EVALUATION OF GROWTH PERFORMANCE AND MORPHOMETRIC TRAITS OF TWO STRAINS OF PULLETS RAISED IN OBIO AKPA, AKWA IBOM STATE

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ABSTRACT

This study was conducted to evaluate the effect of strains on growth performance and morphometric traits of two strains of commercial pullets (Isa brown and Nera black). A total of 90 chicks (45 chicks per strain) were purchased from a reputable hatchery. Each strain was further replicated three times with 15 birds per replicate. Growth performance and morphometric trait measurements were determined from 0 – 10 weeks of age. The growth performance traits studied were body weight (BW), weight gain (WG), feed intake (FI) and feed conversion ratio (FCR). The morphometric traits measured were body length (BL), wing length (WL), shank length (SL), breast girth (BG) and neck length (NL). Data obtained were subjected to an independent t-test using the SPSS package. The results indicated that BW and other growth performance traits (FI, WG and FCR) were significantly influenced (p<0.05) by the strain of pullets. Nera black pullets consistently had higher BW, WG, FI and FCR than Isa brown at all ages studied. However, morphometric traits were not affected by strains. It was also indicated in the study that regardless of strain, BW and all morphometric traits increased in mean values with the advancing age of the birds. Nera black was identified as having better BW because it had the highest mean value in BW and other performance traits and could be recommended to farmers for an increase in productivity.

Keywords: Growth, Performance, Morphometric, Traits, Strains, Chicken

INTRODUCTION

The urgency to boost animal protein production within Nigeria has increased due to the continual increase in population. The present human population in Nigeria is estimated to be 223,804,632 as of 2023 and is anticipated to increase to 263 million people in 2030 and 401 million in 2050 (Worldometer, 2024). This human population growth has seriously surpassed food production. Currently, the majority of the population is faced with serious food insecurity. In response to this challenge, poultry meat and eggs have been advocated as one of the best livