Breed effects of three commercial broiler chickens reared in the tropics on performance, carcass, serum and haematological parameters

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Abstract

Performance and other parameters of broiler chickens could be influenced by the environment (feeds, housing, climate) and genetic potentials (breeds). Three hundred (300) broiler chicks comprising of one hundred each of the three breeds designated as A, B and C were used in a completely randomized design experiment which lasted for 56 days. Each breed represents a treatment with 5 replicates of 20 birds each. The birds were fed ad libitum with the same commercial starter and finisher diets throughout the period of the study; and water supplied free of choice. Average final body weight, average daily feed intake, average daily weight gain, feed conversion ratio, cost/kg feed and cost of feed/kg live weight gains at the starter and finisher phase were the performance parameters measured. Carcass, serum and haematological indices of these birds were also investigated. Proximate composition of the experimental starter and finisher diets indicated that both were adequately formulated for birds in the tropics under which the study was carried out. Results of the performance parameters showed that the values were similar for the starters and finishers except for highest ($P < 0.05$) feed intake of 134.68g/b/d obtained for breed A compared with 112.01g/b/d and 106.69g/b/d respectively for breeds C and B at the finisher phase. The highest ($P < 0.05$) cost (₦210.94) of feed per kg live weight gain was obtained for breed A than ₦196.10 and ₦190.80 respectively for breeds B and C at the starter phase. The average cost of feed per kg live weight (1-8 weeks) were ₦282.54, ₦270.30 and ₦269.28 respectively for breeds A, B and C; with breed C having the lowest cost. The dressed weights were 62.86, 67.29 and 67.84% for breeds A, B and C in the same order. The abdominal fat reduced ($P < 0.05$) from 1.52% in breed A to 1.02% and 0.77% in breeds B and C. Although the thighs were similar across the breeds, variations in the drumstick, 10.27g/kg breed A, 11.69g/kg breed B and 10.64g/kg breed C differed ($P < 0.05$). The breast increased ($P < 0.05$) from 18.62g/kg breed A to 20.36g/kg breed B and 21.95g/kg breed C. Globulin and neutrophils were the only blood indices which differed ($P < 0.05$) across the breeds at the starter phase. Breed C was considered the best of the 3 breeds in terms of performance, cost, carcass and health status indicated by blood indices; and could be recommended for commercial broiler production for better economic returns.

Keywords: performance, breeds, carcass, blood parameters, health status

Introduction

The poultry industry is going through a gradual but definite change in product differentiation in response to consumer and industry demands (Chukwuka *et al.*, 2010). To implement these changes, genetic improvements have focused primarily on

selection for growth rate, feed conversion efficiency and degree of muscling resulting in gross changes in commercial poultry. Poultry production has undergone rapid changes since 1940's when modern intensive production methods were introduced together with new breeds,

improved bio-security and preventive health measures (Permin and Pedersen, 2000). Poultry production provides the opportunity of meeting animal protein intake from livestock industry in Nigeria. It provides ready job for a large number of populations (Olaloku, 1999). It is now by far the largest livestock species worldwide, accounting for more than 30% of all animal protein consumption (Permin and Pedersen, 2000). Poultry production stemmed from the ancient traditional practices and in general, village producers who kept small flocks of between 2 and 20 birds per household (Gueye, 1997) and they survived as scavengers. Rudimentary shelters might be provided to give some measures of protection against bad weather and night predators such as reptiles (Gueye, 1997). The demand for meat is increasing daily due to increase in population growth. To meet up with this demand at the recommended level, effort of farmers should not only be geared towards increasing poultry production but also rearing strains of chickens with some desirable attributes such as disease resistance, adaptability to tropical/harsh environmental conditions, optimum feed consumption at lower cost yet with greater out-put. The development of suitable strains of broiler chickens for the tropical environment is a research interest which has engaged the attention of a number of poultry geneticists and breeders for the past decades (Nargish *et al.*, 2010). Consumer preference for tender and white meat containing low contents of fat and cholesterol seems to act as catalyst engendering increased broiler production not only at festive periods but all year round. Broiler meat is sold whole or cut into parts for individuals and families who could not afford whole chicken (Olawunmi and Fagbuaro, 2011). The genetic selection of broiler chicken breeds for superior growth

