HAEMATOLOGICAL STUDIES ON THE GUINEA FOWL (*Numida meleagris* Pallas): 1. EFFECT OF AGE, SEX AND TIME OF BLEEDING OF THE HAEMATOLOGICAL VALUES OF GUINEA FOWLS.

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ABSTRACT

The blood profile and the effects of age, sex and time of bleeding on the parameters were investigated in a 2x2x2 factorial experiment using twenty four guinea fowls (*Numida meleagris* pallas). The results showed that erythrocytes values were $2.43 \pm 0.04 \times 10^6/\text{mm}^3$; packed cell volume, 37.44%; haemoglobin concentration (gm %), 13.17; erythrocyte sedimentation rate (mm/hr) 1.69; length of red blood cell, 12.89 microns; width of RBC, 6.63 microns, leucocyte count, $22.18 \pm 0.64 \times 10^3/\text{mm}^3$ and clotting time, 7.30 min. Sex and sometimes age, time of bleeding and their interactions had significant effect on these haematological values. Correlations between these were calculated.

INTRODUCTION

Reports in the literature on the haematological values of indigenous greybreasted helmet guinea fowl (*Numida meleagris* Pallas) are few and far between (Adene and Dipeolu, 1975; Olowo-Okorun *et al*; 1983). Yet such reports are very important in the current attempt at increasing the contribution of guinea fowl ranked second only to the domestic chicken in Nigeria in the production of meat and eggs (Ayeeni, 1983). Haematological values of domestic chickens have always provided veterinary clinicians the diagnostic baseline for routine management of guinea fowls. This,

however, could be misleading because of species differences. For instance, whereas for most domestic chickens, keeping laying hens beyond one or two years in production is not normally recommended, the guinea hens have been found to remain actively in lay for 7 or more years (Ayeeni, 1983). The present study is intended to establish the baseline blood profile of tropical guinea fowls and to determine how these profile parameters are affected by age, sex and time of bleeding.

MATERIALS AND METHODS

Twenty four mature guinea fowls balanced for age (one age group was approximately 4 years and the second 2 years), sex (males and females) and time of bleeding (mornings, 0800–1000 hours and afternoons, 1400 – 1600 hours) were used for this study conducted for 6 weeks duration in the Teaching and Research Farm of the University of Nigeria, Nsukka. The guinea fowls were on deep litter, fed layers mash (17.8% crude protein, 9.2% crude fibre) and water *ad libitum*.

Blood collection and analysis:

Each bird was bled from the brachial vein in the wing with a 5ml sterile syringe and about 2ml of blood was collected into a bijou blood

vial containing ethylene diaminetetra acetic acid (EDTA). Thin smears were made on clean glass slides and the rest of the sample taken to the laboratory for analysis. Packed cell volume (PCV) was determined by the microhaematocrit method. The erythrocyte sedimentation rate (ESR) was determined by the Wintrobe Haematocrit method (1935) within six hours of sample collection. Erythrocyte count (RBC) was done in a haemocytometer chamber. Haemoglobin content was determined within cyanmethaemoglobin using spectrophotometer and reading the light absorption at 540 mμ after standing for 10 minutes. The dimensions of the erythrocytes involved measurement of the length and width of the nucleus, all in microns. Total leucocyte count was determined in haemocytometer counting chamber after staining with leucocyte diluting fluid (glacial acetic acid tinged with Gentian Violet). Leucocytes were counted in the presence of nucleated erythrocytes because of difficulty in selectively lysing the erythrocytes to the exclusion of leucocytes. A correction factor (corrected count =

$$\frac{\text{observed count} \times 100}{100 + \text{percent nucleated rbc}}$$

as suggested by Benjamin (1961) was incorporated. Thin blood smears stained with Leishman's stain were used for differential leucocyte count. Clotting time was determined using the glass slide method (Benjamin, 1961). All the animals were bled six times at weekly intervals during the course of the experiment, three times in the morning hours and three times in the afternoons.

