

# Hematological Characteristics of Ducks (*Cairina moschata*) of Southeastern Nigeria

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## Summary

Morning (9-10 am) blood samples collected through the wing veins of six males and six females clinically healthy adult ducks (*Cairina moschata*) were used to study the hematological profile and serum chemistry of southeastern Nigerian ducks. Packed cell volume (PCV) and hemoglobin concentration (HBC) means were  $46.00 \pm 1.73\%$ ,  $41.17 \pm 3.13\%$  and  $15.67 \pm 0.29$  g%,  $14.17 \pm 1.13$  g% for drakes and ducks respectively indicating significant differences ( $P < 0.01$ ) between male and female values. Mean erythrocytes sedimentation rate (ESR) of the drakes ( $1.63 \pm 0.35$  mm/hr.) was significantly different ( $P < 0.05$ ) from the  $1.95 \pm 0.30$  mm/hr observed in the ducks. Male and female blood coagulation time (BCT) and mean corpuscular hemoglobin concentration (MCHC) values were  $1.55 \pm 1.00$  and  $1.85 \pm 11.05$  seconds and  $34.07 \pm 1.01\%$ ,  $34.42 \pm 2.13\%$  respectively. Leukocyte count indicated no significant difference ( $P > 0.05$ ) between the males and females. Again, heterophils and lymphocytes counts did not reveal significant differences ( $P > 0.05$ ) between the male and female birds. The mean serum protein value of the females ( $12.07 \pm 1.59/100$  ml) was significantly higher ( $P < 0.01$ ) than the  $6.87 \pm 0.42$  g/100 ml recorded in males. Mean serum calcium and phosphorous levels were also significantly different ( $P < 0.01$ ) at  $7.43 \pm 0.75$  mg/dl,  $8.52 \pm 0.58$  mg/dl and  $3.20 \pm 1.51$  mg/dl,  $7.98 \pm 1.39$  mg/dl in the males and females respectively.

## Résumé

### Caractéristiques hématologiques des canards (*Cairina moschata*) du sud-est du Nigeria

Des échantillons de sang prélevés, dans les veines d'ailes, de six femelles et de six mâles des canards (*Cairina moschata*) ont été collectés les matins entre 9 et 10 heures afin d'étudier leurs profils hématologiques ainsi que la composition chimique du sérum. Les résultats obtenus montrent que le volume des cellules tassées (VCT) et la concentration en hémoglobine (CHB) étaient très hautement significatifs ( $P < 0,01$ ) entre les mâles et les femelles. Les moyennes du VTC étaient respectivement de  $46,00 \pm 1,73\%$  et de  $41,17 \pm 3,13\%$  pour les mâles et pour les femelles alors que la CHB était de  $15,67 \pm 0,29$  g% et de  $14,17 \pm 1,13$  g% respectivement pour les mâles et pour les femelles. Le taux de sédimentation des érythrocytes (TSE) des mâles ( $1,63 \pm 0,35$  mm/h) était significativement différent ( $P < 0,05$ ) des femelles ( $1,95 \pm 0,30$  mm/h). Le temps de coagulation du sang (TCS) et la concentration moyenne de l'hémoglobine corpusculaire (CMHC) étaient respectivement de  $1,55 \pm 1,00$  et de  $1,85 \pm 11,05$  secondes; ainsi que de  $34,07 \pm 1,01\%$  et de  $34,42 \pm 2,13\%$  pour les mâles et pour les femelles. Le nombre de leucocytes, d'hétérophiles et de lymphocytes n'a montré aucune différence significative entre les mâles et les femelles ( $P > 0,05$ ). Par contre, la valeur moyenne de protéines ainsi que les niveaux du calcium et du phosphore dans le sérum des femelles était hautement significativement différents ( $P < 0,01$ ) entre les mâles et les femelles. La valeur moyenne de protéines était respectivement de  $12,07 \pm 1,59$  g/100 ml et de  $6,87 \pm 0,42$  g/100 ml chez les femelles et chez les mâles alors que pour le calcium, les niveaux étaient respectivement de  $7,43 \pm 0,75$  mg/dl et de  $8,52 \pm 0,58$  mg/dl chez les mâles et chez les femelles. Le niveau de phosphore était de  $3,20 \pm 1,51$  mg/dl et de  $7,98 \pm 1,39$  mg/dl respectivement pour les mâles et pour les femelles.

