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Haematological and plasma biochemical parameters of the Nigerian laughing dove (*Streptopelia senegalensis*) and the Nigerian duck (*Anas platyrhynchos*)

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ABSTRACT

As part of ongoing studies on the blood profiles of the Nigerian avian species, haematological and plasma biochemical parameters were determined in the Nigerian laughing dove (*Streptopelia senegalensis*). There were no significant sex differences in all the parameters studied. However, when the values that were observed in the Nigerian laughing dove were compared with those of the Nigerian duck (*Anas platyrhynchos*), the Nigerian duck had significantly higher mean corpuscular volume, total white blood counts, plasma urea, total protein and globulin, but significantly lower red blood cell counts, haemoglobin concentration, mean corpuscular haemoglobin concentration, plasma potassium and albumin/globulin ratio than the Nigerian laughing dove. However, the packed cell volume, mean corpuscular haemoglobin, plasma sodium, creatinine and albumin were similar in the two species of bird.

Key words: haematology, plasma biochemistry, Nigerian laughing dove, Nigerian duck

Introduction

The normal haematological and plasma biochemical parameters of several avian species found in Nigeria have been reported; these include the White England turkey (MAKINDE and FATUNMBI, 1985; OYEWALE and AJIBADE, 1990a); Nigerian domestic fowl (OYEWALE, 1988); Peking duck (OYEWALE and AJIBADE, 1990b); Guinea fowl (OYEWALE

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and OGWUEGBU, 1986); Pigeon and Peafowl (OYEWALE, 1994). There are also reports on the normal haematological and plasma biochemical parameters of the Nigerian duck (OLUFEMI and FATUNMBI, 1980; OYEWALE et al., 1998; OLAYEMI et al., 2002 and 2003).

There is, however, a dearth of information on the normal blood profiles of the Nigerian laughing dove and there are no reports about it despite our extensive search of the literature. The Nigerian laughing dove and the Nigerian duck are highly ubiquitous in all the regions of Nigeria (AROWOLO, 1999; FAGBOHUN et al., 2000) and are highly beneficial as both are eaten to supplement the protein requirements of the rural community. Therefore, in this paper we present the blood profiles of the Nigerian laughing dove and a comparison of the haematological and plasma biochemical parameters of the Nigerian laughing dove and the Nigerian duck.

Materials and methods

The twenty-one adult Nigerian laughing dove (*Streptopelia senegalensi*s) (14 male and 7 female) used for this study were bought from a local aviary and were aged between 1-2 years. They were kept in a cage at the Experimental Animal Unit of our Faculty for three weeks before commencement of the study. They were fed with guinea corn and given water *ad libitum*. They were also dewormed with Piperazine hydrochloride (Wormazine®) at 1g/L of water.

Nineteen adult Nigerian ducks (*Anas platyrhynchos*) (6 males and 13 females) aged between 1 and 2 years, also used for this study, were purchased from a local market and housed in a deep litter pen at the Experimental Animal Unit of the Faculty of Veterinary Medicine, University of Ibadan, Nigeria. They were fed commercially prepared growers mash (14.5% protein, 4.8% fat, 7.2% fibre and 0.8% calcium) produced by Bendel Feeds and Flour Mill Ltd, Edo State, Benin. Feed and water were given *ad libitum* for three weeks before commencement of the study. The ducks were treated against nematodes using Piperazine hydrochloride (Wormazine®) (Alfasan International BV3440AB Woerden, Holland) at 1g/Litre of water during the acclimatization period.

Blood was obtained from the jugular vein of each of the Nigerian ducks and from the heart of each of the Nigerian laughing doves into bottles containing ethylene diamine tetraacetic acid (EDTA) (2 mg/mL of blood). Red blood cell (RBC) and white blood cells (WBC) were counted using haemocytometers. Packed cell volume (PCV) was determined using the microhaematocrit method. Haemoglobin (Hb) concentration was measured by the cyanmethaemoglobin method. From the values obtained the haematimetric indicies (mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC)) were calculated (JAIN, 1986). The remaining blood was centrifuged at 3000 g for 10 m to obtain plasma.

Sodium and potassium concentration of plasma were determined by standard flame photometry. Total protein was determined by the buiret method (REINHOLD, 1953) and albumin by the method of DOUMAS et al. (1971). Globulin was calculated by subtracting albumin from total protein. Urea and creatinine were determined by the method described by HARRISON (1947).

The results were statistically evaluated using Student's *t*-test.

