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Research Article

Effects of Ecotype and Batch of Hatch on Biometric Characteristics of Tiv and Fulani Local Chickens of Nigeria

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Abstract: Study was undertaken to determine variations in biometric parameters within and between the Tiv and Fulani local chickens. The study was carried out at the Livestock Teaching and Research Farm of the Faculty of Agriculture, Shabu-Lafia Campus, Nasarawa State University, Keffi, Nasarawa State. A total of 110 birds comprising of 10 hens and 1 cock from each of five randomly selected locations for the Tiv and the Fulani chicken ecotypes were purchased and used as the base population. A mating ratio of 1 cock to 10 hens was applied to generate the experimental birds. After successful four batches of hatching, 538 chicks comprising 354 and 184 chicks for the Tiv and the Fulani ecotypes respectively were generated. The birds were raised according to their ecotype and location. Data were collected on biometric traits such as such as body length, shank length, wing lengths and breast girth. The data were subjected to appropriate statistical analysis using the SPSS statistical package. The results indicate that mean linear body measurements increased with advancing age until maturity in both ecotypes. The coefficients of variation (CV) values were generally higher in the Tiv ecotype compared to the Fulani ecotype. In the Tiv ecotype, the highest CV value (42.21 %) was noted in the breast girth at 8 week of age. However in the Fulani ecotype, wing length at week 1 showed the highest CV value (14.23 %). The Fulani ecotype had significantly ($P<0.05$) higher body length, wing length, shank length and breast girth compared to the Tiv ecotype at all ages. Batch of hatch had significant effect on body linear measures in both ecotypes. In the Tiv ecotype, birds in batch 1 had significantly ($P<0.05$) higher body linear parameters compared to other batches at weeks 1, 4, 8, 12 and 16 except at at week 20 where batch 3 and 4 demonstrated significantly ($P<0.05$) higher wing length and breast girth. In the Fulani ecotype, batch 1 at weeks 1 and 4 had significantly ($P<0.05$) better breast girth than other batches. Batches 2, 3 and 4 at week 4 and batches 1 and 2 at week 8 had significantly ($P<0.04$) higher wing length compared to other batches. Batch 4 had significantly ($P<0.05$) higher body length (36.47±0.24 cm) and breast girth (4.92±0.02 cm) compared to other batches at week 12. From the findings of this study, it was concluded that, the genetic diversity within and between the Tiv and the Fulani chicken ecotypes observed in this study should be exploited through selection within each ecotype and subsequent crossing between birds from different batch of hatch/ecotype to take advantage of heterosis.

Keywords: determine variations in biometric parameters within and between the Tiv and Fulani local chickens

INTRODUCTION

The ever increasing human population in developing word and Nigeria in particular has led to high demand for the available but insufficient animal and poultry products in the country. Poultry, particularly chickens are very important and have been recognized as important genetic resources among the avian species (Olowofeso *et al.*, 2005). Poultry products are one of the cheapest and easily affordable animal protein sources for the teeming population. Chickens are the most widely distributed of all poultry types in Nigeria with a population of 166 million birds (FAOSTAT, 2007). Thus Chickens play very significant socio-cultural and economic roles in most African societies. Genetic diversities in the indigenous livestock species in developing countries are valuable attributes or assets for production, adaptation and resistance of the indigenous animals to endemic diseases. Genetic diversity is the product of interaction between environment and gene effects. This interaction which leads to differentiation of biometric traits is vital to all production systems which could enable researcher develope selection criterion for breed improvement needed for adaptation to changing environmental

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circumstances (Ceriotti *et al.*,, 2003). The unique values of their genes for egg and meat production, disease resistance, hardiness and adaptation to local environment would in future be needed to broaden the genetic resource base for breeding of improved commercial birds. The objective of the study was to determine variations in body linear measurements within and between the Tiv and Fulani local chickens.

MATERIALS AND METHODS

Location of the Study

The experiment was carried out at the Livestock Teaching and Research Farm of the Faculty of Agriculture, Shabu-Lafia Campus, Nasarawa State University, Keffi, Nasarawa State. Nasarawa State falls within the Southern Guinea Savannah Zone of Nigeria. Lafia lies between latitude 7^0 and 9^0 North and Longitude 7^0 and 10^0 East. It has a climate typical of the tropical zone because of its location. It has a temperature ranging from 20 ^{0}c in October to 36 ^{0}c in March while rainfall varies from 13.73 cm in some places to 14.00 cm in others (NIMET 2008).

