



# Gender Differences in some Haematological and Blood Biochemical Parameters in Wild Indian Peafowl (*Pavo cristatus*) of Thar Desert, Pakistan

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## ABSTRACT

In the present study, the hematological and serum biochemical parameters were determined to establish the reference values in the wild Indian blue peafowl (*Pavo cristatus*) of Thar (desert) region in the Sindh province of Pakistan. A total of 60 blood samples were collected from peafowl (30 males and 30 female) in months of March and April, 2015. The gender difference showed that RBC, MCV and MCH concentrations were significantly higher ( $P < 0.05$ ) and the serum total protein and Mg concentrations were significantly lower ( $P < 0.05$ ) in male compared to female peafowl. In conclusion, the present study provides base-line values for hematology and serum biochemistry of apparently healthy Indian adult blue peafowl of Thar and can be used as reference values to evaluate the health or diseased conditions in the same species.

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## Authors' Contribution

MM conceived and designed the study. VK executed the study and wrote the manuscript. MNS and KDM helped in data analysis and manuscript revision. SAS supervised the study and provided the technical assistance.

## Key words

Indian blue peafowl, Haematological parameters, Electrolytes, *Pavo cristatus*.

## INTRODUCTION

Peafowl are classified into African Congo, Indian and the green peacocks but all of them are believed to have originated from Asia, particularly the Indian subcontinent. Indian blue peafowl locally called as “Mor or Mayur” is a well-known species in Indo-Pak region because of its historical and mythological value. The Indian peafowl (*Pavo cristatus*) also known as the blue or common peafowl is distributed worldwide. Asia is a native origin of peafowl, where they are predominantly found in South Asian countries like India, Nepal, Sri Lanka, Burma and Pakistan (Madge and McGowan, 2002; Ali and Ripley, 1980). In Pakistan, it is found in the forests of Mansehra, northern-eastern border areas of Punjab province and predominantly found in Thar (desert) in Sindh province (Roberts, 1991; Akbar *et al.*, 2005; Anwar *et al.*, 2015). They are well known for their exquisite crest, plumage and train and considered as one of the largest flying birds when the total body length is measured along with long tail and wingspan

(Roberts, 1991). Naturally they are found from 900 to 1200 m above sea level in areas vary from a dense forest to a desert habitat. They prefer to live in an open sandy area distant from human population with availability of perch, small territory and plentiful supply of water and food resources (Brickle, 2002; Jackson, 2006). A part from their natural habitat, the peafowl are captive-reared in zoos, gardens, bungalows, villas and farmhouses, where they are provided conditions artificially that match their natural habitat. However, they are capable to adapt the harsher climate in captivity (Brickle, 2002; Jackson, 2006).

Currently, there is no authentic data regarding the distribution status and population size of peafowl, however, the conservative population of peafowl in India has been estimated to habitat over 100,000 (Madge and McGowan, 2002). The estimated population of both the blue and green Indian peafowl in Thar (Desert) of Sindh province, Pakistan is 65,000 to 70,000 (Kalhor and Dhanani, 2013). Because of widespread distribution, occurrence of locally abundant semi-feral populations, and religious protection, it has been listed as Least Concern species in the Red List of International Union for Conservation of nature (Bird Life International, 2008). The bird is under severe threats nowadays due to consumption

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of its meat, habitat degradation, poaching, crop rotation and contamination of its food and water resources through extensive use of fertilizers and pesticides (Sharma, 1974; Rajeshkumar and Balasubramanian, 2011). This is why the peafowl has been almost extinct from Bangladesh and in other countries including Pakistan; the species is at risk of extinction (Ramesh and McGowan, 2009; Anwar *et al.*, 2015). Besides various natural and man-made threats, the peafowl population of Thar in Pakistan has been affected by nutritional deficiencies and other bacterial and viral diseases in past few years. Many deaths of peafowl have been reported due to New Castle Disease (NCD) outbreak in recent years (Kalhor and Dhanani, 2013; Anwar *et al.*, 2015).