## Introduction

Domestic ducks are raised throughout the tropics, but are most numerous in regions of high rainfall, riverine areas, deltas and coastal districts. Under extensive management, which is their most common system of management in the rainforest zone of southern Nigeria, ducks form efficient scavengers and foragers

of household wastes (10, 12). Even under adverse conditions such as high rainfall, temperature, excessive humidity and poor housing, ducks exceed the best of laying strains of chicken in livability (13). They also have the additional advantage of immunity to the most prevalent disease problems of gallinaceous birds (17).

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In southeastern Nigeria, ducks are kept for sale and home consumption (9). Nigerian local ducks are known to be good meat producing Muscovy strains that have the ability to withstand extremely hot ambient temperatures better than chickens (8, 16, 17). However, under the present system of extensive management, they perform rather poorly and remain prejudiced poultry species in much of the areas where they are found in Nigeria (16). Thus, the actual potential of this Muscovy duck under the humid tropical conditions of Nigeria remains largely unknown (13).

Improving the productivity of any animal necessitates the understanding of its physiology including hematological characteristics. Hematological studies are usually undertaken to establish the diagnostic baselines of blood characteristics for routine management practices of farm animals (18, 19). For example, hematological constituents usually reflect the physiological responsiveness of the animal to its external and internal environments and thus serve as a veritable tool for monitoring animal health (20, 21).

Since strong differences are reported between hematological characteristics of local breeds of ducks from different geographical and agricultural zones of the world (24, 27), there is the need to establish the diagnostic blood profile or characterize the hematological baselines for the Nigerian ducks.

The present study aims at establishing the hematological values of the local duck of southeastern Nigeria.

## Material and methods

### Experimental animals

Six adult male and 6 adult female ducks (*Cairina moschata*) aged about 4 months were purchased from a local farm and used for the study. The birds were dewormed with piperazine wormer-17 (Pfizer) and placed on dip litter in a conventional open sided poultry pen at the Teaching and Research Farm of the Federal University Technology Owerri for 90 days before commencement of the study. They were fed a commercial grower ration which on analysis contained 89.69% dry matter, 22.13% crude protein, 13.15% crude fiber, 19.47% ether extract, 14.35% ash and 3.57% nitrogen free extract. Fresh clean water was offered *ad libitum*. The birds were aged approximately seven months (28 weeks) at the time of bleeding and had mean body weight of 3.53 kg and 2.88 kg for ducks and drakes respectively. They were also certified clinically healthy at the time of bleeding.

### Blood collection

The birds were bled between 9 and 10.30 am from a punctured wing vein to aspirate 7 ml of blood from each bird. Two milliliter of each blood sample was discarded into Ethylene Di-amine Tetra Acetic acid (EDTA) treated Bijou bottles for hematological assay. The remaining 5 ml of each blood sample were allowed to coagulate to produce sera for blood chemistry measurements.

### Blood analysis

Blood samples were analyzed within 3 hours of their collection for total erythrocyte and leukocyte counts, hematocrit (PCV), hemoglobin, erythrocyte sedimentation rate (ESR) and differential leukocyte count according to the methods described by Dein (4). Erythrocyte count (RBC) was done in a hemocytometer chamber. Total leukocyte count was obtained using a hemacytometer with Natt and Henrick's diluent to obtain an 1:200 blood dilution. The number of leukocytes were thereafter estimated as total WBC/ul = number of cells to total WBC x 200. PCV was measured by the microhematocrit method with 75 x 16 mm capillary tubes filled with blood and centrifuged at 3000 rpm for 5 min. Differential count of leukocytes was made from blood smears stained with Wright's dye and each type of cell was counted with a laboratory counter. Hemoglobin concentration (HBC) was also measured by the cyanmethemoglobin method.

Various hematological indices like mean corpuscular hemoglobin (MCH), mean corpuscular volume (MCV) and mean corpuscular hemoglobin concentration (MCHC) were calculated from results obtained.

Erythrocyte sedimentation rate (ESR) was determined within six hours of sample collection according to the methods described by Orji *et al.* (19). Clotting time was determined using the glass slide method (2).

### Blood chemistry

The bottles of coagulated blood were subjected to standard method of serum separation and the harvested sera used for evaluation of total serum protein (TSP) and total serum electrolyte (TSE). Total serum protein was determined by the Golgberg refractometer method to obtain concentrations (g/dl) for each blood sample. The standard flame photometry using Gallenkamp analysis was used to determine serum sodium ( $\text{Na}^+$ ) ion and potassium ( $\text{K}^+$ ) ion. Calcium ( $\text{Ca}^{2+}$ ) ion and magnesium ( $\text{Mg}^{2+}$ ) ion were determined by atomic absorption photometry while serum phosphate ion ( $\text{HPO}_4^{2-}$ ) was determined using trichloroacetic acid ammonium molybdate and ferrous sulphate to develop blue color read thereafter, in a spectrophotometer.