Results

The values of RBC, PCV, Hb, MCV, MCHC, MCV and total WBC of the male and female Nigerian laughing dove are shown in Table 1. These values were similar in both sexes.

Table 2. presents the plasma levels of sodium, potassium, and urea. There were no significant differences in these values. Table 3. shows the values of the RBC, PCV, Hb, MCV, MCH, MCHC and total WBC in the Nigerian duck and the Nigerian laughing dove. The Nigerian duck had significantly higher MCV ($P<0.01$) and total WBC count ($P<0.001$) but significantly lower RBC count ($P<0.02$), Hb ($P<0.05$) and MCHC ($P<0.01$) than the Nigerian laughing dove. However, the values of PCV and MCH were similar in the two species of bird.

Table 4. presents the plasma levels of electrolytes, metabolites and proteins in the Nigerian duck and the Nigerian laughing dove. The Nigerian duck had significantly higher plasma urea ($P<0.02$), total protein ($P<0.001$), globulin ($P<0.001$) but significantly lower plasma potassium ($P<0.001$) and albumin/globulin ratio ($P<0.01$). However, the values of plasma sodium, creatinine and albumin were similar in the Nigerian duck and the Nigerian laughing dove.

Table 1. Erythrocyte values and total white blood cell counts (mean ± SD) in the male and female Nigerian laughing dove

Parameters	Male (14)	Female (7)
RBC ($\times 10^{12}$/L)	2.78 ± 0.44	2.97 ± 0.24
PCV (%)	43.58 ± 7.33	44.57 ±6.88
Hb (g/L)	148.60 ± 22.10	157.80 ± 22.90
MCH (pg)	55.06 ± 12.89	53.12± 5.93
MCHC (g/dl)	34.95 ± 5.37	35.64 ± 4.28
MCV (fl)	160.10 ± 36.52	150.09 ± 18.42
WBC ($\times 10^{9}$/L)	0.75 ± 0.28	0.64 ± 0.26

Number of birds in parentheses

Table 2. Plasma sodium, potassium and urea levels (Mean ± SD) in the male and female Nigerian laughing dove

Parameter	Male	Female
Sodium (mmol/L)	161.54 ± 54.59 (5)	174690 ± 20.07 (5)
Potassium(mmol/L)	50.58 ± 22.18 (5)	57.24 ± 21.89 (5)
Urea (mmol/L)	3.43 ± 1.69 (5)	3.36 ± 1.55 (5)

Number of birds in parentheses

Table 3. Erythrocyte values and total white blood cell counts (mean ± SD) in the Nigerian laughing dove and the Nigerian duck

Parameters	Duck (19)	Dove (21)
RBC(X 10^{12}/L)	2.43 ± 0.58	2.83 ± 0.39*
PCV (%)	42.58 ± 5.67	43.76 ± 7.03
Hb (g/L)	136.10 ± 20.40	151.70 ± 22.20**
MCH (pg)	57.64 ± 9.04	54.41 ± 10.93
MCHC (g/dL)	31.51 ± 1.09	35.18 ± 4.94 ***
MCV (fL)	183.06 ± 28.95	156.77 ± 31.50***
WBC (X 10^{9}/L)	16.96 ± 2.23	0.72 ± 0.27****

Number of birds in parentheses, Value significantly different from duck at *P<0.02, **P<0.05, ***P<0.01 and ****P<0.001

Table 4. Plasma electrolyte, enzyme, protein and metabolite levels (mean ± SD) in the Nigerian laughing dove and the Nigerian duck

Parameters	Duck (n)	Dove (n)
Sodium (mmol/L)	167.33 ± 9.04 (15)	167.90 ± 39.42 (10)
Potassium (mmol/L)	18.63 ± 4.26 (15)	53.91 ± 21.07 (10)*
Total protein (g/L)	32.30 ± 7.80 (15)	16.80 ± 4.90 (6)*
Albumin (g/L)	12.20 ± 2.90 (15)	10.20 ± 4.20 (6)
Globulin (g/L)	20.10 ± 5.10(15)	6.70 ± 1.20 (6)*
Albumin/globulin ratio	0.61 ± 0.08 (15)	1.52 ± 0.58 (6)**
Urea (mmol/L)	5.76 ± 3.13 (15)	3.39 ± 1.53 (10)***
Creatinine (μmol/L)	79.56 ± 12.38 (15)	116.69 ± 64.53 (10)