Experimental Procedure

A total of 100 hens comprising 50 Tiv and 50 Fulani ecotypes as well as 10 breeding cocks of each ecotype were purchased from five localities for each ecotype and used as the base population. The birds in this base population were housed according to their ecotype and location for two weeks for quarantine and acclimatization. During this period, the birds were dusted against ectoparasites, dewormed and vaccinated against Newcastle disease using Lasota ®. Antistress (vitalyte), antibiotics and coccidiostat were administered through water to check against possible disease outbreak. After quarantine and acclimatization, each ecotype was randomly assigned into identified five breeding pens in the rearing house. A mating ratio of 1:10 (i.e. 1 cock to 10 hens) was used. The cock in each breeding pen was allowed to freely mate their respective hens. Fertile eggs for hatching were collected when the birds had laid for four weeks. This was aimed at obtaining higher fertility and hatchability. The birds were fed standard feed as recommended by Dafwang (2006). Feed and water were provided *ad-libitum.*

Hatching eggs were collected twice a day and were identified according to locations and ecotypes. The eggs were accumulated for 5 days during which they were held in egg crates under room temperature with good ventilation. At the end of 5 days of egg collection, the eggs were transported to Phenab Agro Venture, beside fire service, Bukuru express way, Angul-D Jos for hatching. The eggs were set for pedigree hatching in an automatic electric incubator at weekly interval for four consecutive weeks (four batches).

After successful four batches of hatching, a total of 538 chicks comprising of 354 and 184 chicks for the Tiv and the Fulani ecotypes from were obtained from the base population. The birds were managed using standard procedure until maturity and data collected. Data on body linear measurements such as body length, shank length, wing lengths and breast girth were measured at weekly interval until maturity using measuring tape.

Experimental Design Data Analysis

Stratified random sampling technique was employed in assembling the base population. Completely randomized design (CRD) was used in which the two ecotypes (Tiv and Fulani) were each replicated into five pens such that each pen or replicate represented a locality in each batch of hatch. Data collected on all the parameters of body linear measurements were analyzed using a two factor (ecotype and batch of hatch) factorial analysis of variance (ANOVA) using the SPSS statistical software (2011). The following statistical model was entertained:

$$Y_{ijk} = \mu+E_i+H_j+(EH)_{ij}+e_{ijk}$$

Y_{ijk} = The k^{th} observation on the i^{th} ecotype from the j^{th} batch of hatch
μ = Overall mean
E_i = Fixed effect of the i^{th} ecotype (I = 1, 2)
H_j = Fixed effect of the j^{th} batch of hatch (j = 1, 2, 3 and 4)
$(EH)_{ij}$ = Interaction effect between ecotype and batch of hatch
e_{ijk} = Random residual error ~ (0, 1)

RESULTS

The descriptive statistics of body linear measurement (BLM) of the Tiv and the Fulani ecotypes are presented in Table 1. The coefficients of variation (CV) values were generally higher in the Tiv ecotype compared to the Fulani ecotype. In the Tiv ecotype, the higest CV value (42.21 %) was noted in the breast girth at eight week of age. This was followed by shank length at week 1 which had CV value of 23.29 %. The lowest CV value (4.50 %) in the Tiv ecotype was noted in shank length at week 12. However in the Fulani ecotype, wing length at week 1 showed the higest CV value (14.23 %) while the least was observed in breast girth at week 8.

The effect of ecotype on body linear measurements (BLM) is presented in Table 2. Ecotype had no significant ($P>0.05$) effect on body length at weeks 1, 2, 3, 4, 5, 6, 8, and 12. However, ecotype had significant ($P<0.05$) effect on body length at weeks 16 and 20. The Fulani ecotype had significantly ($P<0.05$) higher body length compared to the Tiv ecotype with a value of 43.89±0.27 cm and 51.63±0.33 cm at weeks 16 and 20, respectively. Ecotype effect was significant ($P<0.05$) on shank length at weeks 6, 8, 12 and 16

where the Fulani ecotype demonstrated significantly (P<0.05) longer shank length than the Tiv ecotype. There was no significant (P>0.05) difference between shank length of the Tiv and the Fulani ecotypes at weeks 1, 2, 3, 4, 5, and 20. Fulani ecotype had significantly (P<0.05) higher wing length than the Tiv ecotype at weeks 2, 6, 8 and 16. At weeks 1, 3, 4, 5, 12 and 20, there were no significant (P>0.05) difference between the wing lengths of the Tiv and the Fulani ecotypes. Breast girth in Fulani ecotype was significantly (P<0.05) higher than those of the Tiv ecotype at weeks 5, 6 and 16. However, there was no significant (P>0.05) difference between the breast girth of the two ecotype at weeks 1, 2, 3, 4, 8, 12 and 20.

