

HAEMATOLOGICAL STUDIES ON THE GUINEA FOWL (*Numida meleagris* (Pallas): II. EFFECT OF AGE, SEX AND TIME OF BLEEDING ON PROTEIN AND ELECTROLYTE LEVELS IN BLOOD SERUM OF GUINEA FOWLS.

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ABSTRACT

The blood serum protein and electrolyte levels as well as the effects of age, sex and time of bleeding on these were investigated in a 2x2x2 factorial experiment using twenty four mature guinea fowls (*Numida meleagris* pallas). The results showed that the serum proteins and major electrolyte levels — sodium (ppm), potassium (ppm) calcium (mg/100 ml), magnesium (mg/100 ml) and phosphates (mg/100 ml) were respectively 2.45 ± 0.04 , 3231.56 ± 107.52 , 1301.26 ± 33.01 , 14.16 ± 0.054 , 4.18 ± 0.10 and 6.43 ± 0.22 . Sex, time of bleeding and sometimes age and their interactions had significant effect on the levels of these parameters in blood. Correlations between these were also calculated.

INTRODUCTION

In an earlier study (Orji, Okeke and Akunyiba, 1985) the haematological values — cellular elements, haemoglobin content and clotting time, of blood of guinea fowls as well as the effect of age, sex and time of bleeding on these constituents were reported. The results suggested species differences in the haematological values in addition to some significant sex and sometimes age differences in the

values. In order to properly define the baseline blood characteristics for guinea fowls for diagnostic and management purposes, another study was planned alongside to evaluate the biochemical indices of guinea fowl blood, important constituents of hard shelled eggs characteristically produced by guinea fowls.

MATERIALS AND METHODS

Twenty four mature guinea fowls of two age groups — 4 year old and 2 year old and two sexes — males and females were programmed for bleeding at two different times of the day — mornings, 0800 to 1000 hours and afternoons, 1200 to 1600 hours. The guinea fowls were kept on deep litter, fed layers mash containing 17.8% crude protein and 9.2% crude fibre. Water was provided *ad libitum* throughout the study which lasted for six weeks in the University of Nigeria Farm.

Blood collection and analysis.

Each bird was bled six times at weekly intervals during the study three times in the morning hours and three times in the afternoons as above. Birds were bled from the brachial

vein in the wing with a 5 ml sterile syringe. The blood samples were immediately transferred into small bijou bottles containing no anticoagulant. The blood was allowed to clot at room temperature (23°C), centrifuged to separate the serum which was thereafter stored frozen until analysed.

Total serum protein was determined by the biuret method of Reinhold (1953), the colour developed after 10 minutes in a water bath at 37°C and cooling to room temperature for 5 minutes, was read in a spectrophotometer (Bausch and Lomb Spectronic 20). Serum phosphates were determined using trichloroacetic acid ammonium molybdate and ferrous sulphate to develop blue colour, read thereafter, in a spectrophotometer. Serum calcium and magnesium were determined by the atomic absorption spectrophotometer. Serum sodium and potassium were estimated by the standard flame photometry using Gallenkamp flame analyser.

The means and standard errors of each of the blood parameters were calculated. Analysis of variance was done to determine the effect of the time of bleeding, age and sex of the birds on each parameter. All statistical analysis were done in accordance with the procedures and methods outlined for factorial analysis by Snedecor and Cochran (1967).

RESULTS

The serum protein and electrolyte values in the adult guinea fowls are presented in table 1. The mean serum protein value, 2.45 g/100 ml, was significantly affected by time of bleeding and sex (table 2). Morning

collections and significantly higher serum protein content, 2.54 g/100 ml, than afternoon collection, 2.40 g/100 ml. Females had significantly higher serum proteins 2.50 ± 0.08 g/100 ml than males, 2.43 g/100 ml. (table 3). The total serum protein content decreased from an average of 2.93 ± 0.09 g/100 ml in the first collection to 2.04 ± 0.06 g/100 ml in the sixth (table 4). There was a highly significant ($P < 0.01$) sex age group interaction in the protein content of blood serum. Females in the two year age group had higher serum proteins 2.52 ± 0.10 g/100 ml, than their male counterparts, 2.36 ± 0.12 g/100 ml (table 3).

