



Haematology and Serum Biochemistry of Four Strains of Indigenous Chickens in the Rain Forest Zone of Nigeria

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Abstract

Four strains of light-ecotype Nigerian indigenous chickens consisting of naked neck, frizzle feathered, normal feathered and the short winged were used to evaluate their haematological and some biochemical parameters. Blood samples were collected from four (4) cocks and twelve (12) pullets from each of the four genotype making a total of sixty (64) samples. Haematological parameters measured include packed cell volume, haemoglobin concentration, white blood cell, red blood cell, mean corpuscular haemoglobin, mean corpuscular volume, mean corpuscular haemoglobin concentration, heterophil, lymphocytes, monocytes, eosinophil, and basophil. The biochemical parameters considered are total cholesterol, total serum protein, serum albumin and serum globulin. Results obtained revealed that the normal feathered strain had significantly higher white blood cell (WBC) value ($P < 0.05$), while other parameters showed no significant difference ($P > 0.05$) in haematological traits among the four strains. Though cholesterol was not significantly different among the four chicken genotypes, naked necked chickens showed significantly ($P < 0.05$) higher white blood cell (WBC) values for total protein and globulin while the short winged chickens had higher albumin values. It was also observed that male indigenous chickens had significantly higher ($P < 0.05$) packed cell volume (PCV) (39.01 %), Haemoglobin concentration (Hb) (12.79 g/dl) and red blood cell (RBC) ($4.33 \times 10^{12/l}$) but lower cholesterol (92.5 mg/dl) values compared to females. It was concluded that there was no remarkable haematological difference between the four strains of indigenous chickens but differences exist between the males and females with respect to PCV, Hb, RBC and cholesterol values.

Key words: Light-Ecotype, Indigenous Chickens, haematology, serum biochemistry, Sex.

Introduction

The Nigeria indigenous chickens found scavenging around most rural communities are majorly owned and raised by household in the area for economic and socio-cultural functions. They have been found to possess special outstanding features such as their ability to tolerate stress that is prevalent in the tropical environment characterized by high temperature (Ibe, 1993). It has been reported that the Nigeria indigenous chickens possess many gene complexes that are of advantage to be exploited in the development of improved meat and egg type tropical chicken breeds (Machebe and Ezekwe, 2004). A number of the major genes or

gene complexes such as resistance to endemic diseases, adaptation to adverse environment among others have been identified in the genome of Nigeria indigenous chicken population comprising of naked neck, frizzle feathered, normal feathered and the short winged feathered chickens with variant plumage colours (Peters, *et al.*, 2002; Ajayi, 2010).

Variation in term of body weight and the location of these indigenous chickens necessitated their classification into two different ecotypes: The light ecotype also known as the Yoruba-ecotype comprises of chickens from the swamp, rainforest, and

derived savanna ecological zone with matured body weights ranging from 0.68 – 1.5kg while the heavy ecotype also known as the Fulani ecotype are those of the Guinea savannah, Sahel savannah and parts of the Montane regions with matured body weight between 0.9 to 2.5kg (Atteh, 1990). The evaluation of birds on the basis of their genetic distinctness and performance data as well as the conservation of the desired genes to enhance increased productivity within their local conditions has been advocated (Horst, 1999; Sonaiya, 2001)

Valuable information on the immune status of animals is mostly revealed through haematological and serum biochemical parameters. Information of this type is not only useful for diagnostic and management purposes but could be helpful in breeding programmes for the genetic improvement of indigenous chickens (Ladokun, *et al.*, 2008). This study was therefore carried out to evaluate the haematology and some serum biochemical parameters of four strains of indigenous chickens raised intensively in the rainforest zone of Nigeria with the aim of knowing if differences exist among the four strains in the location.