Haematological and blood biochemical parameters indicate the health and metabolic status of body and provide valuable information in the diagnosis of various nutritional deficiency and pathological disorders. Limited studies have been conducted in India and China which provide information regarding the haematological and blood biochemical parameters of Indian blue peafowl, however very limited studies have been conducted on blue peafowl of Thar (desert) region of Sindh, Pakistan. Therefore, the present study has been designed to determine the base-line values for haematology and blood biochemical parameters of peafowl.

## MATERIALS AND METHODS

### Study area

The study area was the district Tharparkar, which is 433 Km far from Karachi and situated in south-eastern part in Sindh province, Pakistan (Ahmed *et al.*, 2013). It is bounded on the north by Mirpurkhas and Umerkot districts, on the east by Barmer and Jaisalmer districts of India, on the west by Badin district and on the south by the disputed Rann of Kachchh. The total area of the district is 19,638 km<sup>2</sup>. It consists of five talukas *viz.*, Diplo, Islamkot, Chachro, Mithi and Nagarparkar with 44 union councils and approximately 2366 villages.

### Bird selection

A total of 60 blood samples were collected from peafowl (30 males and 30 female) during field visit in months of March and April, 2015. Minimum ten villages rich in peafowl population were visited and at least six peafowl (3 males and 3 female) were selected from each village for sample collection. Apparently healthy and adult peafowl were randomly selected for blood sampling. The birds were captured from the wild natural condition either through catching nets or by gloved hands in a humane way and were restrained properly and gently (Samour *et al.*,

2010). Proper attention was given while capturing and restraining the bird to avoid any harm or much stress to the bird.

### Collection and analysis of blood samples

The bird was restrained in dorsal recumbency, the wing was spread a part and after cleansing the sampling site with an antiseptic, the blood samples were drawn through basilica vein (venacutanea ulnaris superficialis) in the disposable syringe, using the safety clothes and gloves to avoid any contamination (Samour *et al.*, 2010). Two samples were collected, firstly an aliquot of 2 ml whole blood in EDTA vacutainers for hematological analysis. The other 2 ml of blood was centrifuged at 3,000 rpm for 30 min at 5 °C (Jouan GR 412 centrifuge, Winchester, VA) and the serum was collected for biochemical analysis. The blood samples were stored at -20 °C until analyzed. The whole blood samples were analyzed for hematological indices by using Beckman Coulter AcT Diff Hematology Analyzer (Beckman Coulter, Tokyo, Japan). The serum samples were analyzed for biochemical parameters by commercial enzymatic colorimetric kits (Merck, Germany).

### Statistical Analysis

On completion of the study, the data collected was tabulated and statistically analyzed. Student *t* test was applied to compare the hematological and biochemical values between male and female peafowl, using SPSS-12 statistical software package. Data were presented as Mean  $\pm$  SEM and differences were considered significant at  $P < 0.05$ .

**Table I.- Gender difference in hematological indices of wild, apparently healthy adult Indian blue peafowl.**

Items	Blue peafowl	
	Male	Female
Hb (g/L)	115.64 $\pm$ 6.28	118.37 $\pm$ 8.55*
HCT	24.76 $\pm$ 1.45	25.79 $\pm$ 0.46*
LYM (%)	87.29 $\pm$ 2.07	71.27 $\pm$ 5.39*
LYM (10 <sup>9</sup> /L)	197.86 $\pm$ 11.42	151.34 $\pm$ 18.29*
MCH (pg)	81.62 $\pm$ 3.81	69.12 $\pm$ 4.63**
MCHC (g/L)	458.58 $\pm$ 16.62	441.28 $\pm$ 25.39*
MCV (fL)	177.48 $\pm$ 3.06	170.58 $\pm$ 2.47**
PLT (10 <sup>9</sup> /L)	26.77 $\pm$ 1.43	28.27 $\pm$ 0.97*
RBC (10 <sup>12</sup> /L)	1.49 $\pm$ 0.036	1.28 $\pm$ 0.073**
RDW-CV (%)	9.05 $\pm$ 1.24	11.18 $\pm$ 1.96*
WBC (10 <sup>9</sup> /L)	210.38 $\pm$ 7.17	218.47 $\pm$ 5.54*

