

**Comparative assessment of the white blood cell values, plasma volume and blood volume in the young and adult Nigerian duck (*Anas platyrhynchos*)**

**Funsho Olayemi\*, Johnson Oyewale, Samson Rahman, and Olayinka Omolewa**

*Department of Veterinary Physiology and Pharmacology, University of Ibadan, Ibadan, Nigeria.*

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**OLAYEMI, F., J. OYEWALE, S. RAHMAN, O. OMOLEWA: Comparative assessment of the white blood cell values, plasma volume and blood volume in the young and adult Nigerian duck (*Anas platyrhynchos*). Vet. arhiv 73, 271-276, 2003.**

**ABSTRACT**

White blood cell (WBC) and plasma volume and blood volume were determined in healthy adult (52-80 weeks old) and healthy young (8-10 weeks old) Nigerian ducks (*Anas platyrhynchos*). This was done in order to determine the effect of age on these parameters. Mean total WBC, heterophil, lymphocyte, eosinophil and monocyte counts in the adult duck were 10.42, 4.22, 5.93, 0.09 and 0.17  $\times 10^9/L$ , respectively. These counts in adult birds were similar to the values in young ducks. Mean plasma volume and blood volume in adult ducks were 36.30 and 57.43 ml/kg body mass, respectively. These values did not differ significantly from those of young ducks.

**Key words:** white blood cell, plasma volume, blood volume, age, Nigerian ducks

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\* Contact address:

Dr. Funsho Olayemi, Department of Veterinary Physiology and Pharmacology, University of Ibadan, Ibadan, Nigeria, Phone: +02 8105 785; E-mail: funsho\_olayemi@yahoo.com

## Introduction

The duck population in Nigeria is about 11.9 million (AROWOLO, 1999). The majority of these ducks are Nigerian ducks which are mostly reared extensively under the extensive management system. Although there are reports on the blood profiles of exotic breeds of duck (KOCAN and PITTS, 1976; MULLEY, 1979; MULLEY, 1980; DRIVER, 1981; OYEWALE and AJIBADE, 1990; HATIPOGLU and BAGCI, 1996), there is, however, a dearth of information on the blood profiles of the Nigerian duck (*Anas platyrhynchos*).

This paper is part of a study on the blood parameters of normal, healthy Nigerian ducks (*Anas platyrhynchos*) in a tropical environment, and is concerned with the white blood cell parameters, plasma volume, and blood volume of young and adult birds. It follows a previous paper (OYEWALE et al., 1998) on red blood cell characteristics on young and adult birds of the same species.

## Materials and methods

Healthy, unsexed young (8-10 weeks old) and healthy adult (52-80 weeks old) male and female Nigerian ducks were used for the present investigation. The ducks were purchased from a local market in Ibadan, Nigeria and housed in deep litter pens at the University of Ibadan Teaching and Research farm for 4 weeks prior to commencement of the study. They were given commercially available growers mash (Bendel Feed and Flour Mill Limited, Nigeria) and water *ad libitum* during this period. Deworming was done once with piperazine (Piperazine wormer<sup>®</sup>, Pfizer Products Plc, Ikeja, Nigeria) and the birds received the coccidiostatic drug, sulfadimidine sodium (Vetacox; Associated Pharmaceutical Product Limited, Lagos, Nigeria) and vitamins with amino acid supplements (Vitalyte<sup>®</sup>, Laboratories Hipra, Avda, La Selva S/N 17170 Amer., Girona, Spain) for 3 days.

Blood was obtained from the jugular vein of each bird into a bottle containing ethylene diamine tetra acetic acid (EDTA, 2 mg/ml of blood). Total white blood cell (WBC) count was determined with a Neubauer haemocytometer using the WBC diluting fluid described by BLAXHALL and DAISLEY (1973). Blood smears, made in duplicate, were fixed in alcohol and stained with Giemsa stain for differential WBC counts.

Two hundred white cells were counted from each blood smear. The percentage of each white cell type was calculated and multiplied by the total WBC count to obtain the absolute count. The heterophil/lymphocyte ratios were calculated by dividing the number of heterophils by the number of lymphocytes (GROSS and SIEGEL, 1983).

Plasma volume and blood volume were determined by intravenous injections of Evans blue dye (T-1824) adapting the technique described by NEWELL and SHAFFNER (1950). Each bird was weighed and 1% Evans blue dye was injected into the wing vein at the rate of 0.1 ml/kg body mass. After 10 minutes, by which time a complete mixing of the dye in blood plasma would have taken place, 4 ml of blood were collected from the jugular vein into the EDTA bottle. The blood sample was centrifuged at 3,000 g for 10 minutes and the supernatant, (plasma with dye) was separated. The light absorption of the supernatant was measured with a model 6100 spectrophotometer (Jenway Limited, Felsted, Donmow, Essex, England, CM6 3LB) at a wavelength of 620 m $\mu$  using plasma without dye as the blank. The light absorption of a standard dye solution of 40  $\mu$ g/ml was measured using distilled water as the blank. The plasma volume was calculated as described by JAIN (1986). The values of packed cell volume determined by the microhaematocrit method (results not shown here) were used to calculate the blood volume from the plasma volume (JAIN, 1986).

All the results obtained were statistically evaluated by Student's *t*-test.

### Results

Table 1 reveals that the total WBC, heterophil, lymphocyte, eosinophil and monocyte counts in young Nigerian ducks did not differ significantly ( $P>0.5$ ) from those of the adult duck.

Table 2 shows that the plasma volume and blood volume in Nigerian ducks did not differ significantly ( $P>0.5$ ) between the adult and young birds.