Materials And Methods

Four strains of light Eco-type indigenous chickens consisting of naked neck, frizzle feathered, normal feathered and the short-winged of both sexes were purchased from small holders flocks in Kwara, Oyo and Osun States. The local chickens were brought to the poultry unit of Benson Idahosa University Teaching and Research Farm, Benin City, Edo State. The area lies within the geographical coordinate of longitude 5° 04' East and 6° 43' East and latitude 5° 44' North and 7° 34' North. It has a prevailing tropical climate with a mean annual rainfall of 2162mm, average annual temperature of 27.6° C and a mean relative humidity of 72%. Nigeria Airport Authority (NAA), (2014). The different strains

were mated to generate offspring of the same strain that were used in this study. These offspring were raised according to genetic groups. Each genotype was made up of unsexed chicks which were replicated thrice and assigned into their various pen in a completely randomized design. Routine management practices including *ad-libitum* feeding, regular water supply as well as occasional medication during the rearing period were performed. At the twenty third week when distinctive differentiating features of males such as striking plumage (saddle) typically of brighter, bolder colour than those of the females of the same strain, as well as the more developed comb of the males than the females were conspicuous, blood samples were collected from four (4) cocks and twelve (12) pullets from each of the four genotype making a total of sixty four (64) blood samples.

Blood collection: About 5mls of blood samples was taken from the wing vein of each chicken using a sterile disposable needle and syringe. For haematological analysis, about 2mls of blood were collected and stored in bottles containing anticoagulant, Ethylene Diamine Tetracetic Acid (EDTA) capped and rolled gently to prevent clotting. The other 3.0 ml was store without anticoagulant, after coagulation the serum was separated and harvested for biochemical analysis. The haematological parameters measured were the Packed Cell Volume (PCV), Haemoglobin Concentration (Hb), White Blood Cell (WBC), Red Blood Cell (RBC), Mean Cell Haemoglobin (MCH), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin Concentration (MCHC), Heterophil (H), Lymphocytes (L), Monocytes (M), Eosinophil (E), and Basophil (B) using the standard procedures described by Davice and Lewis (1991). The biochemical parameters considered were: total cholesterol, total serum protein, (TSP), serum albumin (SA), and serum globulin (SG) following the standard procedure described by Baker and

Silverton (1985).

Statistical Analysis

Data collected were subjected to analysis of variance (ANOVA) using Genstat (2005) software statistical package (released 4.24) applicable to Complete Randomized Design (CRD) and significant means were separated using Duncan Multiple Range Test (Duncan, 1955)

Results

Presented in Table 1 are the means for haematological indices of four indigenous chicken genotypes used in the study. There were no significant difference ($P>0.05$) for Packed Cell Volume (PCV) and Haemoglobin Concentration (Hb) means among the chicken genotypes. The normal feathered chickens had

significantly higher means ($P<0.05$) for White Blood Cell (WBC) ($3.56\pm.54$) than the other strains. The Red Blood Cell (RBC), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin Concentration (MCHC), monocytes,, basophils, eosinophils, heterophils, and lymphocytes were not significantly different ($P>0.05$) among the chicken genotypes studied.

The blood biochemical indices of the four indigenous chicken genotypes used in this study are presented in Table 2. There were significant differences ($P<0.05$) in the mean for total protein and globulin among genotypes, with naked neck consistently having higher means than the short wing but similar to those of the frizzle feathered and normal feathered except albumin content which was opposite. There was no significant difference ($P>0.05$) in cholesterol between strains.

Table 1: Haematological Indices of Four Indigenous Chicken Genotypes

Indices	Naked neck	Frizzle	Normal	Short wing	SEM	Reference*
PCV (%)	28.50 \pm 2.27	31.50 \pm 2.54	28.00 \pm 2.80	30.00 \pm 1.56	1.14	22.0 – 35.0
Hb (g/dl)	9.41 \pm 0.80	10.41 \pm 0.77	9.25 \pm 0.94	9.78 \pm 0.54	0.37	7.0 – 13.0
RBC ($\times 10^{12/l}$)	3.35 \pm 0.26	3.71 \pm 0.27	3.23 \pm 0.29	3.43 \pm 0.13	0.12	2.5 – 3.5
MCH (pg)	28 \pm 0.73	27.38 \pm 0.83	28.50 \pm 0.46	28.75 \pm 0.62	0.33	33.0 – 47.0
MCV (fl)	85.13 \pm 1.88	84.50 \pm 1.09	86.25 \pm 1.43	85.00 \pm 2.40	0.85	90.0 – 140.0
MCHC (g/dl)	32.99 \pm 0.22	33.03 \pm 0.35	33.00 \pm 0.20	32.65 \pm 0.38	0.14	26.0 – 35.0
WBC ($\times 10^9/l$)	2.45 \pm 0.47 ^b	2.61 \pm 0.58 ^b	3.56 \pm 0.54 ^a	2.44 \pm 0.41 ^b	0.28	1.2 – 3.0
Eosinophils (%)	00	00	0.25 \pm 0.25	0.63 \pm 0.32	1.11	1.5 – 6.0
Monocytes (%)	00	00	00	00	00	5.0 – 10.0
Basophils (%)	00	00	00	00	00	Rare
Heterophils (%)	47.13 \pm 3.75	39.89 \pm 2.37	43.50 \pm 4.24	42.13 \pm 2.70	1.66	15.0 – 40.0
Lymphocytes %)	52.88 \pm 3.75	60.13 \pm 2.37	56.38 \pm 4.15	59.63 \pm 3.84	1.79	45.0 – 70.0