\*, non-significant; \*\*, significant at  $P < 0.05$ ; Hb, Hemoglobin; HCT, hematocrit; LYM, lymphocytes; MCH, mean corpuscular hemoglobin; MCHC, mean corpuscular hemoglobin concentration; MCV, mean corpuscular volume; PLT, platelets; RBC, red blood cells; RDW, red cell distribution width; WBC, white blood cells.

## RESULTS

The gender difference in hematological indices of wild, apparently healthy adult Indian blue peafowl are shown in Table I. The results revealed that among erythrocytes indices the concentrations of RBC significantly increased ( $P < 0.05$ ) in male ( $1.49 \pm 0.036 \times 10^{12}/L$ ) compared to female ( $1.28 \pm 0.073 \times 10^{12}/L$ ) peafowl. There was no significant difference ( $P > 0.05$ ) in the concentration of HGB between male and female peafowl, however, the MCV and MCH concentrations significantly increased ( $P < 0.05$ ) in the blood of male peafowl ( $177.48 \pm 3.06$  fL and  $81.62 \pm 3.81$  pg) compared to female peafowl ( $170.58 \pm 2.47$  fL and  $69.12 \pm 4.63$  pg). No significant difference ( $P > 0.05$ ) was observed in the rest of the erythrocytes indices between male and female peafowl.

Among leucocyte indices, the concentrations ( $10^9/L$ ) of WBC and lymphocytes were not significantly different ( $P > 0.05$ ) between the male and female peafowl; however, the lymphocytes concentration was approximately 30 % higher in male compared to female peafowl. Whereas no gender effect ( $P > 0.05$ ) was found on platelet concentration in the blood of peafowl.

**Table II.- Gender differences in serum biochemical indices of wild, apparently healthy adult Indian blue peafowl.**

Items (mmol/L)	Blue peafowl	
	Male	Female
Total protein (g/L)	$35.61 \pm 3.97$	$46.38 \pm 6.74^{**}$
Glucose	$16.68 \pm 0.59$	$17.24 \pm 1.57^*$
BUN (mg/dl)	$0.31 \pm 0.04$	$0.52 \pm 0.16^*$
Cholesterol	$3.13 \pm 0.43$	$4.56 \pm 0.82^*$
Triglycerides	$1.52 \pm 0.12$	$2.03 \pm 0.49^*$
HDL	$1.08 \pm 0.21$	$1.25 \pm 0.14^*$
LDL	$1.40 \pm 0.24$	$1.67 \pm 0.26^*$

\*, non-significant; \*\*, significant at  $P < 0.05$ ; BUN, blood urea nitrogen; HDL, high density lipoprotein; LDL, low density lipoprotein.

Table II presents the gender difference in the serum biochemical indices of wild, apparently healthy adult Indian blue peafowl. All of the biochemical analyzed in this study showed no gender effect except for total protein that was significantly higher ( $P < 0.05$ ) in female compared to male peafowl.

Table III presents the gender difference in the serum electrolytes indices of wild, apparently healthy adult Indian blue peafowl. The electrolytes analyzed in this study showed no gender effect except for Mg that was significantly higher ( $P < 0.05$ ) in male compared to female peafowl.

**Table III.- Gender differences in serum electrolytes concentrations of wild, apparently healthy adult Indian blue peafowl.**

Items (mmol/L)	Blue peafowl	
	Male	Female
K	$2.88 \pm 0.12$	$3.38 \pm 0.57^*$
Na	$152.45 \pm 0.46$	$151.27 \pm 1.91^*$
Cl	$98.53 \pm 1.43$	$97.56 \pm 3.82^*$
Ca	$2.69 \pm 0.02$	$2.73 \pm 0.09^*$
Mg	$0.63 \pm 0.13$	$0.42 \pm 0.014^{**}$
P	$1.40 \pm 0.24$	$1.72 \pm 0.26^*$

\*, non-significant; \*\*, significant at  $P < 0.05$ ; K, potassium; Na, sodium; Cl, chloride; Ca, calcium; Mg, magnesium; P, phosphorus.

## DISCUSSION

The present study investigated the haematological and serum biochemical variables of wild, apparently healthy adult Indian blue peafowl (*Pavo cristatus*) of Thar (desert), Sindh Pakistan. In the present study, the concentrations of RBC ( $10^{12}/L$ ), HB (g/L) and hematocrit (HCT, %) were ( $1.49 \pm 0.04$ ,  $1.12 \pm 0.06$  and  $1.305 \pm 0.05$ ), ( $118.37 \pm 8.55$ ,  $112.23 \pm 8.21$  and  $115.3 \pm 8.38$ ) and ( $25.79 \pm 0.46$ ,  $19.56 \pm 0.41$  and  $22.675 \pm 0.435$ ), respectively. The max, min. and mean values for mean corpuscular volume (MCV, fL), mean corpuscular hemoglobin (MCH, pg), mean corpuscular hemoglobin concentration (MCHC, g/L) and red cell distribution width (RDW – CV, %) were ( $177.48 \pm 3.06$ ,  $169.47 \pm 2.43$  and  $173.475 \pm 2.745$ ), ( $81.62 \pm 3.81$ ,  $63.04 \pm 4.18$  and  $72.33 \pm 3.995$ ), ( $458.58 \pm 16.62$ ,  $435.16 \pm 23.17$  and  $446.87 \pm 19.895$ ) and ( $11.18 \pm 1.96$ ,  $8.97 \pm 1.17$  and  $10.075 \pm 1.565$ ), respectively. In agreement with present results, Xu *et al.* (2015) observed the similar pattern of hematological values in apparently healthy and normal adult peafowl reared in China. They observed that the max and min. values for RBC, HGB and HCT ranged from  $1.4 \times 10^{12}$ – $1.6 \times 10^{12} L^{-1}$ , 122–129 g/L and 26.5–27, respectively. The max and min concentrations of MCV, MCH, MCHC and RDW were 171–182 fL, 79–89 pg, 491–464 g/L and 12–9 %, respectively. Similar patterns of results were also reported by Samaour *et al.* (2010), who examined the haematological profile in blue peafowl reared in India. However, the haematological examination of peafowl reared in Bulgaria showed that the concentration of RBC ( $3.48 \pm 0.35 \times 10^{12}/L$ ) was slightly higher and the concentration of HGB ( $108.1 \pm 1.35$  g/L) was significantly lower compared with the data published for wild peafowl reared in India and China, and the values were closely related with those of pheasants and various breeds of domestic fowl (Lashev *et al.*, 2013, 2015). These data demonstrate that the haematological values

of the same species vary with respect to the region or environment where they are reared.

In the present study, the comparison of erythrocytes indices between male and female peafowl showed significant increase in RBC, MCV and MCH concentrations in the blood of male compared to female. However, the rest of the erythrocytes indices were not significantly different between male and female but the values were slightly higher in male than in female. The hematological profiles of peafowl in relation to gender differences have shown variable reports. In agreement with our results, Xu *et al.* (2015) found that the concentrations of RBC, MCV and MCH were significantly higher in males compared to female peafowl. On the contrary Lashev *et al.* (2013) and (2015) observed no significant differences in erythrocytes indices between male and female peafowl, however, most of the values were slightly higher in male compared to those of female bird. The important role of RBC and HGB is to transport oxygen from lungs to the body cells, which is required to derive energy through oxidative metabolism of fuels to maintain the biochemical activities (Roberson and Bennett-Guerrero, 2012). The increased concentrations of RBC, MCV and MCH could be resulted from increasing oxygen demand due to frequent and intensive activities of male peafowl. Some of the distinctive behavioral activities performed by peacocks are seasonal moulting and re-growth of train feathers, and lekking, a process of congregation of males in an open area to display them to attract the female (Brickle, 2002; Yasmin and Yahya, 1996). Generally, the peacocks weighed higher than the peahens. This could be another possible explanation for higher concentrations of RBC, MCV and MCH in males to meet the oxygen requirement of increasing body tissues.

