

Comparative study for growth performance and feed indices of broiler, heavy ecotype and nondescript local chicken reared in south eastern region of Nigeria

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ABSTRACT

Aim: The main purpose of the study was to investigate the performance traits and feed indices of 3 genotypes of chicken.

Method and materials: A total of 600 birds of 3 genetic compositions (200 broiler chickens, 200 Heavy ecotype chickens (HE) and 200 Nondescript local chickens (NC) were used for 4 weeks. Parameters measured include body weight, body length, chest girth, shank length, average weekly feed intake, average feed intake, average daily weight gain and feed conversion ratio. The body weight of week 8 ranged from 0.382kg for Nc to 3.350kg for broiler, while the average weekly feed intake 3 genotypes were 0.173kg, 0.089kg and 0.092kg for Broilers, NC and HE, respectively.

Results: The body weight, body length, chest girth, shank length, average weekly feed intake, average daily feed intake, average daily weight gain and feed conversion ratio showed significant differences ($p < 0.01$) in all the 3 genotypes. The body weight of 3 genotypes at weeks 6 and 8 for broiler weighed 1.622; 0.252; 0.360 and 3.350; 0.380; 0.510kg for Broilers, NC and HE respectively. It was indicated that broilers weighed significantly ($p < 0.01$) higher than HE, which were also significantly ($p < 0.01$) heavier than NC. The study further revealed relative growth of 3 genotypes during the period of study. At 8 weeks of age, broiler and heavy ecotype were 6.79 and 1.36 times more than non-descript local chicken respectively. While broiler weighed 6 times more than the heavy ecotype chicken. At 8 weeks of age, the body length, shank length and chest girth of broiler grew 1.8, 2.1, 1.9 more than the non-descript local chicken. However the body length, shank length and chest girth of the heavy ecotype were 1.2, 1.3 and 1.3 times more than the non-descript local chicken. The feed intake of Broiler chicken at 4 and 8 weeks of age were 3.34 and 2.38; and 1.94 and 1.88 more times above the feed intake of the nondescript and heavy ecotype chicken.

Conclusion: It was concluded that little genetic progress was made however, the result reveals that selection program is further needed to increase the present body weight of the heavy ecotype.

Keywords: Comparative Performance, Biometric, Linear traits, Feed indices.

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Introduction

Local animal breeder, since last decade has keyed into MDGs goal of animal protein security. This is achievable through management of its ubiquitous local chicken population, evaluation of genetic variances and genetic parameters for improvement of meat and egg performance of its chicken population (Emmanuel-Ohagenyi and Ugwu, 2023). Chickens are far and away most numerous type of livestock on planet and noted for its key role in global meat production. It has a population 22.6 billion, contributing 121million tonnes to world meat production of (FAO, 2018).

US Broiler forecast for 2023 is 46.750 billion pounds (USDA 2023). It has massively contributed to global animal protein consumption, however Nigerian contribution to the global chicken is infinitesimal, due to the poor performance of its chicken population, which hitherto is dominated by local chicken (80% local and 20% exotic). The Nigerian native chicken constitutes 80% of the 120 million poultry birds in Nigeria (Adedokun and Sonaiya, 2001). Genetic improvement of the majority of its local chicken population to a meat type or egg type breed of chicken will advance its contribution to global meat. It will both position and expedite Nigeria poultry industry to meet FAO's 2022 prediction that Africa and Nigeria, its most populous country, are expected to provide

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MDGs goal of food security, through proper management of its natural resources, particularly chicken population in the present context. It will lead to exponential growth in the global meat and egg production, reduce global animal protein malnutrition, reduce rate of infant death and stunted growth and positively, increase the income of rural farmers and drastically reduce the predicted 660 million hungry global population.