Table 3 and 4 present the effect of batch of hatch on the body linear parameters of the Tiv and the Fulani ecotype, respectively. In the Tiv ecotype (Table 3), batch of hatch had significant (P<0.05) effect on all the BLM at weeks 1, 4, 12 and 16. However, batch of hatch had no significant (P>0.05) effects on wing length and breast girth at week 8. Batch of hatch had no significant (P>0.05) effect on body length and shank length at week 20. Birds in batch 1 had significantly (P<0.05) higher body length value (14.44±0.11 cm) compared to birds in other batches at weeks 1, 8, 12 and 16. At week 4, batches 1 and 2 had significantly (P<0.05) higher body length values (19.78±0.27 and 19.78±0.14 cm) compared to batches 3 and 4. Shank length of birds in batch 1 were significantly (P<0.05) longer than batches 2, 3 and 4 at weeks 1 and 16 in the Tiv ecotype. At weeks 4 and 12, batches 3 and 4 showed significantly (P<0.05) higher shank length values (3.57±0.03 and 3.50±0.03 cm respectively) compared to batches 1 and 2 in the Tiv ecotype. Batch 1 had significantly (P<0.05) higher wing length (9.35±0.14 cm) compared to batches 2, 3 and 4 at week 1 in the Tiv ecotype. At weeks 4 and 12, batches 1 and 2 had significantly (P<0.05) higher wing length compared to batches 3 and 4 in the Tiv ecotype. Batches 1, 2 and 4 at week 16 and batches 2, 3 and 4 at week 20 had statistically similar wing length in the Tiv ecotype. For the breast girth, batch 1 at weeks 1 and 4 and batches 1 and 2 at weeks 8 and 16 had significantly (P<0.05) higher breast girth than other batches in the Tiv ecotype. However at week 20, batches 3 and 4 had significantly (P<0.05) higher breast girth (9.50±0.14 and 9.56±0.15 cm respectively) compared to batches 1 and 2 in the Tiv ecotype.

In the Fulani ecotype (Table 4), batch of hatch had significant (P<0.05) effect on body length at week 12, shank length at weeks 1 and 4, wing length at weeks 4, 8 and 16 and breast girth at weeks 1, 4 and 8. Batch 4 had significantly (P<0.05) higher body length (36.47±0.24 cm) compared to other batches at week 12. However, batch of hatch had no significant (P>0.05) effect on body length at wekks 1, 4, 8, 16 and 20 in the Fulani ecotype. Batches 1 and 3 had significantly (P<0.05) higher shank length with values of 2.86±0.03 and 3.58±0.04 compared to other batches 2 and 4 at weeks 1 and 4 respectively. Batch of hatch had significant effects on wing length at weeks 4, 8 and 16 and on breast girth at weeks 1, 4 and 8 in the Fulani ecotype. Batches 2, 3 and 4 at week 4 and batches 1 and 2 at week 8 had significantly (P<0.04) higher wing length compared to other batches. However at week 16, batches 3 and 4 had significantly (P<0.04) higher wing length compared to batches 1and 2 in the Fulani ecotype. Breast girth in batch 1 at weeks 1 and 4 were significantly (P<0.05) different from other batches. At week 12 batch 4 showed significantly (P0.05) higher breast girth value (4.92±0.02 cm) in the Fulani ecotype.

Table 5 and 6 present ecotype by batch interaction effect on the body linear measurements (BLM) of the Tiv and the Fulani local chicken ecotypes. At weeks 1, 4 and 8 there were significant (P<0.05) ecotype by batch interaction effects on body length, wing length and reast girth. Ecotype by batch interaction was not significant (P>0.05) on shank length at weeks 1, 4 and 8 and on breast girth at week 8. Ecotype by batch interaction had significant (P<0.05) effect on body length and breast girth at week 12 and wing length at week 16. Ecotype by batch interaction was not significant (P>0.05) on shank and wing length at week 12 and on body length, shank length and breast girth at week 16. At week 20, ecotype by batch interaction was not significant (P>0.05) on all BLM.

Table 1: Descriptive Statistics of Body Linear Measurement of the Two Nigerian Local Chickens

