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Haematological Indices in Three Genotypes (Naked Neck, Frizzled Feather, Normal Feathered) of Nigerian Local Chicken

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Abstract
A study was designed to evaluate the haematological parameters and body weights of three genotypes (naked neck, frizzled feather and normal feathered) of Nigerian chicken. Chickens were managed intensively for 2 months before blood samples were collected for analysis. Body weights and 2ml of capillary blood samples were collected from the right side of the neck of each bird into a syringe and collected in a test tube containing EDTA (Ethylene diaminetetra acetic acid) as an anticoagulant. These blood samples were taken to Animal Science Department Laboratory where haematological parameters in the 3 varieties of local chickens were evaluated within 2 days. Haematological parameters evaluated were Packed Cell Volume, Haemoglobin Concentration, Platelets Counts and White Blood Counts. Hematological parameters and body weights were compared between varieties using Multivariate General Linear model of SPSS version 7.0 for ANOVA. Significant means were separated using Duncan Multiple Range Test. Comparison of cockerels of the 3 varieties revealed that frizzled feather cockerels performed best in Platelets Counts (33.20x10^9l), Haemoglobin Concentration (9.9g/dl), Packed Cell Volume (29.40%), ranked second in White Blood Counts (4.29 x 10^9ml) and body weight (1.12kg). Naked neck cockerels had the best mean body weight (1.15kg), White Blood Counts (4.71 x 10^9ml), ranked second in Platelets Counts (22.90 x 109l), Haemoglobin Concentration (3.82g/dl) and Packed Cell Volume (25.80%). Normal feathered cockerels performed worst in all the haematological parameters and body weight with the values of Packed Cell Volume (28.30%), White Blood Counts (3.20 x 10^9ml), Platelets Counts (203.60 x 10^9l), Haemoglobin Concentration (7.74g/dl) and body weight (0.91kg). There were significant differences ($P<0.05$) in haematological parameters and body weights among the 3 varieties of local chicken cockerels. Comparison of pullets of the 3 varieties revealed that frizzled feather pullets had the best Platelets Counts (30.80 x 10^9l), White Blood Counts (3.64 x 10^9ml), ranked third in mean body weight (0.98kg), Haemoglobin Concentration (8.05g/dl) and Packed Cell Volume (25.80%). Naked neck pullets performed best in mean body weight (2.43kg), Packed Cell Volume (29.80%), ranked second in Haemoglobin Concentration (8.91g/dl), third in Platelets Counts (29.00 x 10^9l) and White Blood Counts (3.51 x 10^9ml). Normal feathered pullets performed best in Haemoglobin Concentration (9.27g/dl), ranked second in mean body weight (1.01kg), White Blood Counts (3.34 x 109ml), Packed Cell Volume (28.30%) and Platelets Counts (29.20 x 10^9l). There were no significant differences ($P>0.05$) in haematological parameters and body weight of pullets in the 3 varieties of local chickens. Best results in haematological parameters were obtained from cockerels of naked neck and frizzled feather varieties. Generally, naked neck and frizzled feather varieties performed better than the normal feathered variety. It is recommended that the naked neck and frizzled feather cockerels be characterized, conserved and crossed with normal feathered pullets to enhance their haemtological profiles and body weights.
Keywords: Local Chickens, haematology, body weight, management, genetic improvement.

Introduction

Chickens dominate about 98% of the total poultry members (ducks, turkeys and Guinea fowls) kept in Africa (Gueye, 2005). Out of the 150 million chickens in Nigeria, 120 million are local and 30 million are exotic (RIM, 1992). Local chickens are widely distributed in the rural areas of Nigeria where they are kept by the majority of the rural poor. Several investigations (Adene, 1990; Dafwang, 1990 and Nwosu, 1990) have reported that each rural household has an average of 11 to 34 local chickens. RIM, 1992 observed that the frequency distribution of the normal feathered chicken variety is about 91.81% while those of frizzled and naked neck varieties are about 5.2% and 3.0% respectively. Their products are preferred by the majority of Nigerians because of the pigmentation, taste, leanness and suitability for special dishes. Their products (eggs and meat) are the major sources of protein and also serve as sources of income for the rural, urban and semi-urban dwellers (Horst, 1989). Studies (Udoh *et al.*, 2012[b]) reveal the varying egg laying characteristics of these varieties, with the naked neck variety performing best in egg weight, egg number, pause length and feed efficiency. There is need to improve the productivity of the Nigerian chicken varieties that are up till now characterized by small body weight, small egg size and few egg numbers(Udoh *et al*., 2012[b]).

