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Effects of Breed and Sex on Performance and Blood Characteristics of Three Commercial Broiler Strains

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ABSTRACT. This study was conducted to compare three strains (Arbor Acre, Cobb and Marshal) of broiler chickens using growth traits and biochemical profile with the view of identifying the best strain in the broilers. The experiment was conducted to investigate the performance and blood characteristics of three commercial broiler strains. 288 day-old of Arbor acre, Cobb and Marshall strains were used comprised of 96 birds per strains on a 12 replicates with 8 birds in a Completely Randomized Design (CRD). The birds were sexed and tagged using a wing tag. All data generated were subjected to 2 by 3 factorial in completely randomized design (CRD). Least square means of body weights indicated that strains had significant ($p < 0.05$) effect on the birds with Cobb having the highest weights compared to Arbore acre and Marshall. Body linear measurement also showed significant ($p < 0.05$) effect on all parameters on both sex and strains. Female birds showed significantly ($p < 0.05$) different than the male on mean cell volume, mean corpuscular haemoglobin only while the strain effect was significant on all haematological parameters measured. Furthermore, serum biochemical indices revealed that there was significant ($p < 0.05$) influence on strain and sex was not significantly ($p > 0.05$) influenced. It was, therefore, concluded from the study that Cobb performed better than Arbor acre and Marshall strains at 6 weeks and could be a better strain to attain maturity at a shortest possible period.

Keywords: broiler; body linear parameters; performance; serum; strain.

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Introduction

Broiler chicken serves as an immediate source of meat and income to the rural dwellers when money is needed for urgent family needs and also constitutes a significant contribution to human livelihood and food security (Laseinde, 2007). The Nigerian indigenous chicken population contains genotypes that vary in productive potentials as well as those that exhibit major gene effects (Oke, 2011) which also influence productivity (Fassill et al., 2010). This, therefore, brings about the use of exotic breeds, in order to improve on the present acute animal protein shortage in Nigeria (Agu et al., 2012). The study of the effects of breed and sex on performance and blood characteristics and its related traits such as body weight, weight gain, shank length (SHL), shank circumference (SHC), drumstick length (DSL), drumstick circumference (DSC), leg length (LL), body length(BL), breast girth (BRG) and height at withers (HAW) attracted the attention of several researchers who affirmed that there were wide variations in these traits between different breeds and/or strains of chickens (Amao, 2017).

The traditional poultry production system is characterized by small flock sizes, low input and output and periodic devastation of the flock by disease (Demeke, 2007).

It has been reported by researchers that the main problem of indigenous chickens in the tropics is that they are a poor producer of egg and meat (Yami, 1995; Tadelle et al., 2000). But even if they show low productivity, they are well adapted to the tropics, resistant to poor management, feed shortages and tolerate some of the most common diseases and parasites. On the other hand, improved exotic chickens produce a higher number of eggs and more meat than the indigenous chicken breeds, but tropical climate is a great challenge (Haftu, 2016).

Attempts have been made to introduce different exotic poultry breeds to smallholder farming systems of Nigeria because of the low performance of indigenous chicken. Therefore, this study was carried out to determine the effect of breed and sex of three commercial broiler strains on performance and blood characteristics.

Material and method

Experimental site

This research work was carried out in the Poultry Unit of the Teaching and Research Farm of the Federal University of Technology, Akure. The Farm is located in the Humid Rain Forest Zone of Western Nigeria, which is characterized by two rainfall peaks and high humidity during the rainy season. The mean annual rainfall is about 1,500 mm and rain lasts for 9 months, usually from March to November every year. The mean annual relative humidity is over 75% and that of temperature is about 27°C.

Experimental birds, layout and feeding trials

A total of two hundred and eighty-eight (288) day old chicks (Arbor Acre, Cobb and Marshall Strains) were used. Each of the strains/treatment comprised 96 birds which consisted of 12 replicates with 8 birds per replicate in a completely randomized design (CRD). The birds were sexed and tagged using a wing tag. The daily and weekly feed intake, weekly weight gains were recorded while carrying out the experiment. Feed conversion ratio was calculated from the data obtained from feed intake and weight gain. Linear body measurements were also recorded at 6^{th} week.

