EFFECT OF GENOTYPE ON HAEMATOLOGY AND BIOCHEMICAL PARAMETERS OF F_1 LOCAL CHICKEN IN THE HUMID TROPICAL ENVIRONMENT

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Abstract
Ninety-nine grower local chicken, 4 weeks of age from three different genotypes (Frizzle n = 33, Naked neck, n= 33 and Normal n = 33) were generated from 36 matured local chickens and used for the study to determine the effect of genotype on hematological and biochemical parameters of local chicken in the humid tropics. The experiment was in a Completely Randomized Design (CRD) subjected to Analysis of Variance (ANOVA). Hematological parameters determined were; Hemoglobin (HB), Packed Cell Volume (PCV), White Blood Cell (WBC), Red Blood Cell (RBC), Neutrophil, Lymphocyte, Monocyte, Basophil and Eosinophil; biochemical parameters include; Blood Glucose(BGC) and Total Blood Protein (TBP). The result shows that the genotypes had no significant ($P>0.05$) effect on Hemoglobin concentration (g/ml) and RBC ($x10^6mm^3$). The PCV (%) in this study ranged from 36.61± 0.60 in naked neck chicken to 40.81±0.60 in Frizzle genotype. The PCV was significantly ($P<0.05$) higher in the frizzle than naked neck and normal feathered chicken. WBC ($x10^3mm^3$) ranged between 37.65±1.50 in Frizzle and 46.04±1.50 in naked neck genotype. However, the effect of genotype on the White Blood Cell($x10^3mm^3$) counts of the Naked Neck was significantly ($P<0.05$) higher than Frizzle and Normal feathered local chicken. The values of TBP ranged (6.33 – 7.25g/dl). The BGC values ranged from 171.66 to 229.11mg/dl. Genotype of the local chicken significantly ($P<0.05$) affected their blood Glucose (mg/dl) level with naked neck producing the most significantly ($P<0.05$) higher value. There was no significant ($P>0.05$) effect on their Neutrophils, Monocyte, Eosinophil and Basophil had no effect on the genotypes. However, Lymphocyte of naked neck was significantly ($P<0.05$) higher than frizzle and normal feathered chicken. It was therefore concluded that the 3 genotypes differed in their PCV and WBC at same age. BGC also differ at same age, lymphocytes and monocytes as well differ in their amount in the chicken genotypes in the humid tropics.

Keywords: Local chicken, genotype, hematological and biochemical parameters

Introduction

The genetically unimproved local chickens remain predominant in African villages despite the introduction of exotic and cross-bred types. Nigeria local chickens have small body size, poor growth, small egg size and poor reproductive performance. These characteristics make them an undesirable stock in a complete economic situation (Oke *et al.*, 2011). However, local chickens are known to have same desirable traits such as tolerance and resistance to certain tropical diseases. Haematological studies are of ecological and physiological interest in helping to understand the relationship of blood characteristics to the environment and so could be useful in the selection of animals that are genetically

resistant to certain diseases and environmental conditions. Haematological parameters are good indicators of the physiological status of animals (Nosike, *et al.*, 2013).The evaluation of blood biochemistry in birds allows for the identification of metabolic alteration due to many endo and exogenous factors including the genotype, season, sex age and husbandry condition. Moreover, the biochemical blood parameters provide valuable information on the predicinal stage. These unique genes have been reported to ameliorate tropical heat stress and enhance the performance of individuals possessing them (Hernandez, 2002). Such information, apart from being useful for diagnostic and management purposes, could equally be incorporated into breeding programs for the genetic improvement of indigenous chickens (Elagib, 2011). Determination of hematological and biochemical parameters is essential in the diagnosis of various health, growth and survival of animals. In addition, it provides highly valuable information on the physiological state of the animal (Harr, 2002). However, hematological parameters could provide information not only for diagnostic and management purposes, but could also be incorporated into breeding programs for genetic improvement (Ibrahim *et al.*, 2011).

