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Season Wise Haematological Parameters of Flightless Bird Emu, *Dromaius novaehollandiae* (Latham, 1790)

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Abstract

The objective of the present study is to find out the haematological parameters of adult captive emus (*Dromaius novaehollandiae*) in three different seasons, i.e., winter, summer and rainy. Hematological parameters like RBC, TLC, Hb, PCV, and erythrocyte indices like, MCV, MCH, and MCHC have been recorded. The mean and significant difference are determined for each hematological parameter. The findings from our study contribute to the database for baseline values of hematological parameters of emu with respect to different seasons. The Hb percentage, RBC counts, and PCV percentage were higher ($P<0.01$) during the winter season than other two seasons. The average reading of TLC is recorded highest during rainy season and lowest during the winter season ($P< 0.05$).

Keywords: Season; Haematology; Flightless Bird; Emu; *Dromaius novaehollandiae*.

Introduction

Emu is the second biggest (first being Ostrich) living bird of the world belonging to order Ratite which is native of Australia [1]. It stands 5-6ft high, 2-3ft less than the Ostrich and dwarfed by the giant moas of New Zealand that became extinct few centuries ago. Emus are related to cassowaries and share with them the coarse, drooping plumage and small wings hidden by the feathers (Fig. 1).

Emus like ostriches, rheas and kiwis as flightless birds are known as ratites. The sexual dimorphism is indistinct excepting the nature of voice of males and females. The male makes a guttural cries, whereas the female has a resonant booming call made by a large air sac connected to the wind pipe. Females are heavier than males just opposite of the normal chicken. Before Europeans settled in Australia there were several species of emu, but all except one have been wiped out.

At one time Tasmania, Kangaroo, Flinders and other islands, had their own emus, but they were killed so rapidly that hardly any specimens reached museum [2]. The eggs of emus are large and dark emerald green.

As flightless birds, they are strong runner and belong to the super-order Palacognathae or Ratitae (flightless bird with a flat breast bone), order Casuariiformes under the family Dromaiidae.

The chemistry, nature and structure of the cells of blood can determine the condition of the heart as well as entire circulatory system. Physiological equilibrium is maintained mainly by the blood [3] but this equilibrium is altered in various physiological conditions. Haematological parameters are related to the blood and blood-forming organs [4]. In veterinary medicine, haematological examination provides an effective tool in monitoring the nutritional and health status of animals [5]. A complete blood count is a good indicator of general health, as seasonal illness and stress can modify hematological parameters, especially with regard to lymphocyte and erythrocyte count [6]. The health of various species of poultry is monitored by haematological parameters and for their physiological changes various stress factors are responsible [7,8]. Haematological and serum biochemical analyses provide beneficial data

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on the immunological status of animals [9]. Many aspects like age, sex, different breeds, physiological status, blood collection procedure, reproductive status, exercise, circadian rhythm [10], and season [11] are the important factors responsible in haematological variation. Other factors also play significant role in the effect of different treatments on metabolic, nutritional, and animal welfare conditions [12]. Level of haemoglobin might be reduced due to nutritional deficiency or exposure to parasites [13]. It is well known that clinical haematology and biochemistry can be useful aids for diagnosis in birds [14]. Since information on the effect of seasons on hematological parameters in emu is inadequate, the present investigation is an effort to analyse the seasonal changes on haematological parameters of adult captive emus (*Dromaius novaehollandiae*).

Materials and Methods

In the present study, blood samples were collected from 10 individuals of emu of different seasons, i.e., winter, summer and rainy in ethylene diamine tetra acetic acid (EDTA) vials from the local poultry farm located at northern Bhubaneswar (20.3360^{0}N, 85.8114^{0}E), Odisha. For each sample, two ml blood was taken from jugular vein of the neck from live bird without harming in different seasons like winter, summer and rainy with average temperature 22.75^0 C, 34.25^{0}C, 27.75^{0}C and relative humidity 72%, 72.25%, 89% respectively. According to the international ethical committee, adequate measures were taken to minimize the discomfort and pain to the bird. Then smears were prepared on microscopic slides (BLUE STAR, PIC 2, Polar Industrial Corporation, Mumbai, Maharashtra, India). Smears were stained with Giemsa's stain prepared from Giemsa's powder (Qualigens CAS NO. 51811-82-6 Product No. 39382, Thermo Fisher Scientific India Pvt.Ltd. Mumbai, Maharashtra, India) for further studies. The recorded data were analysed using Microsoft Office Excel 2007 software and interpreted.