The sodium concentration, 3231.56 ± 107.52 ppm was significantly affected by the time of bleeding. The concentration in the morning bleedings, 3617.86 ± 524.3 ppm was significantly higher ($P < 0.05$) than in the afternoon bleeding, 2882.74 ± 47.31 ppm. The sequence of collection had significant effect ($P < 0.05$) on sodium concentration in blood serum (table 4). A significant drop in concentration was recorded after the 3rd collection when serum sodium concentration range changed from 3,000 to 6,165 ppm in the 3rd collection to 2,187.50 to 3,500 ppm in the 4th collection with a further downward trend in the 6th collection when it ranged from 1,250 to 1,562.5 ppm (table 4). The serum sodium concentration was significantly correlated to the protein concentration from a mean of 1046.88 ± 103 ppm in the first bleeding to $1,407.61 \pm 27.35$ ppm in the 6th bleeding although this increase was not significant ($P < 0.05$) (table 4). Serum potassium level was negatively correlated

TABLE 1

Serum protein and electrolyte values in adult guinea fowls —
Numida meleagris palias

Blood Serum Parameter	n	Mean Values	SE	Range
Protein g/100ml	141	2.45	0.04	1.60–3.54
Sodium ppm	141	3231.56	107.52	1250–6165
Potassium ppm	141	1301.26	33.01	500–3625
Calcium mg/100 ml	141	14.16	0.54	1–30
Magnesium mg/100ml	141	4.18	0.10	1.9 – 9.5
Phosphate mg/100 ml	141	6.43	0.22	2.4 –12.0

TABLE 2

Analysis of variance table showing the effect of age, sex and time of bleeding and their interactions on the proteins and electrolyte levels in blood serum of Guinea fowls.

Source of Variation	df	Mean Squares					
		Proteins	Sodium	Potassium	Calcium	Magnesium	Phosphorus
Replications	2						
Time (T)	1	0.46*	16323137.0*	130187.5	23.32	0.93	19.91*
Age (A)	1	0.10	160809.06	109043.9	145.92*	3.16*	4.45
Sex (S)	1	0.25*	120130.75	71753.8	1087.09*	2.59*	5.12
TA	1	0.01	1571733.00*	1203140.0*	59.10*	5.95*	9.97*
TS	1	0.02	1558.13	39898.9	1.99	0.59	2.15
AS	1	0.63*	1893.48	100459.8	155.50*	2.42*	0.62
TAS	1	0.01	164066.31	4879.6	0.31	0.96	0.01
Error	130	0.10	1532177.9	147962.2	31.64	0.95	4.73

*P < 0.05.

TABLE 3.

Effect of sex, time of bleeding and age on blood serum protein and serum electrolyte levels in Guinea fowl

Blood Parameter	Male	Female	Morning	Afternoon	2 yr. old	4 yr. old
Protein g/100ml	3.43	2.50	2.54	2.40	2.44	2.50
Sodium PPM	3251.56	3243.27	3617.88	2882.74	3209.85	3284.98
Potassium PPM	1279.51	1351.58	1281.24	1349.83	1343.75	1287.34
Calcium mg/100 ml	11.27	17.10	13.54	14.79	14.67	13.35
Magnesium mg/100ml	3.98	4.41	4.38	4.06	4.03	4.36
Phosphorus mg/100ml	6.01	5.88	6.54	6.34	6.55	6.34

TABLE 4.

Effect of sequence of collection on the blood serum protein and serum electrolyte levels in Guinea fowls.

Blood Parameters	Sequence of Collection					
	1	2	3	4	5	6
Protein (g/100ml)	2.93	2.73	2.46	2.42	2.19	2.04
SE	0.09	0.06	0.56	0.06	0.06	0.06
range	2.29-3.54	2.2-3.3	1.9-3.1	1.0-3.1	1.6-2.7	1.602.6
Sodium (ppm)	4283.85	4510.17	128.79	2567.93	1211.41	1451.08
SE	72.49	50.37	128.79	53.84	46.98	16.38
range	3250-5125	3812.5-	3000-6165	2187-3500	1750-2687	1250-1563
Potassium (ppm)	1046.88	1078.13	1380.43	1532.61	1429.35	1407.61
SE	103.86	31.09	86.28	100.44	35.15	27.35
range	500-2625	750-1375	875-2500	1250-3625	1250-1750	1125-1625
Calcium (mg/100ml)	14.08	14.56	11.74	18.35	14.98	11.26
SE	1.06	1.08	1.18	0.92	1.43	1.50
range	7-27.5	7-30	1-24	14-28	7-25	5-27
Magnesium (mg/100ml)	4.61	5.20	4.87	3.75	3.58	3.08
SE	0.28	0.16	0.23	0.22	0.13	0.12
range	2.55-9.5	3.8-6.8	2.65-6.9	2.25-7.5	2.5-5.0	1.9-4.4
Phosphorus (mg/100ml)	4.96	5.73	8.7	5.9	6.1	7.5
SE	0.28	0.47	0.66	0.43	0.40	0.49
range	2.6-6.8	3.2-12.4	3.2-12.0	2.4-10	2.4-9.2	4.0-11.0

ted with serum protein ($r = -0.34$) and sodium ($r = -0.35$) level ($P < 0.05$).