The breeding program at the Animal science Research and Teaching farm of the Department of Animal science, University of Nigeria has developed fairly selected chickens for several generations. The product of the breeding program yielded the heavy local chicken ecotype used for the present study. The base population of the heavy ecotype were offsprings of some local chickens gathered from local chicken markets in the middle belt. They were raised under litter system, given standard feed (chick starter, growers mash and layer starter) and water ad libitum for generations. At maturity the progenies of the best sire were selected based on body weight, hen age at first egg, egg weight, egg number and egg colour (Agbo et al., 2018). The nondescript chicken were obtained from the surrounding chicken market in the eastern Nigeria. These nondescript chicken were raised by rural farmers under extensive system, whereby the scavenge for food with very minimal care. While the broilers, offsprings of a genetically improved meat type parent stocks that has undergone intensive selection, were obtained from Nigeria's most populous commercial poultry farm, Agrited Nigeria Ltd located in Ibadan. Several studies have reported the performance of the Nigerian commercial broiler, local chicken and heavy ecotype chicken independently, however there is porous information on the comparative performance of these three chicken genotypes. The objective of the study was to compare of body weight (0, 7, 14, 21, 28, 35, 42, 49 and 56 days old), body length, chest girth, shank length, average weekly feed intake, average feed intake, average daily weight gain and feed conversion ratio of three chicken genotypes reared in Nigeria.

Materials and Methods

This study was carried out at the Poultry Unit of the Department of Animal Science Teaching and Research Farm University of Nigeria Nsukka. The study lasted for a period of eight (8) weeks.

Experimental Birds and Management: A total of 60 birds were used for the experiment, they comprise

20 heavy ecotypes from the exiting 7th generation of the Nigerian local chicken ecotype at the local chicken breeding unit, Animal Science Teaching Research Farm, University of Nigeria Nsukka and 20 broiler chickens, and 20 nondescript local chickens. The houses were partitioned into 3 compartments which will contain 20 heavy ecotype chickens, 20 broiler chickens, 20 Nondescript local chickens. The pens were swept, cleaned and disinfected with formalin to prevent breakout of diseases.

Data Collection and Analysis: The data collected from body weight, body weight gain, body length, shank were subjected to analysis of variance (ANOVA) according to the procedure or a One way analysis in a completely randomized design using Stat Graphic computer Package (SPSS, 2007) Model. Duncan's multiple range tests was carried out to compare the means of various traits of 3 genotypes using computer software.

Measurement or Comparison of Traits: The comparison of traits was obtained by dividing the values recorded for broiler with values obtained for nondescript and heavy ecotype chicken using the formular below;

Measurement of broiler/ measure of Nondescript or heavy ecotype

Statistical Analysis: Each pen was considered as replicate. There were 4 replicates in one treatment. Data from the completely randomized design was subjected to a 1-way Analysis of variance (ANOVA) using the Stat Graphic computer Package (SPSS, 2007) Model. Duncan's multiple range tests was carried out to compare the means of various traits of 3 genotypes using computer software. Statements of statistical significance were $P < 0.05$ unless otherwise indicated

Model: $X_{ij} = \mu + T_i + \sum_{ij}$

Where;

X_{ij} = Individual observation

μ = Overall population mean

T_i = Treatment effect

\sum_{ij} = Experimental/random error

Results and Discussion

Body Weight: It was showed (Table 1) the body weight of weeks 1, 2, 3, 4, 5, 6, 7 and 8 varied from 0.036 kg for Nondescript local chickens and heavy ecotype to 0.047 kg for broiler; 0.046kg for Nondescript local chickens to 0.276kg for broiler; 0.043kg for Nondescript local chickens to 0.608kg for broiler; 0.120 kg for Nondescript local chickens and to 0.908kg for broiler; 0.164kg for Nondescript local chickens to 1.440kg for broiler; 0.252kg for

Table 1. Descriptive statistics of weekly body weight, Average daily weight gain, Average daily feed intake and Feed conversion ratio of 3 genotypes