^{a, b}. Means within rows carrying different superscripts differ significantly ($P<0.05$)

* Reference values of Jain (1993)

Table 2: Blood Biochemical Indices of Four Indigenous Chicken Genotypes

Indices	Naked neck	Frizzle feathered	Normal Feathered	Short winged	SEM	Reference**
Total Protein (mg/dl)	5.14±0.35 ^a	4.75±0.35 ^{ab}	4.34±0.11 ^{ab}	4.28±0.15 ^b	0.14	3-0 – 4.9
Albumin (mg/dl)	1.64±0.06 ^b	1.82±0.11 ^{ab}	1.73±0.08 ^{ab}	1.91±0.10 ^a	0.05	-----
Globulin (mg/dl)	3.50±0.34 ^a	2.93±0.31 ^{ab}	2.58±0.13 ^{ab}	2.37±0.18 ^b	0.14	-----
Cholesterol (mg/dl)	214.88±27.30	181.25±35.93	179.0±20.75	140.0±28.55 ^a	14.42	129 – 297

^{a, b}. Means within rows carrying different superscripts differ significantly (P<0.05)

** Reference values of clinical Diagnostic Division (1990).

Table 3 shows the means for haematological indices of the indigenous chickens by sex. The results showed that sex had significant effect (P<0.05) on Packed Cell Volume (PCV), Haemoglobin Concentration (Hb) and Red Blood Cell (RBC). The male chickens had higher means than the females. There were no significant difference (P>0.05) in WBC, MCH, MCHC, eosinophils, heterophils, and the lymphocytes values with respect to sex.

The effect of sex on the biochemical indices of the indigenous chickens used in the study are presented in Table 4. The results revealed that with the exception of cholesterol mean which showed a significant difference (P<0.05) with males having lower value, other parameters evaluated were statistically similar. However, the females had consistently higher absolute values.

Table 3: Effect of Sex on Haematological Indices of Indigenous Chickens

Indices	Male	Female	SEM
PCV (%)	39.01±0.78 ^a	26.33±0.72 ^b	1.14
HB (g/dl)	12.79±0.23 ^a	8.69± 0.25 ^b	0.37
RBC (x10 ^{12/l})	4.33±0.15 ^a	3.13±0.09 ^b	0.12
MCH (pg)	28.38±0.96	28.08±0.32	0.33
MCV (fl)	88.00±1.16 ^a	84.29±1.00 ^b	0.85
MCHC (g/dl)	32.91±0.26	32.92±0.17	0.14
WBC (x10 ^{9/l})	2.36±0.55	3.17±0.32	0.28
Eosinophils(%)	0.00	0.29±0.14	0.11
Heterophils (%)	38.75±3.74	44.63±1.78	1.66
Lymphocytes (%)	62.50±3.98	55.50±1.90	1.79

^{a, b}. Means within rows carrying different superscripts differ significantly (P<0.05)

Table 4: Effect of Sex on Biochemical Indices of Indigenous Chickens

Indices	Male	Female	SEM
Total Protein (mg/dl)	4.25±0.11	4.75±0.18	0.14
Albumin (mg/dl)	1.67±0.07	1.87±0.06	0.05
Globulin (mg/dl)	2.58±0.10	2.88±0.19	0.14
Cholesterol (mg/dl)	92.50±7.61 ^a	207.54±14.96 ^b	14.42

^{a, b} Means within rows carrying different superscripts differ significantly (P<0.05)