Haematological studies of these varieties of local chickens are necessary for their proper management and genetic improvement. Haematological values and corresponding body weights are widely used as indices of health in other animals' practices (Solomon *et al*., 2005) but are not widely used in poultry. It is important to have baseline data of these clinically important indices so as to have an objective assessment of health in local chicken varieties. Mitruka and Rawnsley (1997) observed that haemtological parameters are associated with

certain production traits in chickens. For example, high packed cell volume (PCV) and haemoglobin contents are indicators of high feed conversion efficiency while high serum protein is an indicator of good feathering ability and tissue growth in chickens.

These reasons call for the need to evaluate the haematological parameters of existing local chicken varieties. These blood examinations can be used in screening procedures to assess general health. Mmereole (2004) suggested that such haematological parameters that have bearing on the productivity of an animal should be incorporated in the formation of selection indices for optimum productivity. Adequate information on haematological parameters of local chicken varieties can serve as raw materials for breeding programmes (Ajayi, 2010). In this way, the local chicken varieties will effectively be incorporated into poultry breeding programmes, play the strategic role of boosting the Nigerian poultry industry and provide a buffer against shortages of meat products.

2. MATERIALS AND METHODS

2.1 Management of Experimental Birds

Representative samples of local chicken varieties from different localities in Akwa Ibom State, Nigeria were assembled at about ten weeks before the experimental day. A total of 480 pullets and cockerels (160 each of normal feathered, naked neck and frizzled feather) were purchased. They were quarantined for two weeks after which 360 chickens (120 each of normal feathered, naked neck and frizzled feather) were selected based on their health status. Each variety consisted of 60 pullets and 60 cockerels. They were vaccinated and dewormed against prevalent local infections. The study was sited in Uyo ($5^0$1'N; $7^0$35'E). The tropical climate of Uyo has a mean annual temperature of between 26^0C and 28^0C while the mean annual rainfall ranges from 2000mm – 3000mm. The chickens were kept individually in the cells of a 3-tier battery cage in an open-sided poultry house within Teaching and Research Farm, Animal Science Department, University of Uyo, Nigeria. Commercially prepared feed with 17% crude protein and Metabolized Energy of 2500 kcal/kg was fed *ad libitum*. Free-choice drinking water was made available. Birds were managed for two months before blood samples were collected for analysis.

2.2 Blood sample collection and Evaluation

2ml of capillary blood samples were collected from each of the 360 local chickens. In this method, the right side of the neck of each bird was pressed with the finger so that the jugular vein was visible. Disposable syringe was inserted into the vein and blood was collected into a test-tube containing EDTA (Ethylene diaminetetra acetic acid) as anticoagulant. Blood samples were immediately conveyed to Animal Science Department Laboratory, University of Uyo, Nigeria. Haematological parameters in the three varieties of local chicken were evaluated here within two days.

Packed Cell Volume (PCV) was measured by the haematocrit method proposed by Maton *et al.* (1993). PVC was read using a hand-held microhaematocrit reader and was calculated using the formula:

$$PCV = \frac{\text{Length of red cell column (mm)}}{\text{Length of total column (mm)}} \times \frac{100}{1}$$

Haemoglobin (Hb) concentration was estimated according to the method of Stott (1995) which includes dropping blood on an R-Terry haemoglobin scale blotting paper (new WHO haemoglobin colour scale) and allowed to dry. The colour of blood was compared with the corresponding colours on the R-Terry heamoglobin scale blotting paper by tallquist of different levels of haemoglobin ranging from 4-14g/dl. To obtain Platelets (Thrombocytes) Counts, 0.38ml of filtered ammonium oxalate diluting fluid was measured into small chamber. 0.02ml of well-mixed anticoagulated blood was added. The chamber was placed undisturbed for 20 minutes in a petridish covered with a lid. The chamber was then placed on a microscope stage using the 10x objective to focus the rulings of the grid. The central square of the chamber was viewed changing to 40x objective. Platelets were seen as small bright fragments and actual number was counted under the phase contrast microscope (Cheesbrough, 2006).