PARAMETER	WEEK	BROILER	NON DESCRIPT LOCAL CHICKEN	HEAVY ECOTYPE	SEM	P.VALUE
BW(kg)	1	0.047 ^a	0.036 ^b	0.036 ^b	0.001	0.003
	2	0.276 ^a	0.046 ^c	0.082 ^b	0.019	0.000
	3	0.608 ^a	0.043 ^c	0.120 ^b	0.047	0.000
	4	0.908 ^a	0.120 ^c	0.196 ^b	0.670	0.000
	5	1.440 ^a	0.164 ^c	0.248 ^b	0.109	0.000
	6	1.692 ^a	0.252 ^c	0.360 ^b	0.124	0.000
	7	2.580 ^a	0.296 ^c	0.420 ^b	0.195	0.000
	8	3.350 ^a	0.380 ^c	0.516 ^b	0.255	0.000
ADWG(kg)		0.059 ^a	0.0062 ^c	0.0086 ^b	0.004	0.000
ADFI(kg)		0.109 ^a	0.047 ^b	0.051 ^b	0.005	0.000
FCR		1.865 ^c	7.845 ^a	6.096 ^b	0.509	0.000

^{abcd}; mean on the same row with different subscripts were significantly different ($P \leq 0.05$ or $P \leq 0.01$). BW; Body weight, ADWG; Average Daily Weight Gain ADFI; Average Daily Feed Intake, FCR; Feed Conversion Ratio, SEM: Standard error of the mean.

Nondescript local chickens to 1.692kg for broiler; 0.296kg for Nondescript local chickens to 2.580kg for broiler; and 0.382 for Nondescript local chickens to 3.350kg for broiler respectively. The average daily weight gain ranged from 0.0062 for Nondescript to 0.590 for broiler; the average daily feed intake varied from 0.047 for Nondescript local chicken to 0.109 for broiler, and feed conversion ratio ranged from 1.865 for broiler to 7.845 for Nondescript local chicken.

The result showed that body weights were significantly different ($P \leq 0.01$) in all the 3 genotypes. It was also observed that the body weight of Nondescript local chicken and Heavy ecotype are similar at week one. The body weight of broiler at weeks 1 to 8 were significantly ($P \leq 0.01$) higher than Nondescript local chicken and heavy ecotype. More so the result revealed that the heavy ecotype were significantly ($P \leq 0.01$) higher than Nondescript local chicken. The genotypes also varied significantly ($P \leq 0.01$) in average daily weight gain, average daily feed intake and feed conversion ratio.

The increasing trend from 1 to 8 weeks obtained in the study for body weight as the bird advances in age suggests that age is a major determinant of growth and physiological development. The results of body weight of Nondescript local chicken at week 8 was higher than the value (301.80g) reported by (Binda et al., 2012), but agreed with week 1 body weight (0.036kg) report of those authors. The body weight of Nondescript local chicken at week 4 (139g) was higher than the values (0.120kg) reported by Momoh et al. (2010) obtained from the experiment. The result of body weight of heavy ecotype at week 8 with the value (0.516kg) was higher than the value (350g) reported by (Momoh et

al., 2010). The body weight at week 1 with the value (30.23g) reported by Momoh (2005) agreed with the value (0.036kg) obtained from the result, but for Nondescript local chicken the value (0.036) obtained from the experiment was higher than the value (24.27g) reported by the same author. The significant difference observed in the 3 genotype could be as a result of differences in genetic makeup. Growth performance of heavy ecotype is higher than Nondescript local chicken, thus the heavy ecotype has been selected to 7th generation and yet to attain genetic purity for meat trait.

Comparison of the Body Weight of the Broiler and Heavy Ecotype Local Chicken: It was compared the body weight of the broiler and heavy ecotype local chicken (Table 2).

Table 2. Comparison of the body weight of the broiler and nondescript local chicken

Weeks	Increased Performance of Broiler over Nondescript Chicken
4	8
8	6.79

At 4 weeks of age, the broiler has grown 8 times more than the nondescript local chicken. At 8 weeks of age, the broiler is 6.79 times more than the nondescript local chicken.

Comparison of the Body Weight of Heavy ecotype and Nondescript Local Chicken:

The relative performance of the body weight of heavy ecotype and nondescript local chicken were showed (Table 3).

At four weeks of age, the heavy ecotype has grown approximately 2 times more than the nondescript local chicken respectively. However, at 8 weeks of age the heavy ecotype has grown 1.36 times more than the nondescript local chicken.