The level of calcium in blood serum, 14.16 mg/100 ml, was significantly affected by sex and age of the birds (table 2). Female guinea fowl had significantly higher calcium values, 17.1 ± 0.95 mg/100 ml than males, 11.27 ± 0.78 mg/100 ml. There were also significant time of bleeding \times age group and age group \times sex interactions for the serum calcium levels. The concentration of calcium in the female guinea fowl of the 2 year age group averaged in the mornings, 19.22 ± 1.43 mg/100 ml as against 16.58 ± 1.56 mg/100 ml for the 4 year age group females, bled in the afternoons (table 5).

Magnesium values ranged from 1.9-9.5 mg/100 ml with a mean value of 4.18 mg/100 ml. Female guinea fowls had significantly ($P < 0.05$) higher serum magnesium value, 4.41 mg/100 ml than males, 3.98 mg/100 ml. Also, age had significant effect on the serum magnesium levels ($P < 0.05$) (table 2). The correlation coefficient between serum magnesium level and protein ($r = 0.32$), sodium ($r = 0.60$) and calcium levels ($r = 0.27$) were all significant ($P < 0.05$).

Serum phosphate levels averaged 6.43 mg/100ml with significant differences ($P < 0.01$) between males (6.00 mg/100 ml) and females (6.88 mg/100 ml) and also, between morning (5.28 mg/100 ml) and afternoon

TABLE 5

Effect of age group, sex and time of bleeding on calcium concentration (mg/100ml) in blood serum of Guinea fowls.

Age group	Sex	Time of bleeding	Mean values	SE	Range
4 year old	Males	Mornings	10.17	0.65	7.0-15.0
		Afternoons	12.29	1.39	5.0-25.0
	Females	Mornings	14.34	1.36	5.0-25.0
		Afternoons	16.59	1.56	5.0-30.0
2 year old	Males	Mornings	10.44	1.29	3.0-21.0
		Afternoons	10.18	1.06	3.0-15.0
	Females	Mornings	19.22	1.43	5.0-27.5
		Afternoons	18.83	1.37	10.0-27.0

bleeding (6.38 mg/100 ml). Serum phosphate levels were significantly correlated with serum protein levels ($r = -0.32$), potassium levels ($r = 0.19$) and magnesium level ($r = 0.18$) ($P < 0.05$).

The mean clotting time was 7.30 ± 0.6 minutes, range 3-4 minutes and this was negatively correlated with serum protein level, ($r = -0.52$), sodium level ($r = -0.61$), magnesium level ($r = -0.40$) not positively correlated ($P < 0.05$) with potassium level ($r = 0.36$). All correlations were significant ($P < 0.05$).

DISCUSSION

In two previous studies the mean serum protein levels of guinea fowls were 2.68 g/100 ml (Thurston *et al.*, 1981) and 2.82 g/100 ml (Defalco, 1942). The present mean value of 2.45 mg/100 ml, range 1.6 to 3.54 mg/100 ml, is in agreement with these findings. Also, Strukie and Neman (1951) working on the plasma proteins of domestic chicken had observed, as was recorded in this study, that the level of serum proteins

showed a marked difference between the first blood collection and subsequent consecutive collections. The significant effect of the sequence of collection on the serum protein concentration therefore, appears to be normal. The higher serum protein concentration in the females than in the males was in line with the findings of Sturkie and Newman (1951) and Verma *et al.* (1975) on domestic chicken.

Serum electrolytes, sodium and potassium were appreciably of higher concentration in guinea fowls than was reported for domestic fowl by previous workers (Ashok and Rawat, 1975; Ross *et al.*, 1978 and Lake *et al.*, 1958). The significant positive correlation with potassium would appear to explain the noticeable drop and increase in sodium and potassium concentration respectively recorded with bleeding. The serum calcium value of 14.16 mg/100 ml, range 1 to 30 mg/100 ml was within the range of values reported for the domestic fowl (Ross *et al.*, 1978; Polins and Sturkie, 1959). Male guinea fowl with mean total serum calcium value of

11.27 mg/100 ml appears higher than was reported by Urist and Deutsch (1960) for capons and Bell and Campbell (1961) for mixed chicken population. Higher calcium and phosphate levels in the females than in the males recorded in this study had also been reported in domestic chicken (Hertelendy and Taylor, 1961).

The reduction in mean serum protein concentration, sodium and magnesium levels might help to explain the extended clotting time observed in the birds after the third collections. It is known that several blood clotting factors — fibrinogen, thrombin, thromboplastin and plasma globulin fraction are all proteinous in nature (Sturkie and Griminger, 1965).

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