rate has arguably been primary method for increasing productivity (Peter *et al.*, 2010). There is evidence that there are genetic differences in growth rate between strain and changes in weight ranking may be critical in the age ranged between eight and twelve weeks (Deeb and Lamont, 2000). Low productivity experienced by broiler meat chicken producers in the tropics may be attributed to lack of selection of improved poultry breeds. Hitherto, little research work has been carried out on different improved breeds of broiler chickens by local producers, despite the fact that they are more numerous. There is need for research efforts to compare the performance of the various available and popular breeds of broilers with the aim of recommending the best to the farmers. Investigating the blood profiles also has several benefits. According to Kral and Suchy (2000), these include accurate interpretation of health status of birds, diagnostic and management purposes, useful in development of new broiler strains which are genetically resistant to poultry diseases; as well as for genetic improvement of industrial and indigenous poultry. This study investigated the performance, haematological and serum biochemistry; carcass and organ parameters of the three most commonly reared breeds of broiler chickens under tropical condition.

Materials and methods

Experimental site

The study was carried out at the Teaching, Research and Entrepreneurial farm of Joseph Ayo Babalola University, Ikeji – Arakeji, Osun State, Nigeria. Further laboratory analyses were done at the Microbiology Laboratory of the Federal University of Technology, Akure which is about 20 minutes drive away from site of the experiment.

Experimental birds and their management

Three hundred (300), one day old broiler chicks comprising of one hundred A, B and C breeds each, respectively were purchased from reputable hatcheries in Ibadan, Oyo State, Nigeria. Each breed represented a treatment. The experimental chicks were randomly allocated to three treatments according to the breeds of the chicks in a completely randomized design. There were five replicates of 20 birds in each of the replicates. The experimental pen was swept, cleaned, washed and disinfected prior to the arrival of the chicks. Adequate preparations were made for wood shaving, feeders, drinkers and brooding facilities. On arrival, the chicks were unboxed and stabilized in each experimental unit. Feed and water were supplied *ad libitum* throughout the period of the experiment. All routine and occasional management practices were strictly adhered to and adequate health management practices observed during the period of the experiment. All necessary vaccinations/medications were administered accordingly. The experimental chicks were fed with a commercial feed. The proximate analyses of the starter and finisher feeds are as shown in Table 1. The study lasted for 8 weeks with the first 4 weeks as the starter phase and the last 4 weeks as the finisher phase. The performance parameters monitored are feed intake, weight gain and feed conversion ratio. The cost of a Kg feed was calculated and was used to compute the cost of feed per Kg live weight gain of the broiler chicks.

Carcass and organs evaluation

Carcass evaluation was carried out at the Meat Science Section of the Animal Science Laboratory of the Joseph Ayo Babalola University, Ikeji-Arakeji, Osun State, Nigeria. One hundred and twenty (120) birds at the rate of 40 birds per treatment were randomly selected at the end of 8th week for carcass evaluation. The birds were

starved overnight for 12 hours but allowed access to water. The fasted live weights were recorded and the birds were slaughtered by severing the jugular vein after stunning; and hung upside down for proper bleeding. Well-bled carcasses were scalded, de-feathered and eviscerated. The weights were adequately recorded at each of the processing stages and organs (kidney, lungs, heart, liver and gizzard) weights taken. The intestine and abdominal fat were weighed and recorded. Carcass weights (plucked, eviscerated and dressed weights) were calculated as percentages of live weight. The organ weights were calculated as percentages of carcass weight. The weights were measured with sensitive scale calibrated in grammes.

Haematological and serological characteristics

Blood samples were collected at the starter phase and the finisher phase of the study. The samples were collected from ten birds per treatment (two birds per replicate), each picked at random. The blood was collected via the wing vein, the area was disinfected with cotton wool dampened with methyl alcohol swab and by vein puncture; 5mls of blood was drawn and emptied into test tubes and EDTA bottles for serum biochemistry and haematological parameters determination respectively. All EDTA bottles and samples test tubes were labeled appropriately before collection. The haematological parameters determined include the following: Erythrocyte sedimentation rate (ESR), Packed cell volume (PCV), Red blood cell (RBC), Haemoglobin (Hb), Lymphocytes (LYM), Neutrophils (NEU), Monocytes (MONO), Basophils (BAS) and Eosinophils (EOS); and the biochemical components of the serum that were determined include Glucose (GLU), Total protein (TP), Albumin (ALB) and Globulin (GLB).

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Chemical analysis

Proximate composition of the starter and finisher diets were determined as described by AOAC (2005). Nitrogen Free Extract (NFE) was determined by difference and Metabolisable Energy (ME) calculated according to the procedure of Pauzenga, (1985) as: $ME \text{ (kcal/kg)} = 37 \times \% \text{ Protein} + 81.8 \times \% \text{ Fat} + 35.5 \times \% \text{ NFE}$.

Statistical analysis

Data obtained were subjected to analysis of variance (ANOVA) using SAS Statistical Package (SAS, 1999). The means were separated using Duncan's multiple range

test at 5% level of significance.

Results

Result of the proximate compositions of the commercial feeds used in this study (Table 1) showed that the dry matter, crude protein, ether extract, crude fiber, ash, nitrogen free extract and metabolisable energy were 91.03%, 22.32%, 11.45%, 4.10%, 7.00%, 57.16% and 3791.63kcal/kg DM respectively for the starter diet; and 91.92%, 18.94%, 13.86%, 4.62%, 7.43%, 47.07% and 3505.52 kcal/kg DM for the finisher diet.

Table 1: Proximate composition of experimental diets

Parameters	Percentage composition	
	Starter	Finisher
Dry matter (%)	91.03	91.92
Crude protein (%)	22.32	18.94
Ether extract (%)	11.45	13.86
Crude fibre (%)	4.10	4.62
Ash (%)	7.00	7.43
Nitrogen free extract (%)	57.16	47.07
Metabolisable energy (Kcal/kg DM)	3791.63	3505.52

Table 2 presents the performance of the three breeds (A, B and C) of the experimental chicks at the starter phase. The average initial body weights of the three breeds were not ($P < 0.05$) different from each other. All of the performance indices investigated were similar ($P > 0.05$) except the cost of feed per kg live weight gain which differed ($P < 0.05$). The highest cost of feed per kg live weight gain of <210.94 obtained for breed A was higher ($P < 0.05$) than <196.10 and <190.80

respectively obtained for breeds B and C. Breed C, despite having the lowest ($P > 0.05$) average initial body weight (39.87g/b) eventually had the highest ($P > 0.05$) numerical final body weight (748.22g/b). This breed also had the highest ($P > 0.05$) average daily weight gain (25.30g/b), the lowest average daily feed intake ($P > 0.05$) of 45.56g/b, the lowest ($P > 0.05$) FCR (1.80), and finally lowest ($P > 0.05$) cost (< 190.80) of feed per kg live weight gain.

Table 2: Performance characteristics of three breeds of broiler starter chicks

Parameters	Breeds			SEM
	A	B	C	
Average initial body weight (g/b)	41.12	41.89	39.87	0.67
Average final body weight (g/b)	720.39	736.22	748.22	11.39
Average daily weight gain (g/b/d)	24.26	24.80	25.30	0.23
Average daily feed intake (g/b/d)	48.17	45.90	45.56	1.67
Feed conversion ratio	1.99	1.85	1.80	0.32
Cost per kg feed (₦)	106.00	106.00	106.00	0.00
Cost of feed per kg live weight gain (₦)	210.94 ^a	196.10 ^b	190.80 ^c	8.27