The leucocytes (WBC) fight against pathogens and provide immunity to the body. The platelets are activated at, and seal the site of vascular injury through a complex system of clotting factors and thus prevent the loss of blood (Meseguer *et al.*, 2002; Gauri *et al.*, 2012). A study determined the haematological profile of peafowl in China showed that the maximum and minimum concentrations of PLT, WBC and Lymphocytes were  $31\text{--}29 \times 10^9 \text{ L}^{-1}$ ,  $233\text{--}227 \times 10^9 \text{ L}^{-1}$  and  $219\text{--}162 \times 10^9 \text{ L}^{-1}$ , respectively (Xu *et al.*, 2015). The haematological profile determined in blue peafowl reared in India showed similar trend of results (Samaour *et al.*, 2010). However, the haematological examination of peafowl reared in Bulgaria showed that the concentration of WBC was significantly higher compared with the data mentioned above. These values were closely related with those of pheasants and various breeds of domestic fowl (Lashev *et al.*, 2013, 2015).

In the present study, the serum concentrations of glucose (mmol/L), blood urea nitrogen (BUN, mmol/L)

and total protein (TP, g/L) ranged between ( $17.24 \pm 1.57$  and  $13.43 \pm 1.33$ ), ( $0.52 \pm 0.16$  and  $0.28 \pm 0.22$ ) and ( $46.38 \pm 6.74$  and  $30.35 \pm 4.52$ ), respectively. The serum concentrations (mmol/L) of lipid metabolites such as cholesterol, triglycerides, high density lipid (HDL) and low density lipid (LDL) ranged between ( $4.56 \pm 0.82$  and  $2.17 \pm 0.51$ ), ( $2.03 \pm 0.49$  and  $1.17 \pm 0.27$ ), ( $1.25 \pm 0.14$  and  $0.87 \pm 0.17$ ) and ( $1.67 \pm 0.26$  and  $1.23 \pm 0.21$ ), respectively. The range values (mmol/L) for serum electrolytes were K ( $3.38 \pm 0.57$  and  $2.54 \pm 0.11$ ), Na ( $152.45 \pm 0.46$  and  $145.19 \pm 1.37$ ), Cl ( $98.53 \pm 1.43$  and  $91.22 \pm 3.57$ ), Ca ( $2.73 \pm 0.09$  and  $2.24 \pm 0.03$ ), Mg ( $0.63 \pm 0.13$  and  $0.37 \pm 0.011$ ) and P ( $1.72 \pm 0.26$  and  $1.25 \pm 0.21$ ). Samour *et al.* (2010) investigated blood biochemical characteristics in normal captive Indian blue peafowl reared in India and the maximum and minimum values (mg/dl) were: glucose 324-492, total protein 2.88-5.23, blood urea nitrogen 0-4.4, uric acid 0.8-5.8, cholesterol 105-202, calcium 11.7-15.7 and phosphorus 3.9-12.7. Similar pattern of biochemical values was also shown by Xu *et al.* (2015) in Indian peafowl reared in China. In addition, Samour *et al.* (2010) compared these results with published data of other taxonomically related species and found a close relationship for most of the studied biochemical parameters with the other avian species.

#### Statement of conflict of interest

Authors have declared no conflict of interest.

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