In counting the white blood cells, the blood was diluted in an acid reagent which haemolyses the red cells, leaving the white cells to be counted (Rodger, 1987).

2.3 Statistical Analysis

Haematological parameters and body weights were compared between varieties using Multivariate General Linear model of SPSS version 7.0 for analysis of variance (ANOVA). Significant means were separated by the Duncan's Multiple Range Test (1955).

3. Results and Discussion

3.1 Haematological indices and Body Weights of 3 varieties of male (cockerels) local chickens

The results of Packed Cell Volume (PCV) of cockerels presented in Table 1 show that there was a deficiency in PCV of the cockerels, compared to the normal referencing of 35-55% for healthy chickens (Purves *et al*., 2004). Edosein and Switzer (1998) noted that a fall in PCV below the minimum range indicates anaemia. Results obtained in this study therefore suggest that cockerels of the 3 varieties had a critical anaemic condition with the values of 25.80%, 28.30% and 29.40% for naked neck, normal and frizzled feather varieties respectively. Saxena and Madan (1997) attribute this anaemic condition to physiological changes. There were significant differences ($P<0.05$) between the 3 varieties for PCV.

Results of White Blood Counts (WBC) for cockerels in the 3 varieties are presented in Table 1. WBC of the cockerels were within the normal range of 3.0 – 6.0 x 10^9ml opined by Mitruka and Rawnsley (1977) and Lokhande *et al*., (2008). Robert *et al*., (1993) observed that the higher the concentration of WBC, the greater the ability to fight diseases. Results of this study show that frizzled feather had the highest mean counts of 4.71 x 10^9ml followed by naked neck and normal feathered with 4.29 x 10^9ml and 3.20 x 10^9ml respectively. This is an indication of higher cell medicated immunity against diseases in the frizzled feather variety. There were significant differences ($P<0.05$) among the 3 varieties for WBC.

Results of haemoglobin (Hb) Concentration presented in Table I agree with the normal Hb range of 7.0 – 13.0g/dl reported by Mitruka and Rawnsley (1977). Results of this study indicate that there was no deficiency in the Hb of the cockerels. Frizzled feather had the highest concentration (9.91g/dl), followed by naked neck and normal feathered with 8.82g/dl and 7.74g/dl respectively. Mitruka and Rawnsley (1977) opined that high Hb Concentration is an indication of feed conversion efficiency. Therefore the highest Hb concentration in the frizzled feather suggests the possession of certain favourable production traits in the variety. Mmereole (2004) suggested that such haematological parameters which have bearing on the production of an animal should be incorporated into selection indices for optimum production.

Platelets Counts of the 3 varieties of cockerels used in the study are presented in Table 1. The tested varieties performed differently with respect to Platelets Counts with the highest mean (33.20 x 10^9l) for frizzled feather, followed by the naked neck (22.90 x 10^9l) and lastly the normal feathered (22.60 x 10^9l) High Platelets Counts are useful during injury because they help to control bleeding (Health-wise, 2005). Results of Platelets Counts in this study suggest that the normal feathered variety with the least Platelets Count (22.60 x 10^9l) will most likely experience uncontrolled bleeding with injury, compared to naked neck and frizzled feather varieties. Platelets Counts of normal feathered variety was significantly different ($P<0.05$) from those of naked neck and frizzled feather.