Table 3: The relative performance of the body weight of heavy ecotype and nondescript local chicken

Weeks	Increased Performance
4	2.0
8	1.36

From the result of this study, it is evident that the selection program has led to increase in the body weight of the heavy ecotype chicken, however the magnitude of the genetic progress is small considering the duration of selection program. The slow rate of genetic progress could be attributed

to low predictive accuracy of breeding decisions, inefficient selection methods or poor technical know-how. However, the result reveals that high selective accuracy and efficient breeding program could further increase the present body weight of the heavy ecotype at 4 weeks for it to become a pure broiler breed.

Allometric Traits of Three Chicken Genotypes: It was presented the descriptive statistics of allometric traits of 3 genotype (Broiler, Nondescript local chicken and Heavy ecotype) reared in south eastern region of Nigeria (Table 4).

Table 4. Descriptive statistics of allometric traits of 3 genotypes (Broiler, Non descript local chicken and heavy ecotype) reared in south eastern region of Nigeria

PARAMETER	WEEK	BROILER	NON DESCRIPT LOCAL CHICKEN	HEAVYECOTYPE	SEM	P.VALUE
BL(cm)	1	7.410 ^a	6.150 ^b	6.450 ^b	0.131	0.000
	2	11.020 ^a	7.490 ^c	8.530 ^b	0.292	0.000
	3	11.080 ^a	8.040 ^c	10.570 ^b	0.491	0.000
	4	18.450 ^a	9.380 ^c	10.910 ^b	0.750	0.000
	5	19.650 ^a	10.900 ^c	12.570 ^b	0.719	0.000
	6	21.660 ^a	11.690 ^c	14.350 ^b	0.805	0.000
	7	24.350 ^a	10.810 ^c	15.150 ^b	1.076	0.000
	8	24.900 ^a	13.700 ^c	16.390 ^b	0.911	0.000
CG(cm)	1	7.310 ^a	6.090 ^b	5.910 ^b	0.145	0.000
	4	17.700 ^a	8.415 ^c	10.150 ^b	0.770	0.000
	8	26.070 ^a	16.280 ^b	26.070 ^a	0.904	0.000
SL(cm)	1	2.460 ^a	2.280 ^a	2.310 ^a	0.397	0.141
	4	6.820 ^a	3.620 ^c	5.000 ^b	0.253	0.000
	8	9.832 ^a	5.100 ^c	6.500 ^b	0.392	0.000

^{abcd}; mean on the same row with different subscripts were significantly different ($P \leq 0.05$ or $P \leq 0.01$). BL; Body length, CG; Chestgirth, SL; Shanklength, SEM: Standard error of the mean

It was presented the body length at week 1, 4 and 8 ranged from 6.150cm for , Nondescript local chicken to 7.410cm for broiler; 9.380cm for, Nondescript local chicken to 18.450cm for broiler; 13.700cm for Nondescript local chicken to 24.900cm for broiler respectively. The result of body length of broiler at weeks 2 with the value (11.020) coincided with the findings of Ojedapo (2013) whose result was (11.63) at week 2, but did not agree the value (23.53cm) reported by (Dzungwe, 2018). The report of body length of Heavy ecotype from the experiment at week 8 with the value (16.39) was higher than the value (12.15) reported by (Ohagenyi et al., 2012).

The result revealed that the shank length of 3 genotypes at week 1, 2 and 3 ranges from 2.280 for Nondescript local chicken to 2.460 broiler; from 3.620 for Nondescript local chicken to 6.820 broiler and from 5.100 for Nondescript local chicken to 9.882 broiler respectively. The result of shank length of Broiler chicken did not agree with the value (13.54) at week 8 reported by Ojedapo (2013). The shank length of heavy ecotype reported in the

experiment with the value 6.50) at week 8 was higher than the report of Ohagenyi et al. (2012) with the value (5.59).