### Data analysis

The male and female means and standard deviation of each blood parameter were calculated. Student's t-test was applied to determine significance between male and female values (23).

## Results

Aspects of the hematological values of the local duck of southeastern Nigerian are presented in table 1.

Erythrocytes count (RBC), Packed cell volume (PCV) and Hemoglobin concentration (HBC) values were generally lower in ducks as compared to drakes. While PCV and HBC values were significantly higher in males ( $P < 0.01$  and  $P < 0.05$  respectively), the difference observed in RBC values was however not statistically significant. Similarly, the erythrocyte sedi-

**Table 1**  
Aspects of the hematological value of the local ducks and drakes of southeastern Nigeria

Parameters	Mean	Male mean $\pm$ SE	Female mean $\pm$ SE
Erythrocytes (RBC) $\times 10^6/\text{mm}^3$	3.22	3.31 $\pm$ 0.10	3.13 $\pm$ 0.11
Packed cell volume (PCV) %	43.59	46.00 $\pm$ 1.73	41.17 $\pm$ 1.13 **
Hemoglobin concentration (HBC) %	14.92	15.67 $\pm$ 0.29	14.17 $\pm$ 1.13*
Erythrocytes sedimentation rate (ESR) mm/hr	1.79	1.63 $\pm$ 0.35	1.95 $\pm$ 0.30 *
Mean corpuscular hemoglobin concentration (MCHC) %	34.23	34.07 $\pm$ 1.01	34.42 $\pm$ 2.13
Blood clotting time (Seconds)	170.0	155.0 $\pm$ 1.00	185.0 $\pm$ 11.05
Mean corpuscular hemoglobin (MCH) %	4.63	4.73 $\pm$ 0.24	4.53 $\pm$ 0.13
Mean corpuscular volume (MCV) %	13.54	13.90 $\pm$ 1.03	13.15 $\pm$ 0.15
Leucocytes (WBC) $\times 10^3/\text{mm}^3$	24.53	23.81 $\pm$ 0.88	25.24 $\pm$ 1.62
Heterophils (Neutrophils) %	13.67	15.33 $\pm$ 4.16	12.00 $\pm$ 1.27
Eosinophils %	6.25	5.67 $\pm$ 2.08	6.83 $\pm$ 2.64
Lymphocytes %	80.09	79.00 $\pm$ 3.61	81.17 $\pm$ 2.64
Basophils and monocytes %	Na	Na	Na

\*=  $P < 0.05$ , \*\*=  $P < 0.01$ .

Na= Not available.

mentation rate (ESR) recorded for males was significantly ( $P < 0.05$ ) lower than that of the females.

A mean clotting time of 170 seconds was obtained. Although female values were visually higher than male values, the difference was not statistically significant. Mean corpuscular hemoglobin (MCH) and mean corpuscular volume (MCV) figures of the males were higher than the female values although not significantly.

Mean leukocyte count of the ducks stood at  $24.53 \times 10^3/\text{mm}^3$  with the female figure being visually but not significantly higher than the male figure. Differential count of the leukocytes portrayed a higher heterophil value in males than in females. Both eosinophils and lymphocytes values of the female were also higher than that of the male.

Serum protein and electrolyte values of the ducks of southeastern Nigeria are presented in table 2.

## Discussion

There is a dearth of information on the local ducks of Nigeria. Hematological values often used in monitoring the health status of such animals are scanty even though these have been reported extensively in exotic breeds of ducks found in different parts of the world (20, 24).

