piebald strains, respectively) of the same breed. TEC in Kashmir geese was almost similar to the value (3.60 ± 0.27 x 10^6 mm^{-3}) reported in local Iraqi geese, but TLC was much higher in Kashmir geese than local Iraqi geese (9.35± 0.77x$10^3$$mm^{-3}$)[Al-Daraji*etal.*, 2012]. However, much higher TLC values than Kashmir geese have been reported in Khaki Campbell duck (13,166 ± 311.26 x 10^3 mm^{-3}) and Desi duck (13,720 ± 168.58 x 10^3 mm^{-3}) of India (Mondal, 2009).

Table 3: Haematological characteristics of domestic geese (mean±SE)

Parameters	Males	Females	Overall mean	Range
Hemoglobin (mg dL^{-1})	11.22 ± 0.34	11.69 ± 0.25	11.52 ± 0.20	9.6 - 13.9
ESR (mm hr^{-1})	0.09 ± 0.03	0.12 ± 0.02	0.10 ± 0.17	0.0 - 0.2
PCV (%)	51.00 ± 2.48	48.80 ± 2.85	50.08 ± 1.82	41.0 - 65.0
TEC (10^6 mm^{-3})	3.16 ± 0.11	3.00 ± 0.11	3.06 ± 0.78	2.24 - 3.87
TLC (10^3 mm^{-3})	75.44 ± 8.98	61.95 ± 3.36	67.01 ± 4.08	38.0 - 134.0
MCV (μm^3)	166.76 ± 8.72	165.39 ± 5.97	166.13 ± 5.35	123.94 - 232.56
MCH (pg)	37.15 ± 1.66	39.55 ± 1.95	38.25 ± 1.27	28.17 - 55.71
MCHC (%)	22.45 ± 0.58	23.96 ± 0.82	23.14 ± 0.50	18.31 - 27.80
Heterophils (%)	90.17 ± 1.28	88.94 ± 1.83	89.27 ± 1.36	76 – 98
Lymphocytes (%)	7.00 ± 1.34	8.06 ± 1.74	7.77 ± 1.30	0 – 24
Monocytes (%)	2.83 ± 0.83	3.00 ± 0.56	2.96 ± 0.45	0 – 8
Basophils (%)	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	-

Values do not vary significantly between male and female ($P_{0.05}$)

Table 4: Biochemical characteristics of domestic geese of Kashmir (mean±SE)

Parameter	Male	Female	Overall mean	Range
Glucose (mg dL^{-1})	231.82 ± 8.81	217.89 ± 7.37	216.31 ± 5.52	183.9 - 258.1
Total protein (g L^{-1})	21.15 ± 1.34	21.91 ±2.06	21.59 ± 1.29	11.80 - 33.44
Cholesterol-LS (mg dL^{-1})	111.43 ± 7.00	131.43 ± 17.20	123.01 ± 10.42	74.29 - 24.00
HDL-cholesterol (mg dL^{-1})	28.72 ± 2.62	29.27 ± 3.48	29.04 ± 2.24	2.84 - 43.97

Values do not vary significantly between male and female ($P_{0.05}$).

The MCV and MCH values were more but MCHC was less in Kashmir geese. These values are less than the values reported for local Iraqi geese (Al-Daraji *et al.,* 2012). Heterophils and monocytes were more in Kashmir geese than the native Gray, White and Piebald geese of Kurdistan where heterophils were reported to be 41.50 ± 2.46, 39.33 ± 5.14 and 40.83 ± 2.20% and monocytes 2.17 ± 0.71, 1.67 ± 0.77 and 1.50 ± 0.52%, respectively (Ismael, 2011). Much lower percentage of lymphocytes was seen in Kashmir geese than the native Gray (53.83 ± 2.51%), White (56.67 ± 3.98%) and Piebald (55.83 ± 2.65%) geese of Kurdistan (Ismael, 2011). While Ismael (2011) and Al-Daraji *et al.* (2012) reported 0.50 ± 0.10 and 4.23 ± 0.81% basophils in their studies, respectively, these cells could not be observed in the present study. The variation may be attributed to breed difference, health status, nutritional status and geographic location besides time of study. No significant difference was observed in any of the haematological parameters between male and female geese.

Biochemical studies

The overall mean concentration of glucose, total protein, cholesterol-LS and HDL-cholesterol observed in the present study are given in Table 4. The overall mean glucose concentration observed was higher when compared to the reported values of 184 mg dL^{-1} in native Turkish geese whereas total cholesterol was comparable (Arslan and Tufan, 2011). Total protein was low in Kashmir geese than 35.1 g L^{-1}reported in native Turkish geese (Arslan and Tufan, 2011). HDL-cholesterol in Kashmir geese was much lower than that of Landes (497 mg dL^{-1}) and Poland geese (644 mg dL^{-1}) [Fournier *et al.,* 1997]. The differences in these parameters among the sexes were non-significant. The present study established basic physiological and haemato-biochemical indices of Kashmir geese.

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