Number of birds in parentheses, Value significantly different from duck at *P<0.001, **P<0.01 and ***P<0.02

Discussion

The present study revealed that the erythrocyte values were similar in the male and female Nigerian laughing dove (Table 1) This observation agrees with findings in earlier studies in other species of bird such as captive waterfowl (SHAVE and HOWARD, 1976); the black duck (MULLEY, 1979); the wood duck (MULLEY, 1980); pigeon and the peafowl (OYEWALE, 1994) and the Nigerian duck (OLAYEMI et al., 2002), in which no sex differences were observed in their erythrocyte values. However, the finding in the present study disagrees with the observations in domestic fowl (MARCH et al., 1966), Japanese quail (NIRMALAN and ROBINSON, 1971); geese (HUNSAKER et al., 1964); guinea fowl (OYEWALE and OGWUEGBU, 1986) and the white Peking duck (OYEWALE and AJIBADE, 1990b) in which higher erythrocyte values were reported in the male than in the female. The male sex hormone, testosterone, was implicated to be responsible for the higher erythrocyte values in the male (FRIED et al., 1964). It would seem that testosterone plays an insignificant role in the erythropoesis of the Nigerian laughing dove.

The Nigerian laughing dove in the present study had significantly higher RBC ($P<0.02$), Hb ($P<0.05$) and MCHC ($P<0.01$) values than the Nigerian duck (Table 3). These higher values in the Nigerian laughing dove may be because they fly more actively than the Nigerian duck. The guinea fowl, which also flies, was reported to have higher PCV, Hb and MCV than the Nigerian domestic fowl that seldom fly (OYEWALE, 1988). However, the observation by BOND and GILBERT (1958) that a bird that flies more actively (pigeon) had a lower Hb value than a bird that seldom flies (duck) is at variance with the observations of the present study.

In the present study the total WBC value of $16.93x10^9$/L observed in the Nigerian duck was significantly higher ($P<0.001$) than the value of $0.72x10^9$/L observed in the Nigerian laughing dove. The Nigerian duck used for this study are likely to be under some forms of stress, which made the WBC count to be high. The WBC value in the present study was also higher than the values of $3.61x10^9$/L (OLUFEMI and FATUNMBI, 1980) and $6.85x10^9$/L (OLAYEMI et al., 2002) reported in the same species of duck. Nevertheless, the WBC count in the present study was lower than the values reported in the black duck ($19.93x10^9$/L) (MULLEY, 1979) and wood duck ($23.63x10^9$/L) (MULLEY, 1980).

In the present study a similar plasma sodium concentration of 167.90 mmol/L and 167.33 mmol/L in the Nigerian laughing dove and Nigerian duck, respectively, were observed (Table 4.) These values were higher than the value of 136.17 mmol/L reported by (OLAYEMI et al., 2002) in the Nigerian duck and 138.60 mmol/L obtained in the white leghorn fowl (KRAVIS and KARE, 1960). However, the values of plasma sodium in the two species of bird in the present study were lower than the values of 198.90 mmol/L and 207.13 mmol/L reported in the guinea fowl and Nigerian domestic fowl, respectively (OYEWALE, 1988).

In the present study the Nigerian duck had significantly higher levels of plasma total protein and globulin ($P<0.001$) but significantly lower potassium ($P<0.001$) than the Nigerian laughing dove. The difference in nutrition may be responsible for this disparity. It would appear that the commercial feed given to the ducks had higher protein but lower potassium content than the guinea corn administered to the Nigerian laughing dove.

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SAŽETAK

U sklopu istraživanja krvne slike nigerijskih ptica određivani su hematološki i biokemijski pokazatelji u nigerijske gugutke (*Streptopelia senegalensis*). Nije ustanovljena značajna razlika u pretraživanim pokazateljima među spolovima. Usporedbom vrijednosti dobivenih u gugutke i onih u nigerijske patke (*Anas platyrhynchos*) ustanovljeno je da je nigerijska patka imala znatno veću vrijednost srednjeg korpuskularnog volumena, ukupnog broja bijelih krvnih stanica, koncentracije hemoglobina, srednje koncentracije korpuskularnog hemoglobina te omjera kalija i albumina/globulina od gugutke. Ukupni stanični volumen, srednja vrijednost korpuskularnog hemoglobina, te vrijednosti plazmalnog kalija, kreatinina i albumina bile su slične u te dvije vrste ptica.

Ključne riječi: hematologija, biokemijski pokazatelji, nigerijska gugutka, nigerijska patka