The means and standard errors of each blood parameter were determined. Analysis of variance was also done to determine the effect of the time of bleeding, age and sex of the

birds and their interactions on the parameters. All analysis were in accordance with the methods of Snedecor and Cochran (1967) for 2x2x2 factorial experiments.

RESULTS

Blood profile: The blood profile of the adult guinea fowl is presented in table 1.

Erythrocytes:

The mean RBC count in the males $2.58 \pm 0.10 \times 10^6$, was significantly higher ($P < 0.05$) than in the females, $2.24 \pm 0.09 \times 10^6$ ($P < 0.05$) (table 2). The interaction between age and sex of the birds was significant ($P < 0.05$) (table 3). The erythrocyte sedimentation rate (ESR) was significantly affected by the age of the bird (table 4). Packed cell volume (PCV) in the males (39.6%) was significantly higher than in the females (34.6%) (table 2). Males had significantly higher haemoglobin (Hb) concentration ($13.10 \pm 0.4 \text{ gm/100 ml}$) than females ($11.5 \pm 0.4 \text{ gm/100 ml}$). The erythrocyte nuclear dimensions (length and width) showed significant sex differences ($P < 0.05$) with higher values occurring in the males than in the females (table 2).

Leucocyte:

Total leucocyte count was significantly affected by the sex of the birds (table 3) with the guinea hens showing higher values ($23.37 \pm 1.61 \times 10^3$) than the cocks ($20.93 \pm 0.88 \times 10^3$). The differential count (table 1) showed that the lymphocytes alone accounted for over 85% of the total white blood cells and together with the heterophils constituted over 91% of all the leucocytes. The heterophils, monocytes and lymphocytes were significantly ($P < 0.05$) affected by the

TABLE 1.

Mean Blood values in adult Guinea fowl – *Numida meleagris* pallas.

Blood parameter	Mean	Standard Error	Range
Red Blood Corpuseles (RBC) x 10 ⁶ /mm ³	2.43	0.04	1.75– 3.05
Packed Cell Volume (PCV) %	37.44	0.54	30.40–44.70
Haemoglobin (HB) gm %	13.17	0.87	9.70–14.60
Erythrocyte Sedimentation rate ESR mm/hr	1.69	0.05	0.83– 2.50
White Blood Cells (WBC) x 10 ³ /mm ³	22.18	0.64	16.50–35.76
Heterophils %	10.61	0.71	2.50–18.20
Eosinophils %	0.85	0.09	0.20– 1.80
Lymphocytes %	85.86	1.01	77.20–92.60
Monocytes %	1.10	0.10	0.30– 2.00
Basophils %	0.78	0.08	0.00– 1.50
RBC length m	12.89	0.13	10.97–13.73
RBC width m	6.63	0.10	5.94– 7.70
RBC Nuclear length m	5.62	0.13	4.55– 7.38
RBC Nuclear width m	2.41	0.06	1.93– 3.33
Clotting time (min)	7.30	0.60	3.00–14.00

TABLE 2.

Effect of sex on the blood profile of Guinea fowls

Variable	Males Mean ±SE	Values Range	Females Mean ±SE	Range
RCB x 10 ⁶ /mm ³	2.58 ±0.10	2.05– 3.05	2.24 ±0.09	1.75– 2.70
ESR mm/hr	1.66 ±0.13	1.04 – 2.50	1.70 ±0.12	0.83– 2.33
PCV %	39.6 ±1.60	31.0 – 44.70	34.6 ±1.20	30.7 –42.20
Hb gm/100ml	13.1 ±0.40	10.5 –14.60	11.5 ±0.40	9.9 –13.20
RBC length m	12.92 ±0.21	10.97–13.73	12.85 ±0.16	11.89–13.63
Width m	6.71 ±0.15	5.94– 7.70	6.54 ±0.14	5.94– 7.58
RBC Nuclear length m	5.81 ±0.17	4.89– 7.38	5.42 ±0.20	4.55– 6.98
Nuclear Width m	2.44 ±0.11	1.93– 3.33	2.39 ±0.07	2.08– 2.82
WBC x 10 ³ /mm ³	20.92 ±0.88	16.50–27.43	23.37 ±1.61	18.13–30.28
Heterophils %	9.2 ±1.00	2.5 –14.80	12.8 ±1.20	7.0 –20.00
Eosinophils %	0.9 ±0.10	0.2 – 1.80	0.8 ±0.10	0.0 – 1.50
Monocytes %	0.9 ±0.10	0.5 – 1.30	1.2 ±0.20	0.3 – 2.00
Lymphocytes %	8.9 ±1.00	83.3 –92.60	84.4 ±1.20	77.2 –91.30
Basophils %	0.0 ±0.10	0.0 – 1.40	0.6 ±0.10	0.2 – 1.50
Clotting time	7.5 ±0.70	5.0 –12.00	7.0 ±1.00	3.0 –14.00

