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Haematological and Serum Biochemical Indices of Naked Neck and Normally Feathered Nigerian Indigenous Chickens in a Sub Humid Tropical Environment

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Abstract: Haematological and serum biochemical indices of Nigerian indigenous chickens of two genetic groups were evaluated. One hundred and twenty (120) cocks with average weight of 1.10kg, corresponding to sixty (60) naked neck (NaNa) and sixty (60) normally feathered (nana) were utilized in the study. On the basis of feather colour, the normal plumage cocks were subdivided into two equal phenotypic groups. Each genetic group was divided into four replicates of fifteen birds each in a completely randomized design. There were no significant (P>0.05) differences between the genotypes in the mean values of white blood cells(WBC), mean corpuscular volume(MCV), mean corpuscular haemoglobin concentration(MCHC). However, naked neck cocks were significantly superior in packed cell volume (PCV) haemoglobin (Hb) and red blood cells(RBC) compared with their normally feathered counterparts(41.00 vs 35.90%; 13.68 vs 11.60 g/dl; 4.84 vs 4.21x10^6/ml; p>0.05). With the exception of PCV which was significantly (p>0.05) higher in brown cocks than white coloured cocks (38.30 vs 33.50%), plumage colour had no significant effect on the variables estimated. No significant differences were observed in total protein, albumin, urea, glucose, cholesterol, serum alanine amino transaminase (SALT) and serum aspartate amino transferase (SAST) of the genetic groups. The normally feathered cocks, however had significantly (P<0.05) higher globulin content (1.53 vs 1.15 g/dl) and lower creatinine value (0.88 vs 0.95 mg/dl) compared to the naked neck cocks. Plumage colour did not significantly (P>0.05) affect serum biochemical parameters suggesting that the two colour variants might not be true representation of genetically distinct subpopulations. The present result on blood parameters of both naked neck and normally feathered cocks could serve as a baseline data, which could be exploited in the improvement of local stock.

Key words: Naked necks, cocks, normal plumage, chickens, haematology and serum biochemistry

Introduction

The local chickens are among the many local resources of poor people living in the rural areas, which could be harnessed and utilized for poverty alleviation (Njue, 2002). The tropical environment is characterized by stress factors, notable among which is high temperature (Ibe, 1993), which can lead to heat stress and thus, affecting the performance of birds. However, a number of major genes or gene complexes have been identified in the genome of the Nigerian local chicken population (Peters *et al*., 2002). Among these major genes are the feather distribution (Naked neck) and the feather structure (Frizzle) genes. These unique genes have been reported to ameliorate tropical heat stress and enhance the performance of individuals possessing them (Hernandes *et al*., 2002).

Horst (1999) advocated the use of ecotypes in the improvement programmes of birds based on both the evaluation of genetic distinctness and performance data records. Similarly, Sonaiya (2002) reported the need to conserve desirable genes, e.g. disease resistance and promote them, thereby improving the productivity of the local birds within their local conditions. In this respect, an evaluation of the immune response capacities of animals becomes imperative. Haematological and serum biochemical parameters have been reported to provide valuable information on the immune status of animals (Kral and Suchy, 2000). Such information, apart from being useful for diagnostic and management purposes, could equally be incorporated into breeding programmes for the genetic improvement of indigenous chickens.

In the semi-humid tropics, there is dearth of information on immunological parameters of native birds, especially those with tropically relevant genes. This limits objective data base which could be tapped from it, in order to design appropriate breeding strategies. It also affects the classification into distinct genetic groups. Therefore, the present study was embarked upon to evaluate the haematological and serum biochemical parameters of Nigerian indigenous chickens in a sub-humid environment

Materials and Methods

Study site and management of experimental birds: Data on one hundred and twenty indigenous cocks with average initial weight of 1.10kg , from a breeding experiment conducted at the poultry unit, Teaching and

Research farm , Faculty of agriculture, Nasarawa State university, Shabu-Lafia Campus were utilized in the study. The birds were sourced from smallholder poultry farmers. They were classified into two genetic groups, the naked neck (NaNa) and the normally feathered birds (nana) respectively. On the basis of plumage colour, fully feathered cocks were further subdivided into two phenotypically distinguishable groups, white and brown cocks. Plumage colour classification was as described by Salako and Ige (2006). Each genetic group was divided into four replicates of fifteen birds each in a completely randomized design. This corresponded to sixty naked neck and sixty normally feathered (thirty brown and thirty brown) chickens. The birds were reared on deep litter, where proper sanitation and medication were carried out. They were fed ad libitum commercial growers' mash containing 16% crude protein and 2200 Kcal/kg ME. Birds also had unlimited access to fresh clean water.