Table 1. White blood cell values (mean  $\pm$  SD) in young and adult Nigerian ducks

Parameters	Young (n=10)	Adult (n=14)
Total WBC ( $\times 10^9/L$ )	11.08 $\pm$ 5.00	10.42 $\pm$ 2.76
Heterophil ( $\times 10^9/L$ )	4.93 $\pm$ 1.93 (46.50 $\pm$ 11.16) <sup>a</sup>	4.22 $\pm$ 1.57 (40.57 $\pm$ 10.32) <sup>a</sup>
Lymphocyte ( $\times 10^9/L$ )	5.78 $\pm$ 3.49 (50.30 $\pm$ 11.48) <sup>a</sup>	5.93 $\pm$ 1.91 (57.07 $\pm$ 10.11) <sup>a</sup>
Eosinophil ( $\times 10^9/L$ )	0.07 $\pm$ 0.12 (0.70 $\pm$ 0.95) <sup>a</sup>	0.09 $\pm$ 0.18 (0.79 $\pm$ 1.31) <sup>a</sup>
Monocyte ( $\times 10^9/L$ )	0.32 $\pm$ 0.24 (2.60 $\pm$ 1.35) <sup>a</sup>	0.17 $\pm$ 0.23 (1.50 $\pm$ 1.65) <sup>a</sup>
Heterophil/lymphocyte ratio	1.05 $\pm$ 0.63	0.77 $\pm$ 0.38

<sup>a</sup> Value expressed as a percentage of total WBC count.

Table 2. Plasma volume and blood volume (mean  $\pm$  SD) in young and adult Nigerian ducks

Parameters	Young (n=7)	Adult (n=7)
Plasma volume (ml/kg)	41.46 $\pm$ 12.78	36.30 $\pm$ 19.04
Blood volume (ml/kg)	61.76 $\pm$ 18.29	57.43 $\pm$ 27.67

## Discussion

In the present study the total WBC, heterophil, lymphocyte, and monocyte counts in young Nigerian ducks did not differ significantly from those of adult ducks (Table 1). Similarly, MAXWELL et al. (1990) found no significant difference between young and adult domestic fowls in total WBC, lymphocyte and heterophil counts. However, they observed more eosinophils and less monocytes in younger birds. In Hawaiian dark-rumped petrels (*Pterodroma phaeopygia*), WORK (1996) reported lower total WBC and lymphocyte counts and greater heterophil and eosinophil counts in adult than in young birds. He also found that in wedge-tailed shearwaters (*Puffinus pacificus*) adult birds had greater monocyte and heterophil counts and lower lymphocyte and total WBC counts than did young birds. In the

Japanese quail, young birds showed greater percentages of heterophils and monocytes and a lower percentage of lymphocytes than adult birds (NIRMALAN and ROBINSON, 1971). The heterophil/lymphocyte ratio in Nigerian ducks did not differ significantly between young and adult birds (Table 1), which was in agreement with a similar observation in domestic fowl (MAXWELL et al., 1990).

Plasma volume and blood volume in Nigerian ducks did not differ significantly between adult and young birds (Table 2). The higher haemoglobin concentration in adult than in young Nigerian ducks as observed in a previous study (OYEWALE et al., 1998) cannot therefore be explained by decreased plasma volume and blood volume. The present findings of similar plasma volume and blood volume in young and adult Nigerian ducks disagree with the observations of MEDWAY and KARE (1959) in domestic fowl, in which plasma volume and blood volume decrease with age.

The mean ( $\pm$  SD) plasma volume ( $36.30 \pm 19.04$  ml/kg) and blood volume ( $57.43 \pm 27.67$  ml/kg) of the adult Nigerian duck (Table 2), which is a domestic species, are lower than those reported by BOND and GILBERT (1958) in adult mallard and black dabbling ducks (plasma volume =  $64.00 \pm 5.29$  ml/kg; blood volume  $113.00 \pm 10.58$  ml/kg), and in red head and canvas back diving ducks (plasma volume =  $71.00 \pm 4.90$  ml/kg; blood volume =  $110.00 \pm 7.29$  ml/kg) which are non-domesticated or wild species.

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**OLAYEMI, F., J. OYEWALE, S. RAHMAN, O. OMOLEWA: Poredbeno istraživanje broja bijelih krvnih stanica te volumena plazme i krvi u mladim i odraslim nigerijskih pataka (*Anas platyrhynchos*). Vet. arhiv 73, 271-276, 2003.**

**SAŽETAK**

Broj bijelih krvnih stanica te volumen plazme i krvi određen je u zdravih odraslih (52 do 80 tj.) i mladih (8 do 10 tj.) nigerijskih pataka (*Anas platyrhynchos*). To je učinjeno u svrhu određivanja utjecaja dobi na pretraživane pokazatelje. U odraslih pataka srednja vrijednost ukupnog broja leukocita iznosila je  $10,42 \times 10^9/L$ , heterofila  $4,22 \times 10^9/L$ , limfocita  $5,93 \times 10^9/L$ , eozinofila  $0,09 \times 10^9/L$  te monocita  $0,17 \times 10^9/L$ . U mladim pataka dobivene su slične vrijednosti. Srednji volumen plazme iznosio je u odraslih pataka 36,30 ml/kg, dok je volumen krvi iznosio 57,43 ml/kg tjelesne mase. Slične vrijednosti ustanovljene su i u mladim pataka.

**Ključne riječi:** bijele krvne stanice, volumen plazme, volumen krvi, dob, nigerijska patka

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