Mean body weights of the 3 varieties of cockerels presented in Table 1 show that naked neck was the heaviest (1.15kg), followed by frizzled and normal feathered with 1.12kg and 0.91kg respectively. These differences in body weight could be attributed to their feed conversion and growth rate, among other factors (Payne, 1990). Mean body weights of naked neck and frizzled feather were significantly different ($P<0.05$) from that of normal feathered variety. Results of this study suggest better feed conversion, growth rate and feed efficiency in naked neck and frizzled feather variety than in normal feathered.

3.2 Haematological indices and Body Weights of 3 varieties of female (pullets) local chickens

Results of PCV in the 3 varieties (Table 2) were lower than the normal range of 33-35% proposed by Purves *et al.* (2004). These results are indicative of anaemia in the pullets of the 3 varieties. Naked neck had the highest mean value (29.80%), followed by normal feathered and frizzled feather with the corresponding values of 28.30% and 25.80%. There was no significant difference ($P>0.05$) among the 3 varieties for PCV.

WBC of the pullets across the 3 varieties (Table 2) were within the normal range of 3.0-60 x 10^9 ml opined by Mitruka and Rawnsley (1977) and Lokhande *et al.,* (2008). Results reveal that frizzled feather had the highest counts (3.64 x 10^9 ml), followed by normal feathered (3.54 x 10^9 ml) and naked neck variety (3.51 x 10^9 ml). Results suggest greatest ability of the frizzled feather pullets in fighting infections, compared to other varieties. There was no significant difference ($P>0.05$) among the 3 varieties for WBC. Results in Table 2 shown that Hb Concentration of pullets in the 3 verieties were within the normal range of 7.0 -13.0g/dl for healthy chickens (Mitruka and Rawnsley, 1977) and the range of 4.0 – 14.0g/dl by Lewis (1998). Normal feathered pullets had the highest concentration (9.24g/dl), followed by naked neck (8.91g/dl) and frizzled feather (8.05/dl) there was no significant difference ($P>0.05$) among the 3 varieties for Hb concentration.

Platelets Counts of the 3 varieties of pullets studied are presented in Table 2. Tested varieties performed differently with respect to Platelets Counts, with the highest mean (30.80 x 10^9 l) for frizzled feather, followed by normal feathered (29.20 x 10^9 l) and the naked neck (29.00 x 10^9 l). Naked neck pullets with the least Platelets Counts will most likely experience uncontrolled bleeding with injury (Healthwise, 2005). There was no significant difference ($P>0.05$) among the 3 varieties for Platelets Counts.

Mean body weights of the 3 varieties of pullets presented in Table 2 show that naked neck was the

heaviest (2.43kg), followed by normal feathered (1.01kg) and frizzled feather (0.98kg). These values are in greement with the range of 0.9kg – 1.8kg observed by Lokhande *et al.*,(2008). There was no significant difference (P>0.05) among the 3 varieties for mean body weights.

3.3 Ranking of pullets and cockerels of the 3 Varieties for Haematological Indices and Body weights

The ranking of pullets and cockerels of the 3 varieties for haematological indices and body weights are presented in Table 3. Naked neck pullets ranked first for mean body weight and PCV, second for Hb concentration and third for Platelets and WBC. Naked neck cockerels ranked first for mean body weight and WBC, but second for Platelets Counts, Hb Concentration and PCV. Naked neck cockerels performed better than the pullets. Frizzled feather pullets ranked first for Platelets and WBC but ranked third for mean body weight, Hb Concentration and PCV. Frizzled feather cockerels ranked first for Platelets Counts, Hb Concentration and PCV; ranked second for mean body weight and WBC. Frizzled feather cockerels performed better than the pullets. Normal feathered pullets, when compared with the pullets of the other two varieties had best Hb Concentration, ranked second for mean body weight, PCV, Platelets and WBC. Normal feathered cockerels had least mean body weight and performed worst in all the haematological indices studied. Generally, naked neck and frizzled feather varieties performed better than the normal feathered with respect to mean body weight and haematological parameters. Earlier studies (Krat and Suchy (2002), Adenokola and Durotype (2004) and Udoh *et al*. (2012[b]) proposed that local chickens carrying the frizzle and naked neck genes be characterized, conserved and the genes incorporated in the normal feathered variety to enhance performance and growth. Results of this study confirm this proposition and further recommend the crossing of normal feathered pullets with either naked neck or frizzled feather cockerels. Normal feathered cockerels should not be used for crossing because of their poor haematological profile.