Determination of blood parameters: At the end of the sixth week of the study, Blood was collected from the cocks by venipuncture of wing vein. Blood samples were collected into two different sets of bijou bottles. The first set of bottles contained Ethylene-diamine-tetra-acetic acid (EDTA anti coagulant) while the other set was without EDTA. The set with EDTA was used to determine RBC, WBC using the improved Neubauer haemocytometer, as described by Dacie and Lewis (1991); PCV was determined using the microhaematocrit method and haemoglobin (HB) using cyanomethemoglobin method according to Cole, (1986). Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), and Mean Corpuscular Haemoglobin Concentration (MCHC) were determined using the appropriate formulae (Jain, 1986). The set of samples bottles without EDTA were centrifuged in a macro centrifuge to generate serum for biochemical analysis, Total protein was determined using the Biuret method as described by Doumas, (1975); albumin using dye-binding technique with bromocresol green as described by Doumas and Biggs (1972), globulin by difference (total protein minus Albumin), total cholesterol by enzymatic method as described by Allain *et al.* 1974. Creatinine by Jaffe reaction method as described by Henry *et al.* (1974); Urea by di-methyl monoxide method as described by Varley *et al.* (1980). Serum Alanine amino transferase (SALT) and serum aspartate amino transferase (SAST) described by Bergmeyer *et al.* (1978); Serum glucose by enzymatic method (Kaplan and Szabo 1983).

Statistical analysis: Data were subjected to one-way analysis of Variance with genotype as the fixed effect. Where differences were significant, the means were tested using least significant difference (LSD) method as outlined in GENSTAT (2005) statistical package. The statistical model used was

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where Y_{ij} = Observation per cock
μ = General mean
T_i = Effect of genotype
e_{ij} = Error.

Results and Discussion

The haematological parameters of Nigerian indigenous naked neck and normally feathered cocks are shown in Table 1. There were no significant differences (P>0.05) between the genotypes in mean values of WBC, MCV, MCH and MCHC. However, naked neck cocks had significantly (P<0.05) higher PCV (41.00 vs 35.90%), Hb (13.68 vs 11.60 g/dl) and RBC (4.84 vs 4.21x10^6/ml). The mean values obtained in the present study fall within normal physiological range (Ikhimioya *et al.*, 2000; Islam *et al.*, 2004; Simaraks *et al.*, 2004). The higher PCV, Hb and RBC values in naked neck cocks are in agreement with the findings of Clubb and Schubot (1991), although they attributed these to higher weight gains as a result of reduction in heat load. In a similar finding, El-Safty *et al.* (2006) reported the superiority of the naked neck gene in PCV compared to that of the fully feathered. This could be a boost to the growth and productive life of the former. However, the present results are inconsistent with the PCV, RBC and Hb values given by Oke *et al.* (2007), where no significant (P>0.05) genotype effect was observed. This discordant submission could be attributed to environmental and seasonal factors. Their own experiment was carried out in a humid tropical environment. The leucocytes indices offer explanation for the defense mechanism of the birds. The nonexistence of mean differences is an indication that the two genotypes can be ranked equally in this direction. This may largely be informed of the associated inherent resistance to certain tropical diseases. It is noteworthy that the subsisting ecological conditions support several vectors and parasites of economic significance. Table 2 shows the observed haematological characteristics of white and brown cocks. Plumage colour did not significantly (P>0.05) affect the Hb, RBC and WBC, MCH and MCHC mean values. However, the brown feathered cocks had a PCV value (38.30%) which was significantly higher (P<0.05) than that of the white feathered cocks (33.50%). The local chickens appear to be genetically heterogeneous with no specific colour pattern. The present values obtained seemed not convincing enough to suggest that the two colour variants are true representation of genetically distinct subpopulations. That notwithstanding, the major criterion in colour preferences seems to be the uses of the colour in traditional medicine and the ease of camouflaging.

