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Assessment of Hematological Indices of Indian Peafowl (Pavo Cristatus) Kept at Wildlife Breeding Centre, Gatwala, Faisalabad, Pakistan

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ABSTRACT

Indian peafowl (Pavo cristatus) or blue peafowl has been maintained in captivity since long where due to selective breeding, several color mutations/varieties have appeared of which white peafowl, black-shouldered peafowl and pied peafowl are common. Since, hematological analysis is crucial for clinical diagnosis of wild and captive avifauna, so we collected blood samples from healthy male blue peafowl, white peafowl and black-shouldered peafowl kept at Wildlife Breeding Centre, Gatwala, Faisalabad and compared erythrocyte and leucocyte indices among them. Our results indicated that blood physiological values for MO (%), Hgb, HCT, MCH and MCHC were significantly different ($P \leq 0.05$) between blue peafowl and white peafowl whereas MCV and RDW were significantly different ($P \leq 0.05$) between blue peafowl and black-shouldered peafowl. The comparison of hematological parameters between white peafowl and black-shouldered peafowl showed that GR(%), RBC, HCT, MCV and MCHC differ significantly ($P \leq 0.05$) between the two varieties. Our results support the studies indicating high quality color patterns reflect increased resistance and immunity to pathogens.

Keywords: *Indian peafowl, Color Mutations, hematology.*

INTRODUCTION

Galliformes have been historically associated with humans and peafowl are among the first birds to be domesticated. There are three types of peafowl namely Indian or blue peafowl (*Pavo cristatus*), Green or Burmese peafowl (*Pavo muticus*) and African or Congo peafowl (*Afropavo congensis*) (Pinthong, 2012; Naseer *et al*., 2017). Indian peafowl has a wide distribution in India, Pakistan, Sri Lanka and Bangladesh (Hanotte *et al*., 1991, Samour *et al*., 2010). It has been introduced to USA, Europe and Australia besides its native habitat (Long, 1981) and it has become feral in some areas (Ali and Ripley, 1980).

It is the largest among the pheasants and prefers open scrub forest but also inhabits human mediated landscapes, grasslands and areas near streams (Ramesh and McGowan, 2009; Kushwaha and Kumar, 2016). Being omnivorous, diet of Indian peafowl consists of a wide variety of arthropods, seeds, grains, fruit, small reptiles and small mammals (Loyau *et al*. 2005; Takahashi and Hasegawa, 2008; Harikrishnan *et al*., 2010, Naseer *et al*., 2017).

Although Indian peafowl has been listed as Least Concern species in IUCN Red List of Threatened Species because of its widespread distribution and locally abundant semi-feral populations (Imam, 2005; Choudhury and Sathyakumar, 2007; Ramesh and McGowan, 2009) but globally its population is declining and comprehensive census throughout its distribution range is essential to assess the population trend in the wild (Kushwaha and Kumar, 2016).

In Pakistan, Indian peafowl is found in the forests and scrub lands of Punjab, Sindh, KPK and Azad Jammu & Kashmir (Akbar *et al*., 2005; Anwar *et al*., 2015). However, it is facing high risk of extinction in Pakistan in the wild (Anwar *et al*., 2015; Kumar *et al*., 2017). Indian peafowl is protected throughout Pakistan and it has been listed in the First Schedule of Punjab Wildlife (Protection, Preservation, Conservation and Management) (Amendment) Act, 2007.

Indian peafowl has been maintained in captivity for centuries (Madge and McGowan, 2002). Due to selective breeding in captivity, several color mutations have been developed of which black-shouldered or Japanese peafowl, pied peafowl and white peafowl are common (Somes and Burger, 1993; Khulape *et al.*, 2014).

Hematological analysis is a crucial diagnostic tool for clinical management of wild as well as captive avifauna since it assists to determine the health status, identification of infections and subsequent response to treatment (Jones, 2015, Carisch *et al.*, 2019). Although blood parameters of Indian peafowl have been studied but limited studies have been conducted on hematological parameters of captive Indian peafowl in Pakistan. Therefore, this study was planned to study hematological indices of color varieties of Indian peafowl kept at Wildlife Breeding Centre, Gatwala, Faisalabad.