The overall mean values of RBC, PCV, HBC and WBC recorded in the present study were higher than the  $1.72 \times 10^6 \text{ mm}^3$ , 38.09%, 11.64 g/dl and  $18.21 \times 10^3 \text{ mm}^3$  respectively, reported by Ola *et al.* (14) for local muscovy ducks of southwestern Nigeria. These workers reported overall averages from birds of different ages reared either extensively or semi-intensively while our birds were maintained permanently under intensive care and were aged about 28 weeks at the time of bleeding. It is possible that our superior values

**Table 2**  
The serum chemistry of the local ducks and drakes of southeastern Nigeria

Parameters	Mean	Male mean $\pm$ SE	Female mean $\pm$ SE
Serum protein g/dl	9.47	6.87 $\pm$ 0.42	12.07 $\pm$ 1.59*
Serum calcium g/dl	7.98	7.43 $\pm$ 0.75	8.52 $\pm$ 0.58*
Serum phosphate mg/dl	5.59	3.20 $\pm$ 1.51	7.98 $\pm$ 1.39*
Serum potassium millimole/l	3.54	3.77 $\pm$ 0.15	3.30 $\pm$ 0.08
Serum sodium millimole/l	139.5	140.00 $\pm$ 1.00	139.00 $\pm$ 0.89

\*= ( $P < 0.05$ ).

The mean serum protein value obtained in the female was significantly higher ( $P < 0.05$ ) than the male value. Mean value for both sexes stood at 9.47 g/dl.

Calcium and phosphate levels in females were equally significantly different from values recorded in the males ( $P < 0.05$ ). Average value of 3.54 millimole/liter and 139.5 millimole/liter were obtained for potassium and sodium respectively.

reflect the effects of better nutrition, housing and health status usually associated with intensive management. This is further supported by the  $3.6 \times 10^6 \text{ mm}^3$  erythrocyte number reported by Sturkie (24) for adult Dabbling ducks and the fact that RBC, WBC, PCV and HBC values obtained by Ola *et al.* (14) in adult ducks aged about 30 weeks also compared favorably with our figures for adult ducks.

Again, the PCV value of southeastern Nigerian duck is similar to that of adult Peking ducks but higher than that of the Indian native duck and lower than those of the Diving and Babbling ducks (24). These differences may be attributed to species and breed differences. Oluyemi (15) and Nwosu (7) had suggested that the apparent superiority in PCV and hemoglobin concentrations observed in tropical breeds of poultry over exotic breeds, might be due to inherent physiological traits in these local breeds involving their hemopoietic systems. This probably enhances the dissipation of useless energy, which could be used for productive purposes.

There was a preponderance of lymphocytes in the differential leukocyte counts, with over 85% of the leukocytes being accounted for by these cells. This is in agreement with patterns observed in domestic chicken and ducks found in other regions of the world (24).

Our RBC, HBC and PCV values were higher in males. This is at variance with the higher values of the same parameters obtained in females by Ola *et al.* (14) in local ducks of southwestern Nigeria. Again, method of rearing and age of the birds may have contributed to these discrepancies. Mean HBC of males and females reported here on the other hand, were similar to those reported for Diving duck but different from the figures reported for adult female Mallards (24).

Orji *et al.* (18), reported strong species and sex effects on avian hematological parameters.

The observed higher lymphocyte count in the female duck is in agreement with earlier reports, however, our figures (79.0% for male and 81.17% for female) are higher than the 68.0% and 76.6% reported by Sturkie (24) for male and female Indian native ducks respectively. Similarly, the heterophil values of 15.33% and 12.05% for males and females respectively are lower

than the 52% and 32% obtained in male and female Peking ducks respectively (24).

The ESR range of 1.63 mm/hr to 1.95 mm/hr with significantly higher values for females than for males, is consistent with previous literature reports in other avian species (18, 25) which suggests that mean ESR for birds generally, range from 0.5 mm to 9 mm per hour with lower values occurring in males.

The higher serum protein concentration in the female than in males was in line with the findings of Verma *et al.* (26) for adult domestic chicken and Orji *et al.* (19) for the guinea fowls. The mean calcium value was similar to the value reported by Sturkie (24) for adult Diving and Mallard ducks but higher than the levels reported in guinea fowls (11, 19). Higher serum protein, calcium and phosphate levels in the females than in males recorded in this study had also been reported for the domestic chicken (5). This is expected since the physiological processes needed for the reproductive functions of the adult female duck require higher levels of these substances and is reflected by the dimorphisms evidenced in this study. The hormonal basis of this fundamental difference can be explained by the fact that any somatic characteristics by which the male differs from the female will ultimately be determined by the sex hormone and not by the sex chromosome (22). In the bird, the female is the heterogametic sex so that most dimorphisms result from ovarian estrogen secretion and the minority from testicular androgen secretion (6).

## Conclusion

Information on the hematological value of the local ducks of southeastern Nigeria presented here should form important reference data for the routine diagnosis and management of diseases and nutritional problems of such animals in the region.

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