The serum biochemistry profile of the Nigerian indigenous cocks is presented in Table 3. The mean

Table 1: Mean Haematological Values for Naked Neck and Normally Feathered Nigerian Indigenous Cocks

		Parameters						
Genotypes	N	PCV (%)	HB (g/dl)	RBC ($x10^6$/ml)	WBC ($x10^3$/ml)	MCV (fl)	MCH (pg)	MCHC (%)
Naked neck, NaNa	60	41.00[a]	13.68[a]	4.84[a]	4.32	81.60	27.20	33.37
Normally feathered, nana	60	35.90[b]	11.60[b]	4.21[b]	4.07	89.10	28.90	32.41
SEM		1.16	0.41	0.17	0.26	5.81	2.06	0.55

SEM: Standard error of means; [ab]Means within columns bearing different superscripts differ significantly ($p<0.05$)

Table 2: Plumage Colour and Haematological Characteristics of the Normally Feathered Cocks

	Parameters							
Plumage Colour	N	PCV (%)	HB (g/dl)	RBC ($x10^6$/ml)	WBC ($x10^3$/ml)	MCV (fl)	MCH (pg)	MCHC (%)
White	30	33.50[b]	10.90	4.41	4.08	75.96	25.20	33.08
Brown	30	38.30[a]	12.29	4.02	4.05	95.27	32.60	32.19
SEM		1.48	0.55	0.17	0.22	7.46	2.72	0.80

SEM: Standard error of means, [ab]Means within columns bearing different superscripts differ significantly ($p<0.05$)

Table 3: Mean Serum Biochemical Values for Naked Neck and Normally Feathered Nigerian Indigenous Cocks

		Parameters								
Genotypes	N	Total Protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Creat-inine (mg/dl)	Urea (mmol/l)	Glucose (mg/dl)	Chole-sterol (mg/dl)	SALT (i.u./l)	SAST (i.u./l)
Naked neck, NaNa	60	4.63	3.48	1.15[b]	0.95[a]	4.54	44.10	31..30	10.60	8.20
Normally feathered, nana	60	4.81	3.28	1.53[a]	0.88[b]	4.46	45.50	32.45	11.90	10.95
SEM		0.24	0.22	0.31	0.04	0.01	0.22	0.12	0.95	1.07

SEM: Standard error of means, [ab]Means within columns bearing different superscripts differ significantly ($p<0.05$)

Table 4: Plumage Colour and Serum Biochemical Characteristics of Normally Feathered Cocks

		Parameters								
Plumage Colour	N	Total Protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Creatinine (mg/dl)	Urea (mmol/l)	Glucose (mg/dl)	Chole-sterol (mg/dl)	SALT) (i.u./l)	SAST (i.u./l)
White	30	5.01	3.34	1.67	0.88	5.11	48..90	32.00	11.50	8.20
Brown	30	4.61	3.23	1.38	0.89	5.31	42.10	32.90	10.60	10.50
SEM		0.33	0.31	0.44	0.05	0.33	2.96	1.75	1.38	1.55

SEM: Standard error of means, [ab]Means within columns bearing different superscripts differ significantly ($p<0.05$)

values of total protein, albumin, urea, glucose, cholesterol, serum alanine amino transferase (SALT) and serum aspartate amino transferase (SAST) of the genetic groups were not significantly influenced ($P>0.05$). However, the normally feathered cocks had a significantly higher ($P<0.05$) globulin content (1.53 vs 1.15 g/dl) and a lower (0.88 vs 0.95 mg/dl; $P<0.05$) creatinine value. The present findings are in consonance with the reports of earlier workers (Mitruka and Rawnsley, 1977; Clubb and Schubot, 1991; El-Safty *et al.*, 2006). Serum parameters are important in the proper maintenance of the osmotic pressure between the circulating fluid and the fluid in the tissue spaces so that exchange of materials between the blood and cells could be facilitated. They also contribute to the viscosity and maintenance of normal blood pressure and pH. The higher globulin level in the normal plumage cocks aids in better cell-mediated immune response. Their lower serum creatinine, which is a waste product formed in muscle from a high energy storage compound, Creatinine phosphate is also an indication of higher muscle mass. The effect of plumage colour on serum biochemical parameters of normally feathered birds are shown in Table 4. There were no significant differences ($P>0.05$) between the brown and white cocks in mean values of all the variables estimated. This is a further attestation to the fact that plumage colour could be more of traditional values than genetic.

Conclusion: This study revealed that the packed cell volume, haemoglobin and red blood cells of cocks were significantly different with higher mean values recorded for the naked neck compared to their normally feathered counterparts. However, normal plumage cocks had significantly higher globulin and lower serum contents. Apart from the superior packed cell volume of the brown

cocks, plumage colour did not have significant effect on the fully feathered cocks. This is an indication that it is an unreliable trait in the classification of birds into genetically distinct subpopulations. The present haematological and serum biochemical values could be utilized in crossbreeding programmes in order to produce individuals that are fit and more productive.

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