^{a,b,c} Means with different superscript in the same column are significantly ($P < 0.05$) different from each other

At the finisher phase (Table 3), the only performance parameter which differed significantly ($P < 0.05$) was the average daily feed intake. The highest (134.68g/b/d) was obtained for breed A compared to 112.01g/b/d and 106.69g/b/d respectively obtained for breeds C and B. Breed A which had the lowest ($P > 0.05$) average final body weight (720.39g/b) at the starter phase or average initial body weight at the finisher phase having

consumed the highest feed at the finisher phase, had the highest ($P > 0.05$) average final body weight (1886.93g/b) compared with 1708.89g/b and 1655.56g/b respectively for breeds C and B. The FCR were 2.42, 2.44 and 2.45 respectively for breeds A, B and C. Cost of feed per kg live weight gain were ₦237.16 (breed A), ₦239.12 (breed B) and 240.10 (breed C); with breed A having the least at the finisher phase.

Table 3: Performance characteristics of three breeds of broiler chickens at finisher phase (5- 8 weeks)

Parameters	Breeds			SEM
	A	B	C	
Average initial body weight (g/b)	720.39	736.22	748.22	11.39
Average final body weight (g/b)	1886.93	1655.56	1708.89	51.23
Average daily weight gain (g/b/d)	55.55	43.78	45.75	1.35
Average daily feed intake (g/b/d)	134.68 ^a	106.69 ^b	112.01 ^b	4.54
Feed conversion ratio	2.42	2.44	2.45	0.13
Cost per kg feed (<)	98.00	98.00	98.00	0.00
Cost of feed per kg live weight gain (<)	237.16	239.12	240.10	21.76

^{a,b}Means with different superscripts in the same column are significantly ($P < 0.05$) different from each other

Considering these performance traits from day old till end of 8th week of the study, average of the 2 phases (Table 4), none of the indices was affected ($P > 0.05$) by the breed differences. Best performance was

exhibited by breed C at the starter phase in terms of having the highest final body weight gain; and lowest ($P > 0.05$) average daily feed intake, FCR and cost of feed per kg live weight gain.

Table 4: Performance characteristics of three breeds of broiler chickens (1-8 weeks)

Parameters	Breeds			SEM
	A	B	C	
Average initial body weight (g/b)	41.12	41.89	39.87	0.67
Average final body weight (g/b)	1886.93	1655.56	1708.89	51.23
Average daily weight gain (g/b/d)	32.96	28.82	29.80	1.35
Average daily feed intake (g/b/d)	91.43	76.30	78.79	4.54
Feed conversion ratio	2.77	2.65	2.64	0.13
Cost per kg feed (₦)	102.00	102.00	102.00	0.00
Cost of feed per kg live weight gain (₦)	282.54	270.30	269.28	21.76

^{a,b}Means with different superscripts in the same column are significantly ($P < 0.05$) different from each other

Carcass and organ parameters of the experimental birds are presented in Table 5. Out of all the indices monitored, only the bled weight, abdominal fat, kidney, pancreas and bursa differed ($P < 0.05$) across the breeds. The bled weight (91.80%) obtained in breed A was lower

($P < 0.05$) than 98.61% and 97.45% respectively for breeds B and C. The highest (1.52%) abdominal fat obtained in breed A reduced ($P < 0.05$) to 1.02% and 0.77% respectively for breeds B and C. The highest ($P < 0.05$) value for kidney (0.07%) obtained in breed A was similar to 0.04% obtained in

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breed C; with both higher ($P<0.05$) than 0.02% obtained in breed B. The values of pancreas were 0.17, 0.14 and 0.07% respectively for breeds A, B and C. The corresponding values of bursa of fibricus were 0.22, 0.12 and 0.08% respectively in the same order. Variations obtained in the other carcass (live weight, plucked weight, eviscerated weight, dressed weight and gizzard fat); and organs (heart, lung, liver,

intestine, gizzard and proventriculus) were similar ($P>0.05$) across the breeds. It is of interest that the highest ($P>0.05$) dressed weight was obtained in breed C, followed by breed B and the lowest in breed A. The gizzard fat though not significant also followed the same trend with the abdominal fat with breed A having the highest ($P>0.05$), followed by breed B and breed C having the lowest value for this parameter.