Discussion

Haematological indices of four indigenous chicken genotypes studied did not differ significantly (P>0.05) in their packed cell volume (PCV) and Red blood cell (RBC) values. The PCV values were within the range of 22.0 – 35.0% reported by Jain (1993), 25 to 45% reported by Ross *et.al* (1978); Anon (1980) and Simarakas *et al.* (2004) for chickens. The result also agreed with 26.1 to 29.5% reported by Ikhimioya *et al.* (2000) with slight deviation for short winged and frizzle feathered chickens which recorded 30 % and 31.50 % respectively. The slight variation may be attributed to the different locations and the season of the year.

The Haemoglobin concentration (Hb) which ranged between 9.25±0.94 g/dl in normal feathered chicken and 10.41±0.77 g/dl in frizzle chickens were within the accepted range of 7.0 to 13.0 (g/dl) for indigenous chickens (Anon, 1980, Jain, 1993, Swenson, 1999). The results therefore suggest that local chickens possess similar characteristics in terms of haematological concentration (Hb) with those used in the study. The mean for MCV and MCH observed in this study though fall below the reference values of 33 – 47% (MCH) and 90 – 140% (MCV) reported by Jain, (1993), the values obtained were in tandem with 81.60 – 89.10% for MCV, and 27.20 – 28.90% for MCH for naked neck and normal feather indigenous cocks reported Ladokun *et al.* (2008). This is an indication that the four indigenous genotypes can be ranked equally for

these traits suggesting that the chickens were well fed with normal nutritional efficiency without anaemic conditions. The values for WBC obtained in this study were at variance with the reference values of 1.2 – 3.0 (x10⁴µl) reported by Jain (1993). However the values were in tandem with those of Ladokun *et al.* (2008) and Iheukwuemere *et al.* (2006), who reported similar value of 4.32×10³ml for naked neck and normal feathered indigenous chickens. The four strains of indigenous chickens were found to be healthy all through without any sign of ill-health suggesting that the blood cells still effectively performed their phagocytic and immune functions. There are different types of WBCs and changes in their values can indicate disease conditions (Peters, 2002). These cells according to the author include heterophils (equivalent to mammalian neutrophils), lymphocytes, monocytes, eosinophils and basophils. The results from the study revealed similarity among the various genotypes. The differential count of these cells indicated that the four strains of indigenous chicken genotypes falls within the normal range of 0 to 3% for monocytes, 0 to 5% for basophils, 0 to 2 % for eosinophils, and 40 to 75% for heterophils (Scott 1996). Apart from lymphocytes values, other differential counts were not in agreement with the reference values reported by Jain (1993). The lymphocytes revealed higher values above the 40 to 48 % reported by Mohammed *et al.* (2015). This may imply that all the genotype had adequate immune response status indicating absence of infection. Peters (2002) reported that several

factors can change the distribution of lymphocytes and that some species respond to stress with lymphocytosis (increased lymphocytes), while others do so with heterophilia (increased heterophils). Allergic conditions may show increased number of eosinophils, chronic conditions may display increase number of monocytes (monocytosis). The higher counts above normal may be combating some kind of infection, as reported by Adeyemo and Longe (2007). Monocytes and Basophils counts were not found in all the genotypes. Basophils contain the anticoagulant, heparin which is normally released in area of inflammation to prevent clotting of blood and lymph, (Mohammed *et al.*, 2015).

Considering the effect of sex on the haematological parameters, the male Indigenous chickens exhibited higher means for PCV, Hb, and RBC than the hens. The means obtained for PCV(39.0 ± 0.78 %), Hb(12.79 ± 0.23 g/dl) and RBC($4.33 \pm 0.15 \times 10^{12/l}$) were within the range of values obtained by Ladokun *et al.*, (2008) but higher than the values obtained by Iheukwemere *et al.*, (2006). This observation is in agreement with Sharmin and Myenuddin (2004) stating that haematological values for chickens are greatly influenced by sex among other reasons.

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Conclusion

The outcome of this study revealed that there was no substantial haematological and biochemical variation among the four strains of Nigeria indigenous chickens in the rainforest zone, however, remarkable haematological distinctness existed between the males and females with regard to PCV, Hb, RBC and cholesterol values.

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