Experimental diets

The diet used for the experiment was formulated at Teaching and Research Farm Feed Mill, Federal University of Technology, Akure. The diets were fed to them *ad-libitum* for the period of the experiment. The diets were formulated to meet the National Research Council requirement (NRC, 1994) as presented in Table 1.

Table 1. Gross composition of the experimental diet (%).

Ingredients (%)	Starters' mash	Finisher's mash
Maize	51.30	59.50
Wheat offal	4.00	-
Soyabean Meal	21.00	14.50
Groundnut cake	13.00	16.30
Fish meal	5.00	3.00
Lysine	0.10	0.10
Methionine	0.10	0.10
DCP	2.00	1.00
Limestone	1.00	2.00
Premix	0.25	0.25
Salt	0.25	0.25
Vegetable oil	2.00	3.00
Total	100.00	100.00
Calculated Analysis		
ME (MJ kg^{-1})	12.59	13.36
Crude Protein (%)	23.10	20.93
Calcium (%)	1.17	1.06
Phosphorus (%)	0.73	0.41
Lysine (%)	1.28	1.03
Methionine (%)	0.48	0.42

DCP: Dicalcium Phosphate, ME: Metabolizable Energy.

Management of the experimental animals

The chickens were weighed in g kg^{-1} on the first day of the experiment, to obtain the initial weight and were randomly assigned based on the strains. The chickens were raised under a hygienic environment. The chickens were vaccinated and medicated. The feeding and water troughs were properly washed and cleaned on a daily basis before new feed and water were given.

Management practices

All routine and occasional management practices were strictly adhered to. Adequate health management practices were observed during the period of the trial. All necessary vaccination and medications were administered accordingly.

Blood analysis

At the end of the experimental period, blood samples of 5ml were collected from the birds with syringes and needles kept in an EDTA bottle and taken to the Haematology Laboratory of the Animal Production and Health Department for analysis. The blood was obtained carefully from the jugular vein with a needle used only on individual birds. This analysis was used to generate data on haematological characteristics of the experimental birds according to Lamb (1981).

Data collection

During the experimental period, the birds were weighed every week with their linear body measurements taken fortnightly and recorded. The linear body measurements studied were shank length (SHL), shank circumference (SHC), drumstick length (DSL), drumstick circumference (DSC), leg length (LL), body length (BL), breast girth (BRG) and height at withers (HAW). The descriptions of the linear body measurements studied are as given below:

- Shank length (SHL): This is the distance from the knee joint to the foot.
- Shank circumference (SHC): This is the distance around the shank
- Drumstick length (DSL): This is the distance between the hip joint and the knee.
- Drumstick circumference (DSC): This is the distance around the drumstick
- Leg length (LL): This is the distance from the hip joint to the foot
- Body length (BL): This is the distance from the point of the shoulder to the pin bone or to the end of coccygeal vertebrae.
- Breast girth length (BST): This is measured as the body circumference under the wing.
- Height at withers (HAW): This is the distance from the shoulder blade to the ground

Statistical analysis

All data generated were subjected to 2 by 3 factorial experiments in a Complete Randomized Design. The data were analysed on a computer using appropriate subroutine of Statistical Analysis System Institute (SAS, 2008) version 9.2 statistical package to find out the differences between the three-chicken strains with respect to sex. Mean separation of data analyses were carried out using Duncan Multiple Range Test (DMRT) as outlined in the SAS statistical package.

Result

Least squares mean of body weights at weeks 1-6 among the experimental birds

Table 2 represents the least squares means with the standard errors estimated through the analysis of variance (ANOVA) for the body weights of Arbor Acre, Cobb and Marshall broiler chickens from 1-6 weeks of age.