4. Conclusion and Recommendation

Three (3) Nigerian local chicken varieties (naked neck, frizzled and normal feathered) performed differently with respect to haematological parameters and body weights. Packed Cell Volume of pullets and cockerels of the 3 varieties were lower than the range recommended for healthy chickens. There was no significant difference (P>0.05) for haematological parameters and body weights among the pullets of the 3 varieties. Best result with respect to haematological parameters and body weights were obtained by naked neck and frizzled feather cockerels. Generally, naked neck and frizzled feather varieties had better haematological indices than normal feathered vaiety. Cockerels of normal feathered variety performed worst in mean body weight and all haematological parameters studied. Due to the superiority of naked neck and frizzled feather cockerels in the haematological parameters studied, they should be characterized, conserved and crossed with normal feathered pullets to enhance their haematological profiles.

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Table 1: Haelmatological Indices and Body Weights of 3 varieties of male (cockerels) local chickens

Parameter	LOCAL CHICKEN VARIETY		
	Normal feathered	Naked neck	Frizzled feather
PCV (%)	28.30 ± 0.58[b]	25.80 ± 0.14[c]	29.40 ± 0.07[a]
WBC (X10^{9}ml)	3.20 ± 0.04[c]	4.71 ± 0.65[a]	4.29 ± 0.08[b]
Hb (g/dl)	7.74 ± 0.25[c]	8.82 ± 0.45[b]	9.91 ± 0.96[a]
Platelets (x10^{9}l)	20.60 ± 1.74[c]	22.90 ± 1.23[b]	33.20 ± 2.28[a]
Body Weight (kg)	0.91 ± 0.03[b]	1.15 ± 0.04[a]	1.12 ± 0.03[c]

[a,b,c] Mean within rows with different letters are significantly different (P<0.05)
PCV = Packed cell volume; WBC = White Blood counts; Hb =Haemoglobin concentration

Table 2: Haematological Indices and Body Weights of 3 Varieties of female (pullets) local chickens.

Parameter	LOCAL CHICKEN VARIETY		
	Normal feathered	Naked neck	Frizzled feather
PCV (%)	28.30 ± 0.80[a]	29.80 ± 0.06[a]	25.80 ± 0.49[a]
WBC (X10^{9}ml)	3.54 ± 0.08[a]	3.51 ± 0.03[a]	3.64 ± 0.09[a]
Hb (g/dl)	9.24 ± 0.12[a]	8.91 ± 0.14[a]	8.05 ± 0.09[a]
Platelets (x10^{9}l)	29.20 ± 0.84[a]	29.00 ± 0.11[a]	30.80 ± 0.79[a]
Body Weight (kg)	1.01 ± 0.03[a]	2.43 ± 0.25[a]	0.98 ± 0.03[a]

[a] Mean within rows with same letters are not significantly different (P>0.05)
PCV = Packed cell volume; WBC = White Blood counts; Hb =Haemoglobin concentration

Table 3: Ranking of cockerels and pullets of the 3 varieties for Haematological indices and Body weights.

		Ranking		
Parameter	***Sex***	***1***	*2*	***3***
Body weight	M	Nn	Ff	No
	F	Nn	No	Ff
Platelets courts				
	M	Ff	Nn	No
	F	Ff	No	Nn
White Blood courts				
	M	Nn	Ff	No
	F	Ff	No	Nn
Haemoglobin concentration	M	Ff	Nn	No
	F	No	Nn	Ff
Packed cell Volume	M	Ff	Nn	No
	F	Nn	No	Ff

M= Male; F= Female; Nn= Naked neck variety; Ff = Frizzled Feather variety;
No =Normal Feathered variety