		Tiv ecotype								Fulani ecotype							
Week	**BLM**	**N**	**Min**	**Max.**	**Range**	**Mean**	**SD**	**Sem**	**CV**	**N**	**Min**	**Max.**	**Range**	**Mean**	**SD**	**Sem**	**CV**
1	BL	340	10.30	18.50	8.20	13.98	1.04	0.06	7.43	176	11.00	18.00	7.00	14.36	1.10	0.08	7.64
1	SL	340	2.00	13.00	11.00	2.65	0.62	0.03	23.29	176	2.00	3.70	1.70	2.74	0.27	0.02	9.74
1	WL	340	5.20	12.60	7.40	8.84	1.44	0.08	16.34	176	6.50	16.50	10.00	9.39	1.34	0.10	14.23
1	BG	340	2.00	3.20	1.20	2.70	0.22	0.01	8.32	176	2.00	3.30	1.30	2.73	0.24	0.02	8.74
4	BL	326	16.00	27.30	11.30	19.54	1.85	0.10	9.44	169	15.00	24.00	9.00	20.15	1.91	0.15	9.46
4	SL	326	3.00	4.10	1.10	3.47	0.29	0.02	8.48	169	3.00	4.00	1.00	3.54	0.28	0.02	7.78
4	WL	326	11.00	19.00	8.00	14.44	1.74	0.10	12.07	169	10.00	17.00	7.00	15.00	1.35	0.10	9.03
4	BG	326	3.00	4.60	1.60	3.77	0.38	0.02	10.03	169	3.00	4.60	1.60	3.81	0.35	0.03	9.25
8	BL	280	22.00	38.00	16.00	29.60	3.60	0.22	12.16	163	25.00	34.00	9.00	30.09	2.23	0.17	7.42
8	SL	280	4.00	5.30	1.30	4.36	0.27	0.02	6.18	163	4.20	5.90	1.70	4.81	0.36	0.03	7.57
8	WL	280	5.20	25.40	20.20	22.03	2.08	0.12	9.43	163	21.00	36.00	15.00	23.63	1.69	0.13	7.17
8	BG	280	4.10	34.90	30.80	5.24	2.21	0.13	42.21	162	4.10	5.00	0.90	4.90	0.12	0.01	2.53
12	BL	249	24.00	45.00	21.00	35.99	3.31	0.21	9.19	152	33.00	40.00	7.00	35.77	1.59	0.13	4.46
12	SL	249	5.30	6.50	1.20	5.937	0.27	0.02	4.50	152	5.90	7.00	1.10	6.16	0.33	0.03	5.36
12	WL	249	23.00	28.00	5.00	25.82	1.16	0.07	4.48	152	24.00	27.00	3.00	25.47	0.65	0.05	2.55
12	BG	249	5.00	6.50	1.50	5.51	0.43	0.03	7.83	152	5.00	5.60	0.60	5.35	0.20	0.02	3.79
16	BL	222	28.50	52.00	23.50	40.35	4.67	0.31	11.56	141	38.00	55.00	17.00	43.89	3.17	0.27	7.22
16	SL	222	6.00	11.00	5.00	7.46	0.92	0.06	12.40	141	7.50	10.00	2.50	8.54	0.71	0.06	8.32
16	WL	222	23.50	38.00	14.50	29.21	2.24	0.12	7.66	141	27.00	39.00	12.00	32.33	2.59	0.22	8.02
16	BG	222	6.00	11.00	5.00	7.69	0.86	0.06	11.23	141	7.50	12.00	4.50	8.93	0.72	0.06	8.03
20	BL	183	39.00	59.00	20.00	47.92	3.43	0.25	7.15	125	43.00	61.00	18.00	51.63	3.68	0.33	7.13
20	SL	183	7.00	11.00	4.00	8.97	0.93	0.07	10.40	125	8.00	11.50	3.50	9.42	0.89	0.08	9.42
20	WL	183	27.00	37.50	10.50	32.979	2.18	0.16	6.63	125	28.00	46.00	18.00	34.73	3.19	0.29	9.19
20	BG	183	7.50	11.50	4.00	9.30	0.80	0.06	8.60	125	8.00	11.50	3.50	9.82	0.83	0.07	8.40

N = number of observation, BL = body length, SL = shank length, WL = wing length and BG = breast girth, Min = minimum value, Max. = maximum value, SD = standard deviation, Sem. = standard error of the mean and CV = coefficient of variation.

Table 2: Effect of Ecotype on Body Linear Measurement (cm) of two Nigerian Local Chickens