The least squares mean indicated that strain had significant ($p < 0.05$) effect on body weight of birds at different ages. However, the Cobb recorded the highest body weight of 141.75, 353.08, 690.75, 1060.50, 1359.50 and 1780.60 g at weeks 1 to 6 respectively. This was followed by the Arbor acre strain with the body weight of 129.50, 313.75, 646.00, 975.82, 1264.20 and 1678.80 g for 1 to 6 weeks of age. The least body weights were recorded in the Marshall strain that had 108.42, 269.42, 569.92, 821.19, 1125.40 and 1478.70 g as body weight for weeks 1 to 6.

Least squares mean for the effects of strain and sex on body weight (g) and body linear parameters (cm) at 6 weeks

Table 3 represents the least squares means with the standard errors estimated through the analysis of variance (ANOVA) for the effects of strain and sex on body weight and body linear parameters of Arbor Acre, Cobb and Marshall chickens at week 6 of age.

The least squares means indicated that strain had significant ($p < 0.05$) effect on body weight (1668.00, 1784.20, 1605.80 g), breast girth (14.90, 15.75, 14.75 cm), shank length (7.72, 7.77, 7.60 cm), shank circumference (4.89, 4.98, 4.83 cm), drumstick length (12.88, 12.99, 12.65 cm), drumstick circumference (13.46, 13.87, 13.20 cm), body length (22.46, 22.68, 21.43 cm), and height at withers (23.57, 23.80, 23.06cm) for the arbor acre, cobb and marshal chickens respectively. Highest values of theses parameters were observed for the Cobb chickens.

Table 2. Least squares means of body weights (g) at weeks 1-6 among the experimental birds.

bdywgt/weeks	arbor acre	cobb	marshal
initial weight	40.49±0.37	39.77±0.74	39.70±0.31
1	129.50±2.55^{b}	141.75±4.30^{a}	108.42±1.45^{c}
2	313.75±6.50^{b}	353.08±10.67^{a}	269.2±7.61^{c}
3	616.00±2.84^{b}	690.75±10.27^{a}	569.92±19.19^{c}
4	975.82±15.47^{b}	1060.50±19.53^{a}	821.19±26.67^{c}
5	1264.20±40.20^{b}	13.59.50±35.24^{a}	1125.40±43.12^{c}
6	1678.00±43.92^{b}	1780.60±57.13^{a}	1478.70±62.30^{c}

^{a,b,c} = Means in the same column bearing different superscripts are significantly different ($p < 0.05$), BDY WGT: Body Weight

Table 3. Least squares means for the effects of strain and sex on body weight (g) and body linear parameters (cm) at 6 weeks.

Parameters	Body Weight (g)	Breast Girth (cm)	Leg Length (cm)	Shank Leg (cm)	Shank Circumference (cm)	Drumstick Length (cm)	Drumstick Circumference (cm)	Body Length (cm)	Height at withers (cm)
Breed									
AA	1668.00±28.59^{a}	14.90±0.17^{b}	19.50±1.72	7.72±0.03^{a}	4.89±0.03^{b}	12.88±0.06^{a}	13.46±0.08^{b}	22.46±0.17^{a}	23.57±0.12^{a}
CB	1784.20±37.73^{a}	15.75±0.16^{a}	18.06±0.10	7.77±0.03^{a}	4.98±0.03^{a}	12.99±0.07^{a}	13.87±0.10^{a}	22.68±0.17^{a}	23.80±0.14^{a}
MA	1605.80±98.37^{b}	14.75±0.21^{b}	17.65±0.20	7.60±0.07^{b}	4.83±0.04^{b}	12.65±0.12^{b}	13.20±0.15^{b}	21.43±0.22^{b}	23.06±0.28^{b}
SEX									
F	1592.60±58.59^{b}	14.76±0.16^{b}	18.65±1.14	7.58±0.04^{b}	4.80±0.03^{b}	12.65±0.08^{b}	13.22±0.10^{b}	21.97±0.19^{b}	23.12±0.18^{b}
M	1800.00±26.54^{a}	15.60±0.13^{a}	18.205±0.07	7.84±0.02^{a}	5.02±0.02^{a}	13.08±0.04^{a}	13.87±0.06^{a}	22.52±0.09^{a}	23.91±0.07^{a}
Breed*Sex									
AA*F	1569.80±32.99	14.63±0.21	20.51±2.90	7.64±0.05	4.80±0.04	12.72±0.09	13.23±0.10	22.44±0.25	23.40±0.17
AA*M	1810.20±41.85	15.30±0.27	18.04±.15	7.84±0.04	5.02±0.03	13.11±0.07	13.80±0.11	22.49±0.21	23.80±0.12
CB*F	1671.30±55.56	15.54±0.24	17.88±0.17	7.67±0.05	4.91±0.05	12.87±0.12	13.64±0.17	22.43±0.32	23.51±0.25
CB*M	1897.20±45.72	15.96±0.20	18.24±0.11	7.88±0.04	5.05±0.02	13.12±0.06	14.10±0.09	22.92±0.12	24.09±0.10
MA*F	1537.00±188.02	14.06±0.36	17.01±0.35	7.41±0.12	4.67±0.07	12.30±0.22	12.76±0.25	20.82±0.39	22.33±0.51
MA*M	1678.00±43.35	15.47±0.16	18.321±0.09	7.79±0.04	4.99±0.03	13.01±0.07	13.66±0.11	22.08±0.13	23.82±0.13