The result pointed that at week 1 body length of broiler were significantly ($P \leq 0.01$) higher than Light and Heavy ecotype, which are similar. The result of body length obtained at week 2 for broiler were significantly ($P \leq 0.01$) higher than heavy ecotype chicken, which were also significantly ($P \leq 0.01$) higher than Nondescript local chicken. The study revealed that the chest girth were significantly ($P \leq 0.01$) differences all through the experiment. The results of the shank length in this study revealed significant ($P \leq 0.01$) difference in the 3 group at weeks 1, 4 and 8.

The significant difference revealed in the 3 genotypes could be as a reflection of differences in genetic makeup. Growth performance of heavy ecotype is higher than Nondescript local chicken, thus the heavy ecotype has been selected to 7th generation and yet to attain genetic purity for meat trait.

Comparison of the Linear traits of three chicken genotypes

Comparison of the Linear traits of the Broiler and Heavy ecotype Chicken

Table 5. Comparative performance of the broiler above the heavy ecotype and nondescript chicken

Traits	Weeks	Increased Performance of Broiler above Heavy ecotype	Increased Performance of Broiler above Non-descript Chicken
Body length	4	0.6	1.9
	8	0.5	1.8
Shank length	4	1.7	2.1
	8	1.6	2.1
Chest girth	4	1.4	1.9
	8	1.5	1.9

It was presented a comparative outlook of the Broiler and the Heavy ecotype chicken (Table 5). The result showed that 4 weeks body length of broiler measures 0.6 times more than the heavy ecotype chicken. While at 8 weeks the broiler was 0.5 times more than the heavy ecotype chicken.

At four weeks of age, the shank length of broiler was 1.7 times more than the heavy ecotype chicken. While at 8 weeks the broilers were 1.6 times more than the heavy ecotype chicken.

At 4 and 8 weeks of age, the chest girth of broiler were 1.4 and 1.5 times more than the heavy ecotype chicken, respectively.

Comparison of the Linear Traits of the Broiler and Nondescript Local Chicken.

At four weeks of age, the body length of broiler has grown 1.9 times more than the nondescript local chicken. However, at 8 weeks of age, the broiler has grown 1.8 more than the non-descript local chicken

At four weeks of age, the shank length of broiler has grown 2.1 times more than the nondescript local chicken, while at 8 weeks of age, the broiler grew 2.1 times more than the non-descript local chicken.

At 4 and 8 weeks of age, the chest girth of broiler has grown 1.9 times and 1.9 times more than the nondescript local chicken respectively.

Comparison of the Linear Traits of Heavy Ecotype and Nondescript local Chicken

The body length of the heavy ecotype at four weeks of age grew 1.2 times more than the nondescript local chicken. At 8 weeks of age the heavy ecotype was 1.2 times more than the non-descript local chicken.

At four weeks of age, the shank length of the heavy ecotype grew 1.2 times more than the nondescript local chicken, however at 8 weeks of age, the heavy ecotype has grown 1.3 times more

than the non-descript local chicken. At weeks 4 and 8 the heavy ecotype have grown 1.9 and 1.3 times more than the non-descript local chicken respectively.

Table 6. Comparison of the linear traits of heavy ecotype and nondescript chicken

Traits	Weeks	Increased Performance of Heavy ecotype above Non-descript Chicken
Bodylength	4	1.2
	8	1.2
Shanklength	4	1.2
	8	1.3
Chestgirth	4	1.9
	8	1.3

It was presented a comparative evaluation of the linear growth measurement of the Heavy ecotype and the nondescript local chicken (Table 6). *Comparison of the linear traits of nondescript local chicken with its improved counterparts (Broiler and Heavy ecotype chicken)*

The finding of the study showed that at four weeks of age, the body length of broiler and Heavy ecotype have grown 1.9 and 1.2 times more than the nondescript local chicken, respectively. However, at 8 weeks of age, the broiler and Heavy ecotype have grown 1.8 and 1.2 more than the non-descript local chicken, respectively.

At four weeks of age, the shank length of broiler and the heavy ecotype have grown 2.1 times and 1.2 times more than the nondescript local chicken respectively. At 8 weeks of age, the broiler and the heavy ecotype have grown 2.1 and 1.3 times more than the non-descript local chicken respectively.