WK	**Ecotype**	**N**	**BL**	**SL**	**WL**	**BG**	**WK**	**N**	**BL**	**SL**	**WL**	**BG**
1	Tiv	340	13.98±0.06	2.65±0.03	8.84±0.08	2.70±0.01	6	310	23.78±0.11	$3.89±0.02^{b}$	$18.04±0.10^{b}$	$4.05±0.03^{b}$
	Fulani	176	14.36±0.08	2.74±0.02	9.39±0.10	2.73±0.02		168	23.56±0.12	$4.16±0.03^{a}$	$19.00±0.13^{a}$	$4.41±0.02^{a}$
		LOS	NS	NS	NS	NS		LOS	NS	*	*	*
2	Tiv	337	15.83±0.05	3.06±0.01	$10.61±0.08^{b}$	3.08±0.01	8	280	29.60±0.22	$4.36±0.02^{b}$	$22.03±0.12^{b}$	5.24±0.13
	Fulani	175	16.01±0.10	2.97±0.02	$11.47±0.11^{a}$	3.17±0.02		163	30.09±0.17	$4.81±0.03^{a}$	$23.63±0.13^{a}$	4.90±0.01
		LOS	NS	NS	*	NS		LOS	NS	*	*	NS
3	Tiv	329	18.40±0.05	3.16±0.01	13.17±0.05	3.51±0.01	12	249	35.98±0.21	$5.93±0.12^{b}$	25.82±0.07	5.51±0.03
	Fulani	172	18.26±0.12	3.26±0.02	13.48±0.10	3.57±0.02		152	35.77±0.13	$6.16±0.03^{a}$	25.47±0.05	5.35±0.02
		LOS	NS	NS	NS	NS		LOS	NS	*	NS	NS
4	Tiv	326	19.54±0.10	3.47±0.02	14.44±0.10	3.77±0.02	16	222	$40.35±0.31^{b}$	$7.46±0.06^{b}$	$29.21±0.15^{b}$	$7.69±0.06^{b}$
	Fulani	169	20.15±0.15	3.54±0.02	15.00±0.10	3.81±0.03		141	$43.89±0.27^{a}$	$8.54±0.06^{a}$	$32.33±0.22^{a}$	$8.93±0.06^{a}$
		LOS	NS	NS	NS	NS		LOS	*	*	*	*
5	Tiv	322	21.29±0.12	3.73±0.02	16.16±0.10	$3.91±0.12^{b}$	20	183	$47.92±0.25^{b}$	8.97±0.07	32.97±0.16	9.30±0.06
	Fulani	168	22.17±0.18	3.82±0.03	16.53±0.12	$4.21±0.04^{a}$		125	$51.63±0.33^{a}$	9.42±0.08	34.73±0.29	9.82±0.07
		LOS	NS	NS	NS	*		LOS	*	NS	NS	NS

WK = week, LOS = level of significant, NS = not significant, * = significant at 5 percent probability, ^{ab} = means with different superscripts within week subgroup are significantly ((P>0.05) different, N = number of observation, BL = body length, SL = shank length, WL = wing length and BG = breast girth

Table 3: Effect of Batch of Hatch on Body Linear Measurement (cm) of the Tiv Local Chicken Ecotype

Week	Batch	N	Body length	Shank length	Wing length	Breast girth
	1	88	14.44±0.11^{a}	2.77±0.02^{a}	9.35±0.14^{a}	2.78±0.2^{a}
	2	78	13.93±0.15^{b}	2.57±0.03^{b}	8.32±0.16^{c}	2.70±0.03^{b}
1	3	93	13.77±0.08^{b}	2.68±0.11^{ab}	8.78±0.15^{b}	2.67±0.02^{b}
	4	81	13.78±0.09^{b}	2.55±0.02^{b}	8.87±0.16^{b}	2.67±0.02^{b}
LOS			*	*	*	*
	1	84	19.78±0.27^{a}	3.37±0.03^{b}	14.68±0.13^{a}	4.05±0.04^{a}
	2	76	19.78±0.14^{a}	3.41±0.04^{b}	14.75±0.23^{a}	3.62±0.04^{c}
4	3	87	19.13±0.19^{b}	3.57±0.03^{a}	14.05±0.22^{b}	3.63±0.03^{c}
	4	79	19.51±0.17^{ab}	3.50±0.03^{a}	14.32±0.18^{ab}	3.78±0.04^{b}
LOS			*	*	*	*
	1	82	32.85±0.20^{a}	4.42±0.04^{a}	21.57±0.38	5.47±0.25
	2	69	30.38±0.28^{b}	4.38±0.04^{a}	22.27±0.13	5.42±0.44
8	3	76	27.18±0.38^{c}	4.29±0.02^{b}	22.30±0.79	5.02±0.05
	4	53	27.02±0.40^{c}	4.36±0.04^{ab}	22.03±0.77	4.94±0.01
LOS			NS	NS	NS	NS
	1	80	38.63±0.26^{a}	5.89±0.03^{b}	25.86±0.14^{ab}	5.57±0.06^{a}
	2	60	35.77±0.37^{b}	5.86±0.04^{b}	26.13±0.14^{a}	5.65±0.06^{a}
12	3	69	34.07±0.33^{c}	5.98±0.03^{a}	25.64±0.13^{b}	5.41±0.04^{b}
	4	40	34.33±0.48^{c}	6.03±0.04^{a}	25.55±0.18^{b}	5.34±0.04^{b}
LOS			*	*	*	*
	1	76	41.35±0.54^{a}	7.74±0.11^{a}	29.72±0.28^{a}	3.96±0.04^{a}
	2	59	39.21±0.54^{b}	7.37±0.13^{bc}	29.28±0.26^{a}	3.91±0.03^{a}
16	3	51	40.07±0.66^{ab}	7.11±0.10^{c}	28.30±0.20^{b}	3.81±0.02^{b}
	4	36	40.53±0.85^{ab}	7.48±0.15^{ab}	29.32±0.45^{a}	3.94±0.04^{a}
LOS			*	*	*	*
	1	62	47.40±0.36	8.80±0.13	32.18±0.26^{b}	9.05±0.09^{b}
20	2	48	47.53±0.40	9.17±0.12	33.58±0.28^{a}	9.29±0.10^{ab}
	3	42	48.92±0.60	8.92±0.14	33.37±0.35^{a}	9.50±0.14^{a}
	4	31	48.18±0.80	9.09±0.17	33.09±0.43^{a}	9.56±0.15^{a}
LOS			NS	NS	*	*