TABLE 3.

Analysis of variance table showing the effect of time of bleeding, age and sex and their interactions on some haematological values in Guinea fowl.

Source of Variation	df	Squares of blood traits					Clotting time
		RBC	Mean WBC	Heteroph	Eosinoph	Monocytes	
Replications	2						
Time (T)	1	0.0/2	12.248	139.96	1.151	1.058	277.24
Age (A)	1	0.040	8.914	128.87	0.274	0.593	65.34
Sex (S)	1	5.035*	207.936*	717.18*	0.245	3.375*	461.55
TA	1	0.008	1.829	276.58 ²	1.077	5.930*	5.60
TS	1	0.013	3.986	20.80	0.020	0.062	646.23
AS	1	3.335*	122.629*	237.09*	0.478	0.098	6.47
TAS	1	0.203	105.413	44.54	1.535	0.663	76.46
Error	130	0.195	56.779	61.78	1.300	1.381	689.27

*P < 0.05

TABLE 4

Analysis of variance table showing the effect of time of bleeding, age and sex of the birds on some haematological values in Guinea fowls.

Source of Variation	df	Mean Squares				
		ESR	PCV	HB	Lymphocy	Basoph
Replications	2					
Time	1	0.157	1.308	158.880	11.513	0.979
Age	1	4.839*	0.238	105.188	212.426	0.183
Sex	1	0.181	822.381*	390.509*	514.145*	1.785
Error	131	0.368	36.735	105.531	143.199	0.868

*P < 0.05.

sex of the birds (tables 3 and 4). However, while the males showed significantly higher lymphocyte values, the females showed higher heterophil values (table 2). There were significant interactions between the time of bleeding and age of the birds as well as age and sex interaction for the heterophils ($P < 0.05$). In the case of

monocytes, the interaction between the time of bleeding and age of the birds was also significant ($P < 0.05$).

The mean clotting time based on the first 3 collections was 7.30 ± 0.60 , range 3 – 14 minutes. After the third consecutive collection, clotting time varied from 34 minutes to 51.7 minutes and were, therefore, excluded from the determinations.

DISCUSSION

Normal RBB and WBC in the domestic fowls have been reported to range from 2.6 to 3.3×10^9 and 24.4 to 32.1×10^3 respectively (Forkner, 1929; Lucas and Jamroz, 1961 and Epelle, 1982). The mean count of 2.43×10^9 and 22.18×10^3 for the RBC and WBB respectively in the present study on guinea fowls are slightly below the normal range of such parameters in the domestic fowl. This would therefore seem to suggest strong species differences in the various classes of poultry. The haemoglobin concentration of 13.19 gm/100 ml of blood, with significantly higher values in the males than in the females, is well within the range of 9.8 to 13.50 gm/100 ml and the sex trend earlier reported for whole blood of birds (Dukes and Schmarte, 1931). The PCV values of 27% and 37% reported for normal hens and cocks (Bierer *et al.* 1964) were, however, lower than the 35% and 40% respectively recorded in this study on the guinea fowls.