Estimation of haemoglobin was carried out by Sahli's acid hematin method [15] with Sahli's haemometer (HiMedia GW 191-1NO, Plane haemometer (Square Type), HiMedia Laboratories Pvt. Ltd., Mumbai, Maharashtra, India). PCV was found out by centrifugation (REMI Centrifuge, Catalogue No.C852 7/94, Serial NO. GCLC-1632, REMI Motors, Bombay, Maharashtra, India) of blood at 3,000 rpm for 15 minutes [16]. Total erythrocyte count (TEC) and total leukocyte count (TLC) were calculated by using the Neubauer's counting chamber. Erythrocyte indices like, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentration (MCHC) were determined from the values obtained from the haemoglobin concentration, packed cell volume (PCV) and red blood cells (RBC) count [17].

MCV expresses the average volume of the individual RBC.

MCV (fl) =PCV/ Erythrocytes count ×10

MCH expresses the average weight of haemoglobin in the erythrocyte.

MCH (Pg) = Haemoglobin/ Erythrocytes count ×10

MCHC indicates the percentage of the MCV which the haemoglobin occupies.

MCHC (%) = Haemoglobin / PCV ×100

For each parameter, Mean±SE were calculated by using Microsoft Office Excel 2007. For comparison of mean, statistical analyses were undertaken by Paleontological Statistics (PAST) version 2.17 [Natural History Museum, University of Oslo] for One-Way Analysis of variance (ANOVA) followed by Turkey's pair wise comparison tests. Differences were classified as significant at $P<0.05$ and highly significant at $P<0.01$.

Results and Discussion

The value of erythrocyte and leukocyte parameters with respect to seasons is found out (Table 1). Among three seasons, the highest and the lowest mean hemoglobin concentration are recorded in winter and summer season respectively. The highest average total erythrocyte count and PCV have been observed in winter and summer season respectively while the lowest values are recorded in rainy and winter season respectively. The average MCV is recorded to be the highest during summer season when the weather is hot and dry. It is moderately high during the humid rainy season and lowest during the winter season. However, the average MCH is calculated to be the highest in rainy and lowest in winter season. The highest and the lowest MCHC are recorded in winter and summer season respectively. For concentration of hemoglobin (g/dl), no significant differences were observed among the three seasons (Table 1). For total RBCs count, highly significant difference ($p<0.01$) exists between winter and rainy season and highly significant difference ($p<0.01$) between winter and summer season are recorded. For PCV no significant difference was there among the three seasons. The

mean±SE (range) of the packed cell volume 40.62±1.89 to 45.71±2.96 of emu, which is congruent to the findings of Dunan et al [17] comparing to all the seasons. For MCV, winter season has significant difference ($p<0.05$) with summer season and no significant difference was observed in rainy season.

Figures in parentheses are number of observations. Mean±SE with same superscript in the same row differ significantly ($p<0.01$)**, ($p<0.05$)*, Not significant (NS)

For MCH, winter season has significant difference ($p<0.01$) with rainy season. For MCHC, highly significant difference ($p<0.01$) is there between winter and summer season. The highest and lowest total leukocyte counts are recorded in rainy and winter seasons. The value of haematology and blood chemistry amongst species of free-ranging tropical pelagic sea birds varies with age, sex, season, and inland of collection [18].

In juvenile ostriches, the total RBC count and haemoglobin percentage is lower than adults. In raptors, the packed cell volumes are constant [19]. The RBC vaues are significantly higher in the winter and PCV values are significantly higher in rainy season. It seems the lower ambient temperature but higher environmental humidity in the rainy seasons favored higher food intake with the consequent higher haematological values in the rainy seasons than the summer season [20]. WBC count is significantly lower in winter than summer, and rainy respectively. In case of Mallard duck and the Canvasback duck, the higher leucocyte counts during the summer than during the winter matches with the study of [21]. The WBC value in the summer season is observed in the study are similar with the work of Shave and Howard [22]. Increasing value of PCV and MCV depends on temperature and storage duration [23]. In flightless bird like ostrich, the high value for total erythrocyte count, packed cell volume, and haemoglobin concentration might indicate that a high oxygen capacity enables these birds to run at speed as compared to other fast animals [24]. An increase in PCV value is probably due to its higher growth rate, metabolic activities and production of gonadotropins, sex and metabolic hormones [25]. Males have high EI than females and these differences are higher in rainy season. No significant difference is found in temperature, body weight, and all haematological parameters which are measured in two sexes of emu [26]. The significant higher MCV values (Fig. 2) during the summer and rainy season in the present study may be due to the higher ambient temperature and lower relative humidity during the summer season compared to the higher relative humidity and lower ambient temperature during the rainy season. This might have resulted in changes in water content of the blood and blood viscosity due to the decrease in evaporative cooling. This might have caused haemoconcentration, which results in the relative higher MCH and MCHC [27]. Stress leads to reduction in number of erythrocyte, content of haemoglobin, and haematocrit value [28,29].