MATERIALS AND METHODS

Sample Collection and Analysis

A total of 36 blood samples were collected from healthy male blue peafowl, white peafowl and black-shouldered peafowl (12 each) kept at Wildlife Breeding Centre, Gatwala, Faisalabad. Each bird was sampled once. All birds were between one and three years of age and measured 190-230cm in length. The average weight of birds was 4-4.5kg. The birds were examined by vet and determined to be normal. Handled net was used to catch the birds which were retrained manually for blood sampling. The sampling sites were cleaned with antiseptic and samples were collected by wing venipuncture before morning feeding. The samples were collected in vacutainers containing 0.1% heparin to prevent blood clotting.

Blood physiological values including Red blood cell count (RBC), Hemoglobin (Hgb), Hematocrit (HCT), Mean corpuscular volume (MCV), Mean corpuscular hemoglobin (MCH), Hemoglobin concentration (MCHC), Red cell distribution width (RDW), White blood cell count (WBC), Lymphocyte count (LY) , Lymphocyte ratio (LY%), Granulocyte count (GR), Granulocyte ratio (GR%), Monocyte count (MO), Monocyte ratio (MO%) and Platelet count (PLT) were determined using automatic blood analyzer.

Statistical Analysis

All the measurements were carried out in duplicate. The values were averaged and reported along with their standard deviation (S.D). The data were analyzed with paired t test. Probabilities were considered highly significant at $P \leq 0.01$ and significant at $P \leq 0.05$. Comparison between blood physiological values of Indian blue peafowl with its mutant form black shouldered and white peafowl and between black shouldered and white peafowl was done. All statistical calculations were performed with the SPSS statistical software for Windows.

RESULTS

The comparison of blood physiological values of Indian peafowl with its mutant form white peafowl is shown in Table 1. Among erythrocyte indices, MCH (P = 0.014) and MCHC (P = 0.057) were significantly different between the two varieties. Similarly, hemoglobin concentration (Hgb) and hematocrit concentration (HCT) in blood was also significantly different between Indian peafowl and white peafowl (P = 0.016 and P = 0.034, respectively). Among leucocyte indices, monocyte ratio (MO) was significantly higher in the blood of white peafowl (P = 0.33) while no difference was observed among other indices and platelet concentration in the blood of two peafowl varieties.

The hematological indices were also compared between blue peafowl and black-shouldered peafowl and our results indicated significant differences in blood concentration of MCV (P = 0.016) and RDW (P = 0.048) (Table 1). None of the other parameters differed between the two varieties.

Table1. *Mean blood physiological values of Indian blue peafowl (n=12), white peafowl (n=12) and black-shouldered peafowl (n=12) kept at Wildlife Breeding Centre, Gatwala, Faisalabad.*

Parameters	Blue peafowl	White peafowl	Black-shouldered peafowl
RBC (10^6/ µl)	2.12 ± 0.28	2.15 ± 0.07	2.46 ± 0.08
Hgb (g/dl)	16.05 ± 0.78	$14.10 \pm 0.71^{**}$	16.80 ± 0.28
HCT (%)	34.35 ± 0.64	$36.80 \pm 1.41^{*}$	46.05 ± 1.77
MCV (fl)	152.0 ± 1.98	169.90 ± 0.71	$187.10 \pm 0.71^{**}$
MCH (pg)	67.15 ± 0.21	$64.90 \pm 0.28^{**}$	68.25 ± 1.20
MCHC (g/dl)	45.15 ± 0.92	$37.90 \pm 0.02^{*}$	36.45 ± 0.78
RDW (%)	17.95 ± 0.35	16.90 ± 0.71	$12.00 \pm 0.28^{*}$

WBC (10^3/µl)	88.16 ± 0.37	87.85 ± 4.60	89.90 ± 4.24
LY (10^3/µl)	74.95 ± 0.04	74.40 ± 3.53	78.85 ± 4.74
LY (%)	84.90 ± 0.85	85.50 ± 0.71	88.00 ± 1.56
GR (10^3/µl)	6.39 ± 0.27	5.50 ± 0.57	5.10 ± 0.28
GR (%)	7.35 ± 0.21	6.60 ± 0.71	5.75 ± 0.64
MO (10^3/µl)	6.18 ± 0.04	6.30 ± 0.71	5.60 ± 0.56
MO (%)	6.75 ± 0.35	7.70 ± 0.28*	6.25 ± 0.92
PLT (10^3/µl)	8.00 ± 0.00	9.00 ± 0.00	9.00 ± 0.00

***$P \leq 0.01$ and *$P \leq 0.05$*

We also compared blood physiological values of white peafowl with black shouldered peafowl (Table 2) and our analysis depicted significant differences in the concentrations of RBC (P = 0.021), Hgb (P = 0.070), HCT (P = 0.017), MCV (P = 0.035), MCHC (P = 0.023) and GR (P = 0.037) between the two forms.