Table 5: Carcass and organ characteristics of the three breeds of broiler chickens

Parameters	Breeds			SEM
	A	B	C	
Live weight (kg)	2.57	2.48	2.43	0.04
Bled weight (%)	91.80 ^b	98.61 ^a	97.45 ^a	1.46
Plucked weight (%)	93.37	94.79	95.22	2.10
Eviscerated weight (%)	77.39	79.78	79.77	1.68
Dressed weight (%)	62.86	67.29	67.84	1.12
Abdominal fat (%)	1.52 ^a	1.02 ^{ab}	0.77 ^b	0.02
Gizzard fat (%)	0.62	0.44	0.41	0.05
Organs (% of carcass)				
Heart	0.48	0.44	0.35	0.01
Lung	0.61	0.61	0.60	0.03
Liver	1.64	1.49	1.62	0.01
Kidney	0.07 ^a	0.02 ^b	0.04 ^a	0.002
Intestine	4.39	3.56	4.14	0.04
Full gizzard	2.22	2.15	2.35	0.05
Empty gizzard	1.57	1.62	1.60	0.01
Pancreas	0.17 ^a	0.14 ^{ab}	0.07 ^b	0.002
Bursa	0.22 ^a	0.12 ^b	0.08 ^b	0.001
Proventriculus	0.45	0.42	0.59	0.01

^{a,b}Means with different superscripts in the same column are significantly ($P < 0.05$) different from each other

The distribution of the carcass parts of the three breeds of broiler chickens is presented in Table 6. The drumstick and breast differed ($P<0.05$) among the breeds. The highest ($P<0.05$) value (11.69%) of drumstick obtained in breed B compared to

10.64 and 10.27% respectively obtained for breeds C and A. The lowest ($P<0.05$) value (18.62%) of breast obtained in breed A increased ($P<0.05$) to 20.36% and 21.95% in breeds B and C respectively. Other carcass parts were not affected ($P>0.05$) by the breed differences.

Table 6: Carcass parts of the three breeds of broiler chickens

Parameters	Breeds			SEM
	A	B	C	
Head	2.42	2.51	2.20	0.12
Neck	5.99	5.49	5.02	0.16
Leg	4.71	4.87	4.68	0.22
Drumstick	10.27 ^b	11.69 ^a	10.64 ^{ab}	1.34
Thigh	10.63	11.09	10.99	1.21
Wings	8.48	8.77	9.01	1.23
Breast	18.62 ^b	20.36 ^{ab}	21.95 ^a	1.84
Upper back	7.01	7.42	7.48	0.44
Lower back	7.66	7.42	8.04	0.67

^{a,b}Means with different superscripts in the same column are significantly ($P < 0.05$) different from each other

Table 7 shows the biochemical and haematological indices of the three breeds of chicken used for the experiment at the starter phase. All the values for Erythrocyte sedimentation rate (ESR), Packed cell volume (PCV), Red blood cell (RBC), Haemoglobin (Hb), Lymphocytes (LYM), Monocytes (MONO), Basophils (BAS) and Eosinophils (EOS) among the three breeds were not different ($P>0.05$) from each other except for Neutrophils (NEU) which had values that were different ($P<0.05$). Breed A had the highest ($P<0.05$) Neutrophils (23.80%) compared with 21.80% and 20.20% respectively for breeds B and C. Breed A also recorded the highest ($P>0.05$) values for ESR, RBC and BAS, while breed B had the highest values for PCV and eosinophils. Breed C recorded the highest ($P>0.05$) values for the lymphocytes and monocytes. The result of the biochemical profile showed that there were no differences ($P>0.05$) among the three breeds for glucose, total protein and albumin except for globulin which recorded different ($P<0.05$) values. The highest ($P<0.05$) globulin (7.88g/dl) was obtained

for breed A; and this was higher ($P<0.05$) than 6.00g/dl (breed C) and 4.63g/dl (breed B).

