

EFFECT OF PLUMAGE COLOUR ON HAEMATOLOGICAL AND SERUM PARAMETERS OF INDIGENOUS NORMAL FEATHERED CHICKENS

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ABSTRACT

This study was carried to examine the effect of plumage colour on haematological and serum parameters of indigenous normal feathered chickens. A total of two hundred (200) adult chickens with different plumage colours comprising of black, white, red, brown and grey of both sexes reared by smallholder farmers in Lafia, Nasarawa State, Nigeria were randomly sampled. 3ml of blood samples were taken from the wing veins from forty birds of five plumage colours for laboratory analysis. The parameters measured for haematology were Haemoglobin Concentration (Hb), Packed Cell Volume (PCV), Red Blood Cell (RBC), White Blood Cell (WBC), Neutrophils (N), Lymphocytes (L), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) while serum parameters were total protein, albumin, globulin, creatinine, urea, glucose and triglycerides. Statistical Package for Social Sciences (SPSS) version 22 was adopted for the analysis. The result showed significant ($P<0.05$) difference for Hb, MCV/ MCH their higher values (10.65, 106.0/ 35.00) were recorded for grey plumage-coloured chickens. Urea concentration was significant ($P<0.05$) and the least concentration (1.15) was recorded for brown plumage although the result does not significantly differ from those of black plumage. Based on the results of this study, it could be concluded that grey plumage-coloured chickens stand a better chance for selection in times of blood quality counts, brown plumage colour chickens would have a better renal function and feed utilization due to lower concentration of urea in their blood serum.

Keywords: Plumage colour, blood haematology, serum biochemistry, indigenous chickens

INTRODUCTION

Blood plays an important role in the transportation of nutrients, metabolic waste products and gases around the body and represents a means of assessing clinical and health status of animals (Islam *et al.*, 2004). Haematological and serum values of poultry are influenced by age, sex, breed, climate, geographical location, season, day length, time of day, nutritional status, life habit of species, present status of individual and their factors (Islam *et al.*, 2004). Plumage colour which is a genetic factor, is known to adapt animals to different climatic zones and has considerable influence on the performance of various stocks (Ebozoje and Ikeobi, 1998)

Chickens are characterized by a wide variety of colour plumage (Negro *et al.*, 2016). The pigments responsible for this diversity are deposited not only in the feathers but also in the most feathered parts of the body such as the beak and legs. In birds (chicken inclusive), there are three groups of pigments that give variations in the colour of the plumage, these are melanin, carotenoids and unusual colours. Most of these pigments are present only in certain groups of birds (Cooke *et al.*, 2017). The most widespread in chickens are melanins and carotenoids. In poultry, including chickens, plumage colour can serve as a genetic marker useful for the identification of breeds, populations and breeding groups with their characteristic features (Mitrofanova *et al.*, 2017). The molecular genetic mechanism of the appearance of a particular type of colour is not yet fully understood, since several genes can affect the same trait. Some genes cause primary effects on colour, others play the role of modifiers and regulators that affect the zonal and regional distribution of the pigment, its distribution within individual feathers (Yurchenko *et al.*, 2015).

Poultry keeping is of great importance to the human race, providing the teeming populace with a vital source of animal protein and income and plays a key role within the context of many social events (Gondwe, 2004). In tropical countries, poultry production is largely based on the traditional scavenging system and chickens are the most important poultry species. Village chickens are generally birds of indigenous breeds living in symbiotic relationship with human communities (Spradbrow, 1993). Out of a total of 72,400,856 chickens in Nigeria, 86.17% are free-range kept mainly in the rural areas. The indigenous chickens are repositories of unique genes that could be used in other parts of the world

(Adebambo, 2004). This study was aimed to examine the effect of plumage colour on haematological and serum parameters of indigenous normal feathered chickens.

MATERIALS AND METHODS

Experimental Birds and Location

A total of two hundred (200) adult chickens with different plumage colours comprising of black, white, red, brown and grey of both sexes reared by smallholder farmers with similar management system in Lafia metropolis, Nasarawa state, Nigeria were randomly sampled. Lafia lies within the Guinea savanna zone of Nigeria at Latitude 8.33°N and Longitude 8.33°E. It is positioned at altitude 181.35m above sea level with an average rainfall of 1182mm annually (NIMET, 2023). It enjoys two separate seasonal periods namely; raining season (April- September) and dry season between (October-March).

Haematological Parameters

Three (3ml) of blood samples were taken from the wing veins from forty birds (8 samples each) of five (5) plumage colours (Black, White, Red, Brown, Grey) dispensed into Ethylene Diamine Tetra Acetate (EDTA) bottles and transported to the laboratory under cold condition within 2 hours of collection for analyses. The parameters measured were analyzed according to the procedures described by Sood (2016). Packed cell volume was determined using microhaematocrit capillaries. Haemoglobin concentration was determined using cyanmethaemoglobin method which involves mixing 5 ml of Drabkin's solution (1000 ml of deionized water was mixed with 400 mg of potassium ferricyanide, 280mg of potassium dihydrogen phosphate, 100mg of potassium cyanide and 1ml of non-ionic detergent) with 20µl of blood sample. The mixture was read in a photocolormeter at 540 nm (green filter). Blood counts were determined using the improved Neubauer's chamber (area of 9sq/mm and depth of 0.1 mm) manufactured by Marien Field. Platelet count was determined using ReesEcker method using a diluting fluid that consist of 3.8gm of Trisodium citrate, 0.2 ml of Neutral formaldehyde, 0.1 gm of brilliant cresyl blue and 100 ml of Deionized water. The mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) were computed according to Jain, (1986).