At four weeks of age, the chest girth of broiler and the heavy ecotype have grown 1.9 times and 1.9 times more than the nondescript local chicken respectively. At 8 weeks of age, the broiler and the heavy ecotype have grown 1.9 and 1.3 times more than the non-descript local chicken respectively.

Feed intake: It was presented descriptive statistics of average weekly feed intake 3 genotypes (Broiler, Nondescript local chicken and Heavy ecotype) reared in south eastern region of Nigeria (Table 7).

It was showed (Table 7) average weekly feed intake 3 genotype (Broiler, Nondescript local chicken and heavy ecotype) at weeks 3, 4, 5, 6, 7 and 8 0.082kg, 0.082kg, 0.027kg and 0.035kg; 0.107kg, 0.032kg, and 0.045kg; 0.106kg, 0.049kg, and 0.045kg; 0.165kg, 0.043kg and 0.033kg; 0.188kg, 0.080kg and 0.098kg; 0.173kg, 0.089kg and 0.092kg, respectively.

Table 7. Average weekly feed intake of 3 genotype (Broiler, Nondescript local chicken and heavy ecotype)

Weeks	Broiler (Kg)	Nondescript chicken (Kg)	Heavyecotype (Kg)
3	0.082	0.027	0.035
4	0.107	0.032	0.045
5	0.106	0.049	0.045
6	0.165	0.043	0.033
7	0.188	0.080	0.098
8	0.173	0.089	0.092

The average weekly feed intake at week 3, 6 and 8 ranged from 0.027kg for Nondescript local chicken to 0.082kg for broiler; 0.033kg for heavy ecotype to 0.165kg for broiler and 0.089kg for Nondescript local chicken to 0.173kg for broiler respectively. The result of feed intake of Nondescript local chicken at week 1 with the value (0.027kg) were similar to the value (24.74g) of indigenous chicken Miri type reported by (Haunshi, 2009), but did not agree the result of week 8 with the value (0.089).

The result of feed intake obtained at week 1 and 2 for broiler were significantly ($P \leq 0.01$) higher than heavy ecotype, which were also significantly ($P \leq 0.01$) higher than Nondescript local chicken. The result also revealed that the feed intake of broiler at week 5, 6, 7 and 8 were significantly ($P \leq 0.01$) higher than feed intake of Nondescript local chicken and heavy ecotype chicken, which were statistically similar.

The significant differences observed in the 3 genotype could be as a result of differences in genetic makeup. Growth performance of heavy ecotype is higher than Nondescript local chicken, thus the heavy ecotype has been selected to 7th generation and yet to attain genetic purity for meat trait.

Comparison of the Feed Intake of 3 Chicken Genotypes: The study indicated that the broiler chicken feed intake at 4 weeks of age was 3.34 and 2.38 more times above the feed intake of the nondescript and heavy ecotype chicken, respectively. While at 8 weeks of age the broiler feed intake was 1.94 and 1.88 more times higher than the nondescript and heavy ecotype chicken, respectively. The Heavy ecotype feed intake at weeks 4 and 8 were 1.41 and 1.03 more times higher than the nondescript chicken.

The study indicated that the broiler chicken feed intake at 4 weeks of age was 3.34 and 2.38 more times higher than the feed intake of the nondescript and heavy ecotype chicken, respectively. While at 8 weeks of age the broiler feed intake was 1.94 and 1.88 more times higher than the nondescript and

heavy ecotype chicken, respectively. The Heavy ecotype feed intake at weeks 4 and 8 were 1.41 and 1.03 more times higher than the nondescript chicken. The significant difference observed in the 3 genotype could be as a result of differences in genetic makeup. The growth study revealed

Conclusion

It was concluded that genetic progress among the UNN heavy ecotype chicken. The genetic progress recorded in the heavy ecotype chicken by breeders in UNN attest to the fact that breeding work adopted for improvement of the heavy ecotype chicken has high predictive accuracy. The performance of heavy ecotype is higher than Nondescript local chicken due to genetic improvement techniques (selection and breeding methods) that has been carried out on heavy ecotype chicken by researchers.

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