Table 8 revealed the biochemical and haematological indices of the three breeds of chicken used for the experiment at the finisher phase. All the serum biochemical and haematological indices investigated were not affected ($P>0.05$) by the breeds at the finisher phase.

Discussion

The nutritional compositions of the diets were adequate to meet the requirement of broiler starters and finishers irrespective of the breed. The basis for compounding commercial feed for poultry is to meet up with the nutritional requirements of poultry birds (Cerrate and Waldroup, 2009). Most commercially produced poultry feed is produced in granular form for easy and fast conversion to flesh (Cultip *et al.*, 2006); and nutritive value of most commercially produced feed affects the growth performance of broiler chicken either negatively or positively. The proximate composition of the commercial feed used in

Table 7: Serum metabolites and haematological indices of the three breeds of broiler chickens at starter phase

Blood parameters	Breeds			SEM
	A	B	C	
Total protein (g/dl)	24.42	22.08	26.16	1.43
Albumin (g/dl)	16.54	17.45	20.16	1.02
Globulin (g/dl)	7.88 ^a	4.63 ^b	6.00 ^{ab}	0.95
Glucose (g/dl)	2.93	2.58	4.11	0.69
Red blood cells (x 10 ⁶ mm ⁻³)	1.94	1.86	1.80	0.52
Esr (mm/hr)	10.00	5.00	8.40	2.33
Packed cell volume (%)	24.40	25.40	24.00	2.11
Haemoglobin (g/100ml)	8.14	8.48	8.02	0.89
Lymphocytes (%)	61.40	61.00	63.20	2.43
Neutrophils (%)	23.80 ^a	21.80 ^{ab}	20.20 ^b	1.21
Monocytes (%)	11.60	12.60	13.40	1.03
Basophils (%)	2.80	2.40	2.20	0.54
Eosinophils (%)	1.20	1.80	1.00	0.17

^{a,b}Means with different superscripts in the same column are significantly ($P < 0.05$) different from each other

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Table 8: Serum metabolites and haematological indices of the three breeds of broiler chickens at the finisher phase

Blood parameters	Breeds			SEM
	A	B	C	
Total protein (g/dl)	23.92	23.34	24.80	1.02
Albumin (g/dl)	16.88	18.13	20.51	0.94
Globulin (g/dl)	7.51	5.13	6.31	0.59
Glucose (g/dl)	3.08	3.37	4.72	0.57
Red blood cells (x 10 ⁶ mm ⁻³)	1.89	1.93	1.82	0.42
Esr (mm/hr)	9.00	6.60	9.00	2.19
Packed cell volume (%)	25.00	23.20	24.60	2.40
Haemoglobin (g/100ml)	8.64	8.14	8.04	0.98
Lymphocytes (%)	62.60	59.20	67.60	5.21
Neutrophils (%)	23.60	22.60	21.60	1.02
Monocytes (%)	10.60	12.80	13.80	0.94
Basophils (%)	2.40	2.40	2.40	0.24
Eosinophils (%)	1.60	1.60	1.20	0.26

^{a,b}Means with different superscripts in the same column are significantly ($P < 0.05$) different from each other

this study meets the nutritional requirement of broiler chicken as recommended by NRC (1994). Traditionally, the salient criteria for appraising the performance of the broiler strains have been growth rate and feed conversion efficiency, and less frequently carcass composition (Cahaner *et al.*, 1987; Cabel and Waldroup, 1991; Rezaei *et al.*, 2004). However, there was no significant difference in the average final weight and average body weight gain per bird per day observed among the three broiler breeds used for this study at the starter, finisher and even on the average of the two phases. Breed C achieved heavier final body weight and higher weight gain numerically than the other breeds at the starter phase; this could be as a result of the genetic potential of this breed. Similar report of higher final weight and daily weight gain was given by Jana (1989). Breeds A and C recorded the highest and least feed conversion ratio, respectively as lower FCR is better for the producer. The value of feed conversion ratio in this study is lower than the range of 1.97 – 2.54 reported by Seven *et al.* (2008) in broiler chicken. Although the feed intake (g/b/d) was not influenced by breed of broiler chicken but