LOS = level of significant, NS = not significant, * = significant at 5 percent probability, ^{abc} = means with same superscripts within age group are not significantly (P>0.05) different, N = number of observation.

Table 4: Effect of Batch of Hatch on Body Linear Measurements (cm) of the Fulani Local Chicken Ecotype

Week	Batch	N	Body length	Shank length	Wing length	Breast girth
	1	43	14.22±0.20	2.86±0.03^{a}	9.11±0.25	2.87±0.03^{a}
	2	49	14.34±0.16	2.73±0.04^{b}	9.43±0.18	2.71±0.03^{b}
1	3	47	14.63±0.13	2.64±0.03^{b}	9.51±0.18	2.65±0.03^{b}
	4	37	14.22±0.17	2.72±0.05^{b}	9.51±0.20	2.68±0.04^{b}
LOS			NS	*	NS	*
	1	42	19.81±0.34	3.45±0.34^{b}	14.16±0.27^{b}	3.95±0.05^{a}
	2	48	19.91±0.28	3.56±0.04^{ab}	15.04±0.16^{a}	3.77±0.05^{b}
4	3	43	20.42±0.27	3.58±0.04^{a}	15.40±0.16^{a}	3.77±0.05^{b}
	4	36	20.53±0.26	3.57±0.04^{ab}	15.46±0.16^{a}	3.76±0.06^{b}
LOS			NS	*	*	*
	1	40	30.03±0.40	4.88±0.06	24.13±0.37^{a}	4.91±0.02^{ab}
	2	46	30.25±0.33	4.88±0.05	24.00±0.17^{a}	4.85±0.02^{b}
8	3	44	29.81±0.34	4.74±0.05	23.38±0.22^{ab}	4.91±0.02^{ab}
	4	33	30.33±0.32	4.75±0.07	22.85±0.24^{b}	4.92±0.02^{a}
LOS			NS	NS	*	*
	1	37	35.43±0.27^{b}	6.17±0.06	25.49±0.09	5.35±0.04
	2	41	35.39±0.25^{ab}	6.16±0.05	25.39±0.08	5.33±0.03
12	3	43	35.93±0.24^{ab}	6.16±0.05	25.53±0.11	5.34±0.03
	4	31	36.47±0.24^{a}	6.14±0.05	25.48±0.15	5.37±0.03
LOS			*	NS	NS	NS
	1	35	43.69±0.59	8.54±0.10	31.34±0.32^{b}	9.11±0.14
	2	40	43.250.49	8.54±0.11	31.65±0.35^{b}	8.92±0.13
16	3	36	44.14±0.52	8.47±0.12	33.31±0.53^{a}	8.86±0.9
	4	30	44.67±0.53	8.63±0.15	33.23±0.45^{a}	8.79±0.11
LOS			NS	NS	*	NS
	1	30	50.92±0.72	9.22±0.16	34.42±0.43	9.63±0.16
20	2	40	51.96±0.56	9.36±0.14	34.96±0.66	9.75±0.13
	3	32	52.28±0.59	9.53±0.17	34.59±0.52	10.02±0.15
	4	23	51.09±0.84	9.61±0.15	34.91±0.55	9.95±0.16

LOS = level of significant, NS = not significant, * = significant at 5 percent probability, ^{ab} = means with different superscripts within age group are significantly (P>0.05) different, N = number of observations.