^{a,b,c} = Means in the same column bearing different superscripts are significantly different ($p < 0.05$), AA: Arbor Acre, CB: Cobb, MA, Marshall, F: Female, M: Male

Sex had significant ($p < 0.05$) effect on body weight (1592.60, 1800.00 g), breast girth (14.76, 15.60 cm), shank length (7.58, 7.84 cm), shank circumference (4.80, 5.02 cm drumstick length (12.65, 13.08 cm), drumstick circumference (13.22, 13.87 cm), body length (21.97, 22.52 cm) and height at withers (23.12, 23.91 cm) for female and male chickens respectively. Higher values for these parameters were observed in the male chickens than their female counterpart.

Strain and sex interaction had significant ($p < 0.05$) effect on body weight (1569.80, 1810.20, 1671.30, 1897.20, 1537.00 and 1678.00 g), breast girth (14.63, 15.30, 15.54, 15.96, 14.06 and 15.47 cm), shank length (7.64, 7.84, 7.67, 7.88, 7.41 and 7.79 cm) and shank circumference (4.80, 5.02, 4.91, 5.05, 4.67 and 4.99 cm) for the female Arbor acre, male Arbor acre, female Cobb, male Cobb, female Marshal and male Marshal strain of chickens. High values for these parameters were recorded for Cobb males.

Least squares mean for the effects of strain and sex on haematological indices of experimental birds

Table 4 represents the least squares means with the standard errors estimated through the analysis of variance (ANOVA) for the effects of strain and sex on haematological parameters of Arbor Acre, Cobb and Marshall chickens.

The least squares means indicated that strain had significant ($p < 0.05$) effect on packed cell volume (PCV), red blood cell (RBC), mean cell haemoglobin concentration (MCHC), mean cell volume (MCV), haemoglobin concentration (HB), white blood cell (WBC), heterophil (HET), lymphocyte (LYMP), monocytes (MONO), eosinophil (EOS), erythrocyte sedimentation rate (ESR) and mean cell haemoglobin (MCH). Cobb recorded highest least squares means for RBC ($1.88x10^{6}$ mm^{-3}) and HET (76.63%); while Marshall had highest least squares means for PCV (29.21%), MCHC (32.87%), MCV (236.18 μ^{3}), HB (9.73 g dL^{-1}), LYMP (76.63%), EOS (0.67%), ESR (1.99 mm hr^{-1}) and MCH (78.73 pg).

Sex had a significant ($p < 0.05$) effect on MCV and MCH. There were significant differences between male and female chickens for these parameters. Female sex had higher least squares means for MCV and MCH as 204.37μ^{3} and 68.12 pg respectively.