numerically, breed A consumed more than the remaining two breeds. The lowest feed intake value recorded by breed C was efficiently converted to flesh as reflected in the feed conversion ratio and this agrees with the report of Hossain *et al.* (2011). The cost of feed per kg live weight gain was influenced by breed. Breed C recorded the least value which makes it the most economical breed for producers at the starter phase.

Breed A recorded the highest final weight at the finisher phase; and this result disagreed with the report of Peter *et al.* (2010) who found a higher average final weight for another breed. The difference could be as a result of the effects of environment, feed and other exogenous factors. The range of weight gain per bird per day (43.78-55.55) recorded for the finishers in this study are higher than the range (28.38-32.34g) reported by Wang *et al.* (2007). The values by these authors, however, fall in line with the range of 28.82-32.96g/b/d recorded for the average of the two phases in the present study. The efficient use of feed is most frequently expressed as feed conversion ratio (Peter *et al.*, 2010); the values of feed

conversion ratio recorded for the three breeds of broiler chicken used for this study is partially in line with that reported by Kumar *et al.* (2010) for Hubbard and Ross breeds of broiler chicken. The feed intake per bird per day was influenced by breed of chicken; with breed A consumed more feed than breeds B and C. This opposes the result of Hossain *et al.* (2011). Breed A, despite having the highest average final body weight, average daily weight gain, lowest FCR and cost of feed per kg live weight gain at the finisher phase was not able to give the best FCR and cost of feed per kg live weight gain for weeks 1-8. This probably was because this breed consumed highest feed (91.48g/b/d), had highest FCR (2.77) and cost of feed per kg live weight gain (₦282.54) on the average (weeks 1-8). This breed A also consumed the highest feed, had the highest FCR and cost of feed per kg live weight gain at the starter phase. Breed C, having the highest average daily weight gain, consumed the lowest feed per day, having the least FCR and cost per kg feed at the starter phase; coupled with better performance in terms of average daily weight gain (45.75g/b/d), lower daily feed intake (112.01g/b/d) though with highest FCR (2.45) which were just 0.41 and 1.22% higher than for the other 2 breeds; and feed cost per kg live weight gain (₦240.10) which were not outrageous compared with the other 2 breeds, probably gave this breed (breed C) upper hand on the average (1-8 weeks). The breed had the lowest FCR (2.64) and cost of feed per kg live weight gain (₦269.28). Although breed A had the highest daily weight gain (32.96g/b/d); the average daily feed intake (91.43g/b/d) and the highest FCR (2.77) makes it uneconomical compared with breeds B and C. Since a naira saved on cost matters to the farmer, breed C which gave the lowest cost of feed per kg weight gain may be favoured by broiler farmers. Breed C recorded the

most economical cost of feed per kg live weight gain and disagreed with report of Peter (2010) which favoured another strain of broiler chicken. Generally, the performance of these three breeds in the present study was superior to the values recorded for broilers (Bot *et al.*, 2013, Ozung *et al.*, 2013, Ayoola *et al.*, 2015).