Table 5: Ecotype and Batch Interaction effect on the body linear measurements of two Nigerian local chicken ecotypes at week 1, 4 and 8

Ecotype	**Batch**	**BL WK 1**	**SL WK 1**	**WL WK 1**	**BG WK 1**
Tiv	1	14.44±0.11^{a}	2.77±0.06	9.35±0.15^{a}	2.78±0.02
	2	13.93±0.12^{b}	2.57±0.06	8.32±0.16^{c}	2.70±0.03
	3	13.77±0.11^{b}	2.68±0.06	8.78±0.14^{b}	2.67±0.02
	4	13.78±0.12^{b}	2.55±0.06	8.87±0.15^{a}	2.67±0.03
Fulani	1	14.22±0.16^{a}	2.86±0.08	9.11±0.21^{b}	2.87±0.03
	2	14.34±0.15^{ab}	2.74±0.07	9.43±0.20^{a}	2.71±0.03
	3	14.63±0.15 ^{a}	2.65±0.08	9.52±0.20^{a}	2.65±0.03
	4	14.22±0.17^{ab}	2.72±0.09	9.51±0.23^{a}	2.68±0.04
Ecotype	**Batch**	**BL WK 4**	**SL WK 4**	**WL WK 4**	**BG WK 4**
Tiv	1	19.78±0.20^{b}	3.37±0.03	14.68±0.17^{a}	4.05±0.04^{a}
	2	19.78±0.21^{a}	3.41±0.03	14.75±0.18^{a}	3.62±0.04^{c}
	3	19.13±0.20^{a}	3.57±0.03	14.05±0.17^{b}	3.63±0.04^{c}
	4	19.51±0.21^{a}	3.50±0.03	14.32±0.18^{ab}	3.78±0.04^{b}
Fulani	1	19.81±0.29^{b}	3.45±0.04	14.16±0.25	3.95±0.05^{c}
	2	19.91±0.27^{b}	3.56±0.04	15.04±0.23	3.77±0.05^{c}
	3	20.42±0.28^{b}	3.58±0.04	15.40±0.24	3.77±0.05^{c}
	4	20.53±0.31^{b}	3.57±0.05	15.46±0.26	3.76±0.06^{c}
Ecotype	**Batch**	**BL WK 8**	**SL WK 8**	**WL WK 8**	**BG WK 8**
Tiv	1	32.85±0.28^{a}	4.42±0.03	21.57±0.21^{b}	5.47±0.20
	2	30.38±0.30^{b}	4.38±0.04	22.27±0.23^{a}	5.43±0.21
	3	27.18±0.29^{c}	4.29±0.04	22.31±0.22^{a}	5.02±0.20
	4	27.02±0.34^{c}	4.36±0.04	22.04±0.26^{a}	4.94±0.24
Fulani	1	29.95±0.40	4.88±0.05	24.13±0.31^{b}	4.91±0.28
	2	30.25±0.37	4.88±0.05	24.00±0.28^{b}	4.85±0.26
	3	29.81±0.38	4.74±0.05	23.38±0.29^{b}	4.91±0.27
	4	30.33±0.43	4.75±0.05	22.85±0.33^{b}	4.92±0.31

BL = body length , SL = shank length, WL = wing length, BG = breast girth, WK = week, ^{abc} = means with same superscripts within age group are not significantly (P>0.05) different

Table 6: Ecotype and Batch Interaction effect on the body linear measurements of two Nigerian local chickens at weeks 12, 16 and 20

Ecotype	**Batch**	**BL WK 12**	**SL WK 12**	**WL WK 12**	**BG WK 12**
Tiv	1	38.63±0.26[a]	5.89±0.03[a]	25.86±0.11[a]	5.57±0.04
	2	35.77±0.30[b]	5.86±0.04[a]	26.13±0.13[a]	5.65±0.05
	3	34.07±0.28[c]	5.98±0.04[a]	25.64±0.12[a]	5.41±0.04
	4	34.33±0.37[c]	6.03±0.05[a]	25.55±0.16[a]	5.34±0.04
Fulani	1	35.43±0.38	6.17±0.05[a]	25.49±0.16[a]	5.35±0.06
	2	35.39±0.37	6.16±0.05[a]	25.39±0.15[a]	5.33±0.06
	3	35.93±0.36	6.16±0.04[a]	25.54±0.15[a]	5.34±0.05
	4	36.47±0.42	6.14±0.05[a]	25.48±0.18[a]	5.37±0.06
Ecotype	**Batch**	**BL WK 16**	**SL WK 16**	**WL WK 16**	**BG WK 16**
Tiv	1	41.35±0.47	7.75±0.10	29.72±0.26	7.62±0.09
	2	39.21±0.54	7.37±0.11	29.28±0.30	7.69±0.11
	3	40.07±0.58	7.11±0.12	28.30±0.32	7.66±0.11
	4	40.53±0.69	7.48±0.14	29.32±0.38	7.89±0.14
Fulani	1	43.69±0.70	8.54±0.14	31.34±0.39	9.11±0.14
	2	43.25±0.65	8.54±0.13	31.65±0.36	8.92±0.13
	3	44.14±0.69	8.47±0.14	33.31±0.38	8.86±0.14
	4	44.67±0.75	8.63±0.15	33.23±0.42	8.79±0.15
Ecotype	**Batch**	**BL WK 20**	**SL WK 20**	**WL WK 20**	**BG WK 20**
Tiv	1	47.40±0.45	8.80±0.12	32.18±0.33	9.05±0.10
	2	47.53±0.51	9.17±0.13	33.58±0.38	9.29±0.12
	3	48.92±0.54	8.92±0.14	33.37±0.40	9.50±0.12
	4	48.18±0.63	9.09±0.16	33.09±0.47	9.57±0.14
Fulani	1	50.92±0.64	9.22±0.17	34.42±0.48	9.63±0.15
	2	51.96±0.56	9.36±0.14	34.96±0.41	9.75±0.13
	3	52.28±0.62	9.53±0.16	34.59±0.46	10.02±0.14
	4	51.09±0.73	9.61±0.19	34.91±0.55	9.95±0.17