Strain and sex interaction had a significant effect ($p < 0.05$) on the PCV, RBC, MCV, MCH, HET, LYMP, MONO, EOS and ESR. The male Marshall recorded the highest least squares means for LYMP (78.92%), MONO

(1.33%) and ESR (1.99 mm hr^{-1}) while the female Marshall had the highest least squares means for PCV (29.83%), MCV (290.42μ^3), MCH (96.81 pg), EOS(1.00%) and ESR (1.99 mm hr^{-1}). Male and female Cobb had highest least squares means for RBC (1.88 x 10^6 mm^{-3}) while female Arbor Acre had the highest HET (33.17%).

Table 4. Least squares means for the effects of strain and sex on haematological indices of experimental birds.

Parameters	PCV (%)	RBC ($10^6 mm^{-3}$)	MCHC (%)	MCV (U^3)	HB (g dL^{-1})	WBC (%)	Heterophils	LYMP (%)	MON (%)	EOS (%)	ESR (mm hr^{-1})	MCH (pg)
Breed												
AA	27.08±0.49^b	1.73±0.07^a	32.37±0.20^b	164.78±6.45^b	9.04±0.16^b	4.62±0.34^a	32.17±1.97^a	67.04±1.91^b	1.13±0.23	0.01±0.00^c	1.02±0.01^c	54.93±2.15^b
CB	27.42±0.38^b	1.88±0.08^a	32.62±0.20^a	155.54±7.91^b	9.14±0.12^b	4.82±0.31^a	28.83±1.37^a	70.58±1.34^b	0.83±0.21	0.17±0.10^b	1.25±0.04^b	51.85±2.64^b
MA	29.21±0.64^a	1.51±0.09^b	32.87±0.11^a	236.18±24.6^a	9.73±0.22^a	3.629±0.28^b	19.67±0.96^b	76.63±1.46^a	1.29±0.24	0.67±0.20^a	1.99±0.04^a	78.73±8.20^a
Sex												
F	28.14±0.47	1.63±0.0781	32.64±0.11	204.37±17.87^a	68.12±5.96^a	4.68±0.25	27.31±1.48	70.33±1.43	1.06±0.20	0.39±0.14	1.42±0.08	68.12±5.96^a
M	27.67±0.42	1.78±0.06	32.59±0.13	166.63±6.70^b	55.55±2.23^b	4.03±0.27	26.47±1.52	72.50±1.45	1.11±0.18	0.17±0.07	1.42±0.07	55.55±2.32^b
Breed*Sex												
AA*F	27.17±0.63	1.70±0.08	32.40±0.25	167.15±6.10	9.07±0.21	4.86±0.40	33.17±2.11	3.11±0.22	66.08±2.05	1.08±0.26	1.02±0.01	55.72±2.03
AA*M	27.00±0.79	1.75±0.13	32.34±0.32	162.42±11.65	9.00±0.26	4.38±0.56	31.17	2.87±0.30	68.00±3.30	1.17±0.39	1.03±0.02	54.14±3.88
CB*F	27.42±0.60	1.88±0.14	32.61±0.16	155.54±12.98	9.14±0.20	4.82±0.54	28.83±2.30	3.45±0.46	70.58±2.25	0.83±0.37	1.25±0.07	51.85±4.33
CB*M	27.42±0.48	1.88±0.10	32.62±0.13	155.54±9.64	9.14±0.15	4.82±0.33	28.83±1.59	3.46±0.29	70.58±1.57	0.83±0.21	1.25±0.04	51.85±3.22
MA*F	29.83±0.99	1.32±0.14	32.91±0.15	290.42±42.77	9.93±0.33	4.37±0.35	19.92±1.68	3.22±0.30	74.33±2.67	1.25±0.39	1.99±0.07	96.81±14.26
MA*M	28.58±0.82	1.7±0.10	32.83±0.16	181.94±12.89	9.54±0.28	2.89±0.31	19.42±1.00	2.26±0.25	78.92±0.88	1.33±0.31	1.99±0.03	60.65±4.30

^{a,b,c} = Means in the same column bearing different superscripts are significantly different ($p < 0.05$), AA: Arbor Acre, CB: Cobb, MA, Marshall, F: Female, M: Male

Least squares mean for the effects of strain and sex on serum biochemical indices of experimental birds

Table 5 represents the least squares means with the standard errors estimated through the analysis of variance (ANOVA) for the effects of strain and sex on serum biochemical indices of Arbor Acre, Cobb and Marshall chickens.