WBC could serve as a parameter indicating immunity and inherent resistance to tropical poultry diseases and parasites while hemoglobin and MCV values within the reference range of avian could be suitable traits for evaluating and improving the selected population of helmeted guinea fowl for feed conversion efficiency and adequate oxygen supply for maintenance of body function (Adedibu *et al.*, 2014). The test for WBC levels is very important to detect and measure the ability of the body to destroy diseases. A high level of white blood cells may be due to immunological challenge, which may be largely informed by the associated inherent resistance to tropical diseases (Isidahomen *et al.*, 2011). It is also noteworthy that the subsisting ecological condition support several vectors and parasites of economic significance. The measurements of the amount of various biochemical constituents of blood have been used in the evaluation of the physiological status of animals (Solomon *et al.*, 2005).The study was therefore conducted to evaluate the effect of genotype on hematological and biochemical Parameters of Local Chicken in the humid tropics.

Materials and Methods

Location of the Study

The study was conducted at the Poultry Unit of the Teaching and Research Farm of the Michael Okpara University of Agriculture, Umudike, Abia State. Umudike is located on latitude 05^0C 28′ North and 07^0C 32′East and lies at an altitude of 122m above sea level. This area is situated within the tropical rainforest zone of West Africa which is characterized by long duration of rainfall (April - October) and short period of dry season (November-March). Average rainfall is 2169.8mm in 148 – 155 rain days. Average ambient temperature is 26^0C with a range 22^0C and 30^0C. Its relative humidity ranges from 50 to 90%. (NRCRI, 2015)

Experimental birds and management

Thirty-six matured local chickens of the three genetic groups (12 Frizzle, 12 nakednecks and 12 Normal feathered) were purchased as parent stock at different local markets of Umuahia and they were at varied ages to produce the F_1 birds. The experimental birds were in 3 genotypes and replicated three times with 6 birds per replicate. The mating procedure was random mating. The following were the mating system: 2 male Frizzle x 10 female Frizzle, 2 male naked necks x 10 female naked neck and 2 male Normal feathered x 10 female Normal feathered. The mating ratio was 1 male to 5females in each replicate per genotype. The eggs from each of the genetic groups were hatched in commercial hatchery. Generated and selected from the parent stock were 99 chicksfrom the three different genotypes consisting (Frizzles n = 33, Naked neck n= 33 and Normal n = 33) and were used for the study. They were brooded in three small metal cages for each genotype for a period of 2 weeks after which they were transferred to small compartments according to their genotypic group for a period of 4 weeks and

finally to deep litter pens at 6 weeks of age. Dry wood shavings were used as litter material. The chicks were given chicks mash containing 28% crude protein (Cp) and 31000 kcal ME/kg for the first 4 weeks, thereafter, a grower diet containing 22% Cp and 3100 kcal ME/kg. They were housed in a deep litter system which lasted for ten weeks. Clean drinking water was given *ad-libitum*. Routine management operations such as washing of the water and feed troughs were carried out on daily basis. The birds were given routine vaccination during the period of the experiment. Prophylactic antibiotics and anticoccidial drugs were administered to the birds periodically via drinking water. The birds were also dewormed. The brooding period lasted for 6 weeks. From brooding through rearing, maximum comfort for the Poults was ensured.

Data collection

Blood samples were collected from the wing vein using sterile disposable needles (21-guage) and syringes from chicken. Specimen for haematological studies was collected separately in tubes containing ethylene diamine tetra-acetic acid (EDTA) as anticoagulant. Samples for biochemical analysis were collected into anti-coagulant free tubes and was allowed to clot for two hours at room temperature and centrifuged for ten minutes at 2000 rpm to separate the serum. The following haematological and biochemical parameters were determined: Packed cell volume (PCV), Haemoglobin Concentration (Hb) White blood Cell (WBC) and all leukocyte counts, Red Blood Cell (RBC), Blood glucose (BGC) and total plasma protein.

Samples analysis: Blood samples (2ml) were collected weekly and analyzed within two hours of their collection via the wing vein of each bird into individually sterilized bottles with anti-coagulant containing fluoride and oxalate, for analysis of the parameters. The Packed cell volume (PCV) was determined by the micro haematocrit method as described by Dacie and Lewis (1975).Haemoglobin (Hb) was determined with Haemometer as used by Heilmeye and Kilchling (1951).White blood Cell (WBC) and Red Blood Cell (RBC) were determined using a microscope with improved Neubauer haemacytometer as described by Jain (1986) after dilution in Turk's and Hayem's solutions respectively.Total Blood Protein (BPT) was determined by refractometric method.Blood glucose (BGC) was determined spectrophotometrically as described by Nelson (1944).

Experimental design

The experimental design was Completely Randomized Design (CRD) with model;

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

Where: Y_{ij}=General observation or parameter of interest, μ=Overall mean for the parameter of interest; T_i=the effect of treatment (effect of genotype); e_{ij}=Random error

Statistical analysis

Data collected were subjected to analysis of variance (ANOVA) using Statistical Package for SocialSciences, SPSS (2011) software package.

Results and Discussion

The effect of Genotype on hematological parameters of local chicken is presented in Table 1.

The results from Table 1 shows thatthe genotypes of the local chicken had no significant ($P>0.05$) effect onHemoglobin concentration (g/ml) and Red Blood Cell($x10^6mm^3$). PCV (%) in this study ranged from 36.61± 0.60 in Naked neck chicken to 40.81±0.60 in Frizzle genotype. The PCV (%) of frizzle on the other hand was significantly ($P<0.05$) higher than naked neck and normal feathered chicken. This is in line with the research findings of Addass *et al.* (2012) on indigenous chickens, it was reported that age group effect was observed on Packed Cell Volume. Increased PCV shows a better transportation and thus results in an increased primary and secondary polycythemia. According to Adedibu *et al.* (2014), PCV values may be useful markers for predicting spermatozoa maturation in testes, sexual maturity and the onset of semen production. Packed Cell Volume (PCV) or haematocrit is the volume of the red cells (erythrocytes) in the blood. Higher PCV values are usually due to a higher

weight gain as well as reduction in heat load (El-Safty *et al.,* 2006). Selection of Nigeria local chicken with significantly high PCV would therefore lead to a boost in the growth and productive life. PCV can serve as a trait for selection of Nigeria local chicken for improved growth and productive life of the bird through improved weight gain and heat – tolerance.

However, WBC ($x10^3mm^3$) ranged between 37.65±1.50 in Frizzle and 46.04±1.50 in Naked neck genotype. The effect of genotype on WBC was significantly ($P<0.05$) higher in Necked Neck than Frizzle and Normal local chicken genotypes.This is similar to the finding of an research experiment conducted by Chineke *et al.* (2006) on variation in hematological parameters of Nigerian native chickens and reported that Normal-feathered birds had higher ($P < 0.05$) mean values compared to frizzled and native neck genotypes except for albumin, red blood and white blood cells, and mean cell haemoglobin concentration. It could be observed that the hematological parameters of local chicken could be affected by genotype; Durai, *et al.* (2012) conducted a study on haematological profile and erythrocyte indices of different breeds of poultry and observed variation in results which was suggested to be due to differences in breeds. WBC could serve as a marker indicating immunity and inherent resistance to tropical poultry diseases and parasites. The test for WBC levels is very important to detect and measure the ability of the body to destroy diseases. A high level of white blood cells may be due to immunological challenge, which may be largely informed by the associated inherent resistance to tropical diseases (Isidahomen *et al.,* 2011). It is also noteworthy that the subsisting ecological condition support several vectors and parasites of economic significance.

The effect of genotype on biochemical parameters of local chicken is presented in Table 2.The genotype of the Nigerian local chickens significant ($P<0.05$) affected their blood Glucose (mg/dl) level with naked neck producing significantly ($P<0.05$) higher value. The genotype of local chicken did not significantly ($P>0.05$) affect their total blood protein level. The significant difference could be as a result of fluctuation in environmental temperature (Donkoh, 1989). The values of TBP (6.33 – 7.25g/dl) in this study were higher than the values (3.4 – 3.8g/dl) reported by (Albokhadaim *et al.*, 2012). The increased concentrations of total protein may be explained by the very quick somatic growth that could occur in growing chicken.Among numerous factors that can influence the level of plasma protein in broilers, age of the birds seems to be one of the most important factor; higher values are generally found in adult birds compared to young birds (Silva *et al*., 2007).

The BGC values in this study ranged from 171.66 to 229.11mg/dl. These values, however, are higher than the normal range (89.0 – 95.0mg/dL) for domestic animals (Frandson, 1981) and similar to the normal reference values (200-500mg/dl) reported for chickens (Abdi-Hachesoo *et al.*,2011). The differences in BGC may be due to the carbohydrate utilization of the feed given to the birds. This is supported by Murray *et al*. (1993)who stated that blood glucose is influenced by the dietary carbohydrate.

The effect of Genotype on Differential Countsof Local Chicken is shown in Table 3.The result in Table 3 showed no significant ($P>0.05$) effect on their Neutrophil. While, Monocyte, Eosinophil and Basophil had no effect at all. However, Lymphocyte of naked neck was significantly ($P<0.05$) higher. The white blood cell differential count determines the number of each type of white blood cell, present in the blood. It can be expressed as a percentage (relative numbers of each type of WBC in relationship to the total WBC) or as an absolute value (percentage x total WBC). Of these, the absolute value is much more important than the relative value.

Genetic effect was only expressed on the Normal feathered local chicken's monocyte. According to Falcones *et al.*(2000), lymphocytes which is a fraction of the white blood cells are Natural killer cells and are able to kill cells of the body that do not display MHC class I molecules, or display stress markers such as MHC class I polypeptide-related sequence A (MIC-A). The higher the lymphocytes, the better and stronger the immune system of the animal.These cells play both an immediate and delayed role in response to infection or inflammation. Increased numbers of lymphocytes are associated with most viral infections and some bacterial infections whereas decreased numbers of lymphocytes are characterized by Steroid exposure, some cancers, Immunodeficiency and renal failure. Except in Normal feathered chicken, monocytes were not found in the other genotypes. The decreased monocyte counts are associated with steroid exposure (Operational Medicine 2001).Basophils and Eosinophils were not found in all the genotypes studied. Diminished basophil counts are associated with Stress reactions, and some allergic reactions. Decreases in eosinophil counts are associated with Stress, Steroid exposure and anything that may suppress WBC production generally.

Conclusion

The genotype variations haverevealed haematological and biochemical parameters in local chicken and these parameters can be used to assess the health as well as the physiological status of local chicken under consideration in particular and farm animals in general. The 3 genotypes differed in their PCV and WBC at same age. BGC also differ at same age, lymphocytes and monocytes as well differ in their amount in the chicken genotypes. These differences have further underlined the need to establish appropriate physiological baseline values for poultry in Nigeria which could help in realistic evaluation of the management practice, nutrition, diagnosis of health as well as in determining the physiological status of local chicken.

Table 1: Effect of Genotype on hematological parameters of local chicken

Parameters	Naked Neck	Frizzle	Normal feathered	±SEM
Hemoglobin (g/ml)	12.99	14.51	13.54	0.52
Packed Cell Volume (%)	36.61^{c}	40.81^{a}	38.94^{b}	0.60
White Blood Cell ($x10^3mm^3$)	46.04^{a}	37.65^{b}	40.80^{ab}	1.50
Red Blood Cell ($x10^6mm^3$)	2.93	3.05	2.81	0.10

$^{a-c}$Means within the same row with different superscript are significantly (P<0.05) different. SEM: Standard Error of Mean

Table 2: Effect of Genotype on blood biochemical parameters of local chicken

Parameters	Naked Neck	Frizzle	Normal feathered	±SEM
Glucose (mg/dl)	229.11^{a}	171.66^{c}	190.63^{b}	12.14
Total Protein (g/dl)	7.25	6.33	6.84	0.29

$^{a-c}$Means within the same row with different superscript are significantly (P<0.05) different, SEM: Standard Error of Mean.

Table 3: Effect of Genotype on differential Counts of Local Chicken

Parameters	Naked Neck	Frizzle	Normal feathered	±SEM
Neutrophil (mm^3)	14.80	16.60	15.63	0.70
Lymphocyte (mm^3)	85.73^{a}	78.73^{c}	81.60^{b}	1.58
Monocyte (mm^3)	0.00	0.00	38.72^{a}	0.00
Eosinophil (mm^3)	0.00	0.00	0.00	0.00
Basophil (mm^3)	0.00	0.00	0.00	0.00

$^{a-c}$Means within the same row with different superscript are significantly (P<0.05) different, SEM: Standard Error of Mean.

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