BL = body length , SL = shank length, WL = wing length, BG = breast girth, WK = week, [abc] = means with same superscripts within age group are not significantly (P>0.05) different

DISCUSSION

The mean body length in both the Tiv and the Fulani ecotypes at maturity is higher than an average of 23.97 cm with a range of of 22.66-25.85 cm for body length of indigenous chicken in Yobe State as reported by Mbap and Zakar (2000). These present results are also higher than the value reported by Okon *et al.*, (1997) and Mancha (2004) who observed 25.00±0.21 cm as mean body length for chicken in Calabar and 17.97±0.18 cm as mean body length for chicken in Jos Plateaus, respectively. In other parts of Africa, Badubi *et al.*, (2006) reported variation in body length between sexes and regions of Botswana. Body lengths and height of local birds (chicken) have also been observed to vary extensively (Badubi *et al.*, 2006).

The mean shank length in the Tiv and the Fulani ecotypes at maturity as obtained in this study is higher than the average shank length of 7.54±0.09 cm, 7.84 cm, 8.52±0.13 cm and 7.50 cm reported by Nwosu (1990), Mbap and Zakar (2000), Mancha (2004) and Halima (2007) for local chickens at maturity in South East Nigeria, Yobe, Jos Plateau and Mecha (Ethiopia), respectively. Badubi *et al.*, (2006) reported a lower shank length in the Botswana indigenous females and males as 7.00cm and 8.50 cm, respectively. However, Okon *et al.*, (1997) reported a slightly higher mean value of 10.00±0.29 cm for shank length of chicken in Calabar. In Tanzania, five local chicken ecotypes were identified with shank length of 13.30 cm (Kuchi), 13.90 cm (Singamagazi), 12.40 cm (Mbeya), 12.00 cm (Morogoro medium) and 10.00 cm (Ching Wekwe) adult cock. Shank lengths of 11.2 cm for Kuchi, 10.90 cm for Sinnamagazi, 10.20 cm for Mbeya, 9.7 cm for Morogoror medium and 8.20 cm for Ching Wekwe adult hens were also reported (Msoffe *et al.*, 2001). Differences in shank length could be due to genetics, environment and travelling distances in search for feed and water during scavenging.

The wing length of the Tiv and the Fulani ecotypes at maturity is far higher than range of 14.20±0.21 cm to 16.36±0.25 cm reported by Ukwu *et al.*, (2017). The significantly ($P<0.05$) varied breast girth within and between ecotypes observed in the present study disagreed with the report of Mancha (2004) who reported that body circumferences did not vary significantly ($P<0.01$) between populations of local chicken in Plateau State. The mean value of breast girth in the Tiv and the Fulani at maturity in this study is slightly lower than the 9.15 cm to 13.05 cm reported by Ikeobi *et al.*, (2001).

CONCLUSION

The results obtained from the study showed that mean body weight and linear body measurements increased with advancing age until maturity in the Tiv and Fulani chickens. Breast girth demonstrated the highest variability in the Tiv ecotype while wing length demonstrated the highest variability in the Fulani ecotype. Birds in batch 1 had significantly ($P<0.05$) higher body linear parameters compared to other batches at all weeks except week 20 where batches 3 and 4 demonstrated significantly ($P<0.05$) higher wing length and breast girth in the Tiv ecotype. In the Fulani ecotype, Batch 1 at weeks 1 and 4 had significantly ($P<0.05$) better breast girth than other batches. However, batches 2, 3 and 4 at week 4 and batches 1 and 2 at week 8 had significantly ($P<0.04$) higher wing length compared to other batches. From this findings, it was recommended that the biometric variation between the Tiv and the Fulani chicken ecotypes across batch of hatch should be exploited through selection within each ecotype/batch of hatch and subsequent crossing between birds from different ecotype/ batch of hatch to take advantage of heterosis.

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