The least squares mean indicated that strain had significant ($p < 0.05$) effect on cholesterol (CHOL), low-density lipoprotein (LDL), total protein (TP), albumin (ALB), globulin (GLOB), aspartate aminotransferase (AST) and alanine aminotransferase (ALT).

Cobb recorded highest least squares means for CHOL (3.25 mg dL^{-1}) and LDL (1.78 mmol L^{-1}) while Arbor Acre had highest least squares means for TP (45.72 g dL^{-1}), GLOB (35.27 g dL^{-1}) and AST (39.64 IU L^{-1}). Highest least squares mean of ALB (11.68 g dL^{-1}) and ALT (39.64 IU L^{-1}) were recorded for the Marshall strains.

Sex had no significant ($p > 0.05$) effect on all the serum parameters.

Strain and sex interaction had a significant effect ($p < 0.05$) on CHOL (3.25 mg dL^{-1}), TP, ALB, GLOB, AST and ALT. However, both the male and female Arbor Acre recorded highest least squares means for TP (45.72 g dL^{-1}), GLOB (35.27 g dL^{-1}) and AST (180.13 IU L^{-1}) while the male and female Cobb had highest least squares means for CHOL. Male and female Marshall had the highest least squares means for ALB (11.68 g dL^{-1}) and ALT (39.64 IU L^{-1}).

Table 5. Least squares means for the effects of strain and sex on serum biochemical indices of experimental birds.

Parameters	CHOL	TRIG	HDL	LDL	CREA	TP	ALB	GLOB	AST	ALT
Breed										
AA	2.38±0.14^b	0.77±0.04	2.64±0.08^b	0.73±0.16^b	18.45±2.39	45.72±2.17^a	10.45±0.63^a	35.27±2.66^a	180.13±3.05^a	38.27±0.43b^b
CB	3.25±0.13^a	0.78±0.08	2.18±0.12^c	1.78±0.20^a	23.46±1.79	35.10±2.13^b	8.85±0.60^b	26.26±2.50^b	167.35±3.32^b	36.04±0.43^c
MA	2.64±0.14^b	0.69±0.01	3.07±0.07^a	0.48±0.13^b	21.12±1.36	39.82±1.85^b	11.68±0.54^a	28.13±2.13^b	175.96±2.56^a	39.64±0.38^a
Sex										
F	2.75±0.13	0.75±0.05	2.63±0.10	0.99±0.18	21.02±1.57	40.21±1.94	10.33±0.50	29.89±2.18	174.48±2.72	37.98±0.42
M	2.75±0.12	0.75±0.04	2.63±0.09	0.99±0.15	21.01±1..58	40.21±1.70	10.33±0.54	29.89±1.82	174.48±2.45	37.98±0.41
Breed*sex										
AA*F	2.38±0.17	0.77±0.04	2.64±0.08	0.73±0.21	18.47±2.92	45.72±2.50	10.45±0.62	35.27±2.99	180.13±3.22	38.27±0.42
AA*M	2.38±0.24	0.77±0.06	2.64±0.15	0.73±0.26	18.44±3.91	45.72±3.67	10.45±1.13	35.27±4.54	180.13±5.35	38.27±0.77
CB*F	3.25±0.23	0.78±0.13	2.18±0.20	1.78±0.35	23.46±2.96	35.10±3.77	8.85±0.99	26.25±4.41	167.35±5.75	36.04±0.72
CB*M	3.25±0.15	0.78±0.09	2.18±.13	1.78±0.22	23.46±2.16	35.10±2.17	8.85±0.74	26.26±2.56	167.35±3.60	36.04±0.49
MA*F	2.64±0.24	0.69±0.02	3.07±0.12	0.48±0.22	21.12±2.28	39.82±3.19	11.68±0.82	28.13±3.57	175.95±4.39	39.64±0.64
MA*M	2.64±0.14	0.69±0.01	3.07±0.08	0.48±0.14	21.12±1.61	39.82±2.03	11.68±0.74	28.13±2.49	175.96±2.86	39.64±0.43

^{a,b,c} = Means in the same column bearing different superscripts are significantly different ($p < 0.05$), AA: Arbor Acre, CB: Cobb, MA, Marshall, F: Female, M: Male.