Table 2. *Mean blood physiological values of white peafowl (n=12) and black-shouldered peafowl (n=12) kept at Wildlife Breeding Centre, Gatwala, Faisalabad.*

Parameters	**White peafowl**	**Black-shouldered peafowl**
RBC (10^6/ µl)	2.15 ± 0.07	2.46 ± 0.08*
Hgb (g/dl)	14.10 ± 0.71	16.80 ± 0.28*
HCT (%)	36.80 ± 1.41	46.05 ± 1.77**
MCV (fl)	169.90 ± 0.71	187.10 ± 0.71*
MCH (pg)	64.90 ± 0.28	68.25 ± 1.20
MCHC (g/dl)	37.90 ± 0.02	36.45 ± 0.78*
RDW (%)	16.90 ± 0.71	12.00 ± 0.28
WBC (10^3/µl)	87.85 ± 4.60	89.90 ± 4.24
LY (10^3/µl)	74.40 ± 3.53	78.85 ± 4.74
LY (%)	85.50 ± 0.71	88.00 ± 1.56
GR (10^3/µl)	5.50 ± 0.57	5.10 ± 0.28
GR (%)	6.60 ± 0.71	5.75 ± 0.64*
MO (10^3/µl)	6.30 ± 0.71	5.60 ± 0.56
MO (%)	7.70 ± 0.28	6.25 ± 0.92
PLT (10^3/µl)	9.00 ± 0.00	9.00 ± 0.00

***$P<0.01$ and *$P<0.05$*

DISCUSSION

Indian peafowl has characteristic color variations in feather patterns with three color varieties among which black shouldered peafowl is the earliest color mutation followed by white peafowl (Ashok and Goyal, 2013; Naseer, 2017). This study was conducted to investigate the blood parameters of captive healthy Indian peafowl and its two color variants kept at Wildlife Breeding Centre, Gatwala, Faisalabad.

The hematological indices indicate health status of an individual. In the present study, erythrocyte indices of blue peafowl were within normal range for peafowl as depicted by Samour *et al*. (2010) and Xu *et al*. (2015). Our results indicated mean total RBC count to be in the ideal range and these results are in agreement with Morishita (2015) but mean hemoglobin (Hgb) value for three color variants in our study samples was high as compared to 12g/dl as reported by Samour *et al*. (2010). The number of RBC and Hgb concentration is affected by age, sex and nutritional status of animal (Yu-qin and Shi-Yuan, 2007, Xu *et al*., 2015) and determine the oxygen carrying capacity of the animal for sustenance of bio-chemical activities (Roberson and Bennett-Guerrero, 2012). Since our birds were captive, this might be attributed to better rearing conditions and nutritional support than in the wild as reported for several avifauna (Herbert *et al*., 1989).

The leucocytes provide immunity against pathogens and defend the body against harmful agents. In the present study, our results showed much higher mean WBC counts than similar studies conducted in India (Samour *et al*., 2010) but lower mean WBC counts than hematological studies conducted elsewhere (Lashev *et al*., 2013; Kumar *et al*., 2017) but this could be attributed to different methodology used. Carisch *et al*. (2019) depicted that WBC count in birds is affected by certain methodologies since all avian blood cells are nucleated. Our hematological analysis of black shouldered peafowl showed slightly higher lymphocyte count while of blue peafowl showed slightly higher granulocyte count (Table 1) but we could not identify possible effect of any factor in influencing this. Lashev *et al*. (2015) explained that this considerable variation in WBC counts has been widely reported even among different breeds of a species. WBC counts are affected by exposure of birds to pathogens and immune-toxic agents (Campbell and Coles, 1986).

Ornamentation in feather patterns is characteristic of Indian peafowl. Subtle differences in hematological indices of peafowl have been reported by researchers working on specimens in different habitats, altitudes, latitudes and varieties. Our results support the studies indicating high quality color patterns reflect increased resistance and immunity to pathogens (Stewart *et al*., 1996; Takahashi and Hasegawa, 2008).

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