The ESR range of 0.83 to 2.50 mm/hour, with slightly higher values for females than for males, is consistent with previous literature reports (Sturkie and Textor, 1958) that the mean ESR for birds generally, range from 0.5 mm to 9.0 mm per hour with lower values occurring in males. Means dimensions of erythrocytes for mature domestic fowl were: length, 11.2 to 12.3 microns, and width, 6.4 to 6.9 microns (Wintrobe, 1956 and Lucas and Jamroz, 1961) while for the guinea fowls in this study, the dimensions were: length, 10.97 to 13.73 microns, and width, 5.94 to 7.70 microns. The nuclear dimensions of the erythrocytes were slightly

higher; length, 5.62 microns, and width, 2.41 microns, than those of New Hampshire domestic fowl, length 5.1 microns, and width 3.3 microns (Lucas and Jamroz, 1961).

The preponderance of lymphocytes in the differential leucocyte count in blood, over 85% in the present study, has also been earlier reported for poultry (Hodges, 1974). Also, the significantly higher total leucocyte count in the female guinea fowls than in the males is in agreement with the findings of Lucas and Jamroz (1961) in domestic fowl. The mean clotting time of 7.30 minutes is within the range of 2 to 10 minutes for avian species (Bigland, 1964). However, the reason for the extended clotting time after the 3rd consecutive bleeding is not very clear and we did not come across similar reports in the literature.

On the basis of the data presented in this study, it is evident that sex and sex-age interaction play very important role in the haematological values of mature guinea fowls.

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REFERENCES

- ADENE, D.F. and O.O. DIPEOLU, (1975). Survey of blood and ectoparasites of domestic fowls in Ibadan, Western State of Nigeria. *An. Hth. Prod. Bull.* **23**: 333-335.

- AYENI, J.S.O. (1983). State-of-knowledge on the status, biology and management of grey breasted helmet guinea fowl (*Numida meleagris pallas*) in Kainji, Nigeria. 10–20.
In: The Helmet Guinea Fowl *Numida meleagris galeata pallas* in Nigeria ed by J.S.O. Ayeni, T.A. Aire and J. M. Olomu.
- BENJAMIN, M.M. (1961) of *Veterinary Clinical Pathology* 2nd Ed. Ames. Iowa. The Iowa State University Press.
- BIERRER, B.W., T. H. ELEAZER and D.E. ROEBUCK (1964). Sedimentation rate, packed cell volume, Buffy coat value and rectal temperatures of chicken and Turkey at various ages. *J. Amer. Vet. Med. Assoc.* 144: 727 – 730.
- BIGLAND, C.H. (1964). Blood clotting time of five avian species. *Poult. Sci.* 43: 1035–1039.
- DUKES, H.H. and L.H. SCHWARTE (1931). The Haemoglobin content of the blood of Fowls. *Amer. J. Physiol.* 96: 89 – 93.
- EPELLE, J.J. (1982). Haematological studies in local and their crosses with parent stock of Gold-link chickens. *B.Agric. thesis, University of Nigeria, Nsukka.*
- FORKNER, C.E. (1929). Blood and Bone marrow cells of the domestic fowl, *J. Exp. Med.* 50: 121–141.
- HODGES, R.D. (1974). The histology of the fowl, Academic Press London.
- LUCAS, A.M. and C.C. JAMROZ (1961). Atlas of Avian haematology, U.S., Department of Agriculture.
- OLOWO–OKORUN, M.O., MAKINDE, T.A. AIRE and J.S.O. AYENI (1983). Some aspects of the haematology of guinea fowl compared with the Nigerian local fowl. In: Helmet Guinea fowl (*Numida meleagris galeata pallas*) in Nigeria Ed. J.S.O. Ayeni, T.A. Aire and J.M. Olomu.
- SNEDECOR, G.W. and W.G. COCHRAN (1967). Statistical methods. 6th Ed. Iowa St. University Press Ames, Iowa U.S.A.
- STURKIE, P.D. and K. TEXTOR (1958). Sedimentation of erythrocytes in chickens as influenced by method and sex. *Poult. Sci.* 39: 444–447.
- WINTROBE, M.M (1956). Clinical Haematology, 4th ed. Lea and Febiger, Philadelphia.