Discussion

Body growth performance

The result of growth performance showed that Cobb performed better than the Arbor Acre and Marshall strains. The variation in body weight as influenced by age could be as a result of variation in the genotype of the broiler chickens. The result was in accordance with that of Ojedapo et al. (2015) who reported higher body weight for Cobb than Marshall broiler chickens.

Effects of strain and sex on body weight (g) and body linear parameters (cm)

Strain and sex influenced the body weight and linear body parameters at week 6. The result showed that the male chickens were superior when compared to the female. At week 6, sex influences body weight, breast girth, shank length, shank circumference, drumstick length, drumstick circumference, body length and height at withers. High values for linear body parameters recorded in male Cobb was as a strong impact of sexual dimorphism on growth. This result was similar to the report of Sogut et al. (2016); who reported higher values for male than their female. It is also in agreement with the report of Ojedapo et al. (2015); these authors reported higher body weight for male Cobb.

Effects of strain and sex on haematological indices of experimental birds

Reports stated that PCV, HB and MCH were major indices for evaluating circulating avian erythrocytes and were very significant in the diagnosis of anaemia and also served as useful indices of bone marrow capacity to produce red blood cells as in mammals (Chineke et al., 2006).

Strain had a significant effect on packed cell volume (PCV), red blood cell (RBC), mean cell haemoglobin concentration (MCHC), mean cell volume (MCV), haemoglobin concentration (HB), white blood cell (WBC), heterophil (HET), lymphocyte (LYMP), monocytes (MONO), eosinophil (EOS), erythrocyte sedimentation rate (ESR) and mean cell haemoglobin (MCH). The Cobb had the highest values for RBC and HET; Marshal had highest PCV, MCHC, MCV, HB, LYMP, EOS, ESR and MCH values. The variation of values obtained in this study for haematology was similar to that of Iheukwumere et al. (2006) that reported variability in haematological profiles among different breeds of chickens for these parameters.

Sex had a significant effect on MCV and MCH but the female sex had higher MCV and MCH values. Male and female Cobb had the highest mean value for RBC while female Arbor Acre had the highest HET. This result disagreed with the report of Addass et al. (2012) that reported higher mean values in these haematological parameters estimated when compared to their female counterparts across strain.

Effects of strain and sex on serum biochemical indices of experimental birds

In this study, sex had no effect on the serum biochemical indices. This result disagreed with the report of Pampori and Igbal (2007) and Ladokun et al. (2008) whose studies showed that sex had a significant effect on serum parameters of chickens.

Cobb had the lowest cholesterol and Low-Density Lipoprotein while male and female Arbor Acre had highest total protein. This could be due to environmental factor like temperature, as reported by Donkoh (1989) that total protein concentration in broiler chickens increased with a decrease in environmental temperature.

Conclusion

The results from least squares means showed that strain and sex had significant effects on all measured body parameters (body weight, breast girth, shank length, shank circumference, drumstick length, drumstick circumference, body length and height at withers) at 6 weeks.

In terms of growth performance, Cobb performed better than the Arbor Acre and Marshall strains. This study gave an insight that Cobb birds depicted well in term of cut-up parts than the Marshall and Arbor Acre. It was also revealed that strain had a significant effect on the haematological and biochemical parameters of Arbor Acre, Cobb and Marshall broiler chickens while sex had no significant effect on the serum indices. From the results obtained in this study, it can be recommended to the livestock farmers especially those who want to embark on frozen chicken production around this area, to raise Cobb birds due to their better displays of carcass characteristics.

Data availability

The data that support the findings of this study are available from Akanbi O. M. but restriction applies to the availability of the data, which were used under license for the current study, and so are not publicly available. Data are however available from the author upon reasonable request and with permission of Akanbi O. M.

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