There were no variations in the values of live weight, plucked weight, eviscerated weight and dressed weight among the three breeds. Bot *et al.* (2013) linked the reductions in these parameters to reduction in final live weight of the birds. The difference between the live weight and the bled weight may indicate the volume of blood drained after slaughtering. When the bled weight is too high, it may suggest insufficient drainage or too little blood (anaemic condition) in the birds. The amount of blood drained in the present study, for the 3 breeds ranging from 1.39 – 8.20% compares favourably with the level (2.5 – 6.60%) recommended for normal chickens (Mitruka and Rawnsley, 1981). The amount of blood still left in the carcass may also have negative effects on carcass keeping quality since blood is a good medium for the growth of spoilage micro-organisms. The least abdominal fat and gizzard fat obtained in breed C is a plus for this breed. This is because high level of fat in these organs may reflect much fat in the carcass which is not always desirable by the consumers. Reports have also shown that the cost of producing a unit of fat is more than that of lean meat. Although the liver was not affected by breed differences, however, the highest kidney was obtained in breed A which was similar to breed C; and least in breed B. These organs (liver and kidney) are involved in biotransformation in the body; increased size could be due to need for the organs to handle some toxins. The 3 breeds were however fed the same diet which may suggest that the variations

Breed effects of three commercial broiler chickens reared in the tropics

were just as a result of the anatomical differences. The pancreas and bursa of fibricus followed the same trend with the highest values of the 2 organs obtained in breed A and the least in breed C. The prime cuts of a broiler include the drumstick, thigh and the breast. These parts command higher prices. The highest drumstick was obtained in breed B, while thigh was similar across the 3 breeds. The highest breast value obtained in breed C is also a plus for this breed. The other parts were similar for the 3 breeds. Values of the breast, wings and drumsticks had been linked to reflect the live weight of the birds (Bot *et al.*, 2013). The dressed weight and prime cuts obtained in the present study for the three breeds are higher than the values obtained for broiler chickens raised in the tropics (Ayoola *et al.*, 2015).

Haematological studies are useful in the diagnosis of many diseases as well as investigation of the extent of damage to blood (Onyeyili *et al.*, 1992; Togun and Oseni, 2005). Haematological studies are of ecological and physiological interest in helping to understand the relationship of blood characteristics to the environment (Ovuru and Ekweozor, 2004) and so could be useful in the selection of animals that are genetically resistant to certain diseases and environmental conditions (Mmereole, 2008; Isaac *et al.*, 2013). Haematological parameters are good indicators of the physiological status of animals (Khan and Zafar, 2005). The haematological values recorded in this study showed that the three breeds of chicken were in good health. The values for ESR, PCV, RBC, Hb, LYM, MONO, BAS and EOS of the three breeds were similar across the breeds; except for NEU (starter phase) where breed A recorded the highest value statistically. This could be attributed to the genetic potential of the breed. The result is in line

with Chineke *et al.*, (2006) who reported no significant values for PCV, ESR, Hb and RBC in different rabbit breeds. Results of the present study falls within the ranges of $1.58-4.10 \times 10^6 \text{ mm}^{-3}$, 24.90-45.20%, 0.67-2.48% and 7.40-13.10 (g/100ml), respectively for RBC, PCV, EOS and Hb recommended (Mitruka and Rawnsley, 1981). The values recorded for serum metabolites (glucose, total protein and albumin) were also similar for the three breeds which disagreed with the report of Ross *et al.*, (1978) who reported higher values for albumin and total protein. Blood profiles is said to be a reliable health indicator, its variation should display a consistent pattern, with the inter-breed variance component (Nadolski *et al.*, 2006)). Therefore, it is important to investigate blood profiles of indigenous birds for accurate interpretation of health status (Kral and Suchy, 2000). This information, aside from diagnostic and management purposes, can be used for developing new broiler strains that are genetically resistant to poultry diseases as well as for genetic improvement programs of industrial and indigenous poultry. The LYM and BAS values recorded in this study falls within the range that was reported by Talebi *et al.* (2005) in Arbor acre breed of broilers. The stability in serum biochemical values of three breeds of broilers studied suggests that the commercial feed is adequate for the chickens (Egbunike *et al.*, 2009).

Conclusion

Results from the study indicated that breed C gave the best performance at the least cost with desirable carcass indices and good health status portrayed by similar serum and haematological parameters to the other two breeds; and could be recommended for commercial broiler producers for better economic returns.

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