Fig. 1: Emu (*Dromaius novaehollandiae)*

Table 1: Influence of haematological parameters among three different season

Sl. No	Blood Parameters	Winter (n=10)	Summer (n=10)	rainy (n=10)	F Value
1	Hb (%)	15.36±0.68 [a]	12.66±0.76 [ab]	14.72±0.72 [b]	6.39**
2	RBC(millions/mm^3)	2.28±0.12[a]	1.59±0.12 [a]	1.52±0.12 [a]	11.02**
3	PCV (%)	45.71±2.96	44.02±3.04	40.62±1.89	1.34NS
4	WBC(thousands/mm^3)	14.07±1.21 [a]	16.21±1.39	19.95±2.26 [a]	3.21*
5	MCV (fl)	203.42±13.83 [a]	305.264±28.55 [a]	284.69±30.40	4.53*
6	MCH (pg)	68.43±3.51 [a]	83.80±8.36	101.42±8.74 [a]	5.14**
7	MCHC (%)	34.14±1.28	28.48±2.21 [a]	36.63±2.03 [a]	4.87**

Figures in parentheses are number of observations. Mean±SE with same superscript in the same row differ significantly ($p<0.01$)**, ($p<0.05$)*, Not significant (NS)

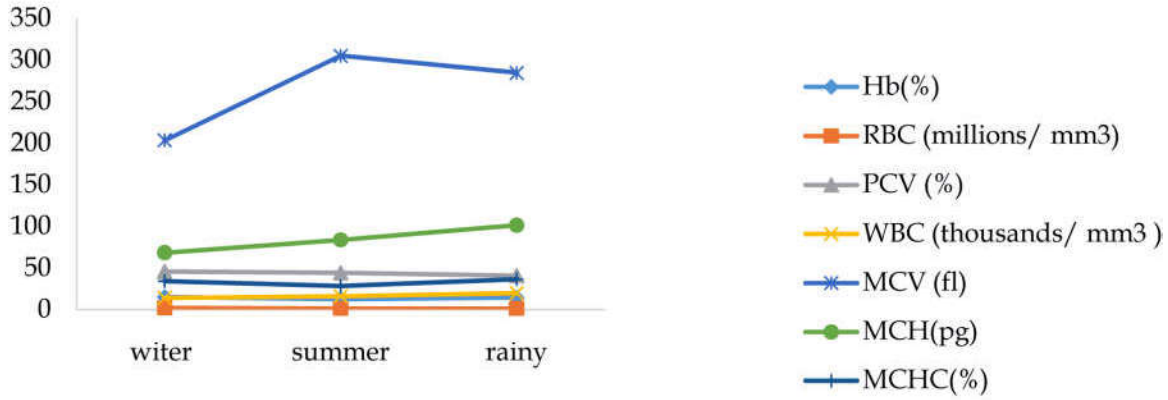

Fig. 2: Comparision of haematological parameters in three different seasons

Future Perspective

Blood profile plays an important role in mainlining the health status of the birds and it is significantly influenced by seasons, so it is suggested that a complete haematological profile with respect to age, sex, egg-laying, feed, environmental condition along with morphology, blood cell morphometry, and biochemical parameters may be analysed and interpreted in detail.

Conclusion

The haematological data obtained in the study can be considered as preliminary reference value which will be helpful for poultry production. Further, blood profiling is helpful in detecting health issues, parasitism, subclinical metabolic conditions, erroneous feeding practices, and welfare of emus, thereby enabling changing conditions to be diagnosed early. The findings from this study show that seasons show significant differences on most of the haematological parameters. The present study can provide a basic haematological profile for further study.

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Compliance with Ethical Standards

Conflict of Interest

The authors declare that we have no conflict of interest.

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