Serum Parameters

Three (3mls) of blood samples collected from forty birds (8 samples each) of five (5) plumage colours (Black, White, Red, Brown, Grey) were dispensed into clean test-tubes and transported to the laboratory on a slanted rack (test-tube holder) and allowed to stand for about 4 - 5 hours till it clotted and a straw coloured liquid which had gathered on top of the clotted blood was harvested by decanting it from the test-tube into a cryo-preserved container and stored at -200C before eventual analysis for serum biochemical indices: total protein, albumin, globulin, creatinine, urea, glucose and triglycerides. All the serum biochemical indices were determined using a commercial kit of Randox Laboratories Ltd., Ardmore Diamond Road, Crumlin, Co. Antrim, United Kingdom, BT294QY.

Statistical Analysis

The General Linear model (GLM) of SPSS version 22 (2010) was adopted to test the fixed effect of plumage colour (Black, White, Red, Brown, Grey) on haematological parameters (Hb, PCV, RBC, WBC, N, L, MCV, MCH, MCHC) and serum parameters (total protein, albumin, globulin, creatinine, urea, glucose and triglycerides). The following linear model was employed:

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

Where;

Y= individual observation

μ = general mean of the population

P_i = plumage colour genes (i=1, i=2, i=3, i=4, i=5) i.e. 1= Black, 2= White, 3=Red, 4=Brown, 5 = Grey

e_{ij} = error term.

RESULTS AND DISCUSSION

The effect of plumage colours genes on haematological parameters of indigenous chicken in Lafia Nasarawa State is presented in Table 1. The result showed significant difference ($P<0.05$) for Haemoglobin Concentration (Hb), Mean Corpuscular Volume (MCV) and Mean Corpuscular Haemoglobin (MCH). Higher mean values (10.65, 106.0 and 35.00) of Hb, MCV and MCH were

recorded for grey plumage-coloured chickens. There was no significant difference recorded for PCV, RBC, WBC, N, L and MCHC for all the plumage colours investigated in this study. The result of PCV

values obtained in this study disagreed with lower values reported by Khan *et al.*, 2005. The haemoglobin values reported in this study corroborate the report of Islam *et al.* (2004) who reported 7.06 to 9.54 g/dl haemoglobin for Fayoumi, Assil and local chickens of Bangladesh. However, the result of this study is not in agreement with the report of Pampori and Iqbal, (2007) who obtained 11.32 to 13.21% haemoglobin values for the native chicken of Kashmir. The result of RBC of this study agrees with the report of Khan, (2005) who reported RBC of local grower chicken fed PKC based diets (2.82 ± 0.34 to $3.37 \pm 0.02 \times 10^6/\text{mm}^3$) and are within the range of established values for healthy domestic chickens. The PCV, haemoglobin and RBC values obtained in this study indicated that the birds were healthy and normal. The WBC play prominent role in disease resistance, especially with respect to the generation of antibodies and the process of phagocytosis. This could explain the reason of high degree of resistance to disease as reported by Anyanwu and Adikuru (1993) for the Nigerian local chicken. The values of MCV and MCH of this study were significant ($P < 0.05$). The mean values obtained in this study falls within the normal physiological range as reported by Simaraks *et al.*, 2004. It could be deduced that the highest haemoglobin count, MCV and MCH possessed by the grey plumage coloured chicken could be as a result of exposure of the plumage to the sunlight in the environment. This is also in line with the results of Sanusi, 2012 who reported significant effect of coat colour genes on the blood counts. The high red blood cells count in this study also agreed with the findings of Sanusi, (2012) who reported an increase in the quantity of the red blood cell.

Table 1. Effect of plumage colours on haematological parameters of indigenous normal feathered chickens in Lafia, Nasarawa State

Parameters	Black Mean $\pm$ SE	Brown Mean $\pm$ SE	White Mean $\pm$ SE	Grey Mean $\pm$ SE	Red Mean $\pm$ SE	Sig
Hb (g/dl)	9.65 $\pm$ 0.35 ^b	9.55 $\pm$ 0.15 ^b	10.20 $\pm$ 0.20 ^{ab}	10.65 $\pm$ 0.05 ^a	9.75 $\pm$ 0.25 ^b	*
PCV (%)	29.00 $\pm$ 1.00	28.50 $\pm$ 0.50	30.50 $\pm$ 0.05	32.00 $\pm$ 0.00	32.00 $\pm$ 4.00	NS
RBC ($\times 10^{12}/\text{l}$)	2.86 $\pm$ 0.11	2.82 $\pm$ 0.06	2.98 $\pm$ 0.02	3.02 $\pm$ 0.01	2.87 $\pm$ 0.11	NS
WBC ($\times 10^9/\text{l}$)	134.00 $\pm$ 27.00	98.50 $\pm$ 0.50	81.50 $\pm$ 21.50	101.50 $\pm$ 14.50	105.50 $\pm$ 4.50	NS
N (%)	17.00 $\pm$ 10.00	7.00 $\pm$ 4.00	2.50 $\pm$ 1.50	1.50 $\pm$ 0.50	3.50 $\pm$ 1.50	NS
L (%)	77.50 $\pm$ 15.50	92.00 $\pm$ 5.00	97.50 $\pm$ 1.50	98.50 $\pm$ 0.50	96.50 $\pm$ 1.50	NS
MCV (%)	101.50 $\pm$ 0.50 ^b	101.00 $\pm$ 0.00 ^b	102.50 $\pm$ 1.50 ^b	106.00 $\pm$ 0.00 ^a	101.00 $\pm$ 0.00 ^b	*
MCH (%)	34.00 $\pm$ 0.00 ^b	34.50 $\pm$ 0.50 ^{ab}	34.00 $\pm$ 0.00 ^b	35.00 $\pm$ 0.00 ^a	34.00 $\pm$ 0.00 ^b	*
MCHC (g/dl)	33.00 $\pm$ 0.00	34.00 $\pm$ 0.00	33.00 $\pm$ 0.00	33.50 $\pm$ 0.50	33.50 $\pm$ 0.50	NS

^{ab}Means on the same row with different letters are significantly different ($P < 0.05$). *Significant at 95%; NS-Not significant, Sig –Significance, Hb-Haemoglobin Concentration; PCV- Packed Cell Volume; RBC- Red Blood Cell; WBC- White Blood Cell; N- Neutrophils; L- Lymphocytes; MCV-Mean Corpuscular Volume; MCH- Mean Corpuscular Haemoglobin, Mean Corpuscular Haemoglobin Concentration.

The effect of plumage colour genes on serum chemistry of indigenous normal feathered chicken is presented in Table 2. The result showed that there was no significant ($p > 0.05$) difference for globulin, total protein, albumin, creatinine, glucose and triglyceride among all the plumage colours investigated. Urea concentration was significant ($P < 0.05$). The lowest values of urea (1.15) recorded for brown colour chicken is an indication of the better functionality of their kidneys. The higher concentration of urea (2.75) recorded for white plumage was an indication that there could be nitrogenous waste product of metabolism in the blood and is generated from protein breakdown although it is eliminated by the body almost exclusively by the kidneys in urine. The highest coefficient of variation (CV) 35.33% was recorded for urea whereas the least (10.09%) was recorded for total protein. The least CV recorded for total protein is an indication of better reliability.

The result of this study is consistent with the report of Ladokun *et al.* (2008) who observed no significant ($P < 0.05$) genetic effect for serum globulin, total protein, albumin, creatinine, glucose and cholesterol of the indigenous normal feathered chicken. Also Ladokun *et al.* (2008) observed no difference in serum biochemical parameters between brown and white plumaged cocks.

Table 2. Effect of plumage colour gene on serum chemistry of indigenous normal feathered chickens

Parameters	Brown	Red	White	Grey	Black	S.D	C.V
	Mean±SE	Mean±SE	Mean±SE	Mean±SE	Mean±SE		
Globulin	22.50±2.50	18.00±5.00	25.50±4.50	18.00±1.00	29.50±2.50	5.91	26.04 ^{NS}
Total protein	49.50±0.50	49.00±4.00	51.50±7.50	44.00±2.00	50.00±0.00	4.92	10.09 ^{NS}
Urea	1.15±0.15 ^c	1.30±0.10 ^{bc}	2.75±0.35 ^a	2.05±0.15 ^{ab}	1.95±0.25 ^{abc}	0.65	35.33 [*]
Creatinine	33.50±11.50	30.50±6.50	46.50±1.50	45.50±4.50	29.50±7.50	10.82	29.16 ^{NS}
Glucose	22.00±3.00	21.00±1.00	25.00±5.00	22.00±0.00	28.00±3.00	4.14	17.55 ^{NS}
Triglyceride	1.40±0.20	1.35±0.05	1.40±0.20	1.35±0.05	1.35±0.05	0.14	10.22 ^{NS}

^{abc} Means on the same row with different letters are significant (P<0.05). *Significant at 95%, SE- Standard Error, NS – Not significant, S.D – Standard Deviation, CV –Coefficient of variability

CONCLUSION AND RECOMMENDATION

The result of this study revealed that grey plumage-coloured chickens recorded higher values (10.65, 106.0 and 35.00) for haemoglobin concentration (Hb), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and the brown plumage colour chickens recorded the least (1.15) urea concentration.

It could be recommended that grey plumage-coloured chickens stand a better chance for selection in times of blood quality counts and brown plumage colour chickens would have a better renal function and feed utilization due to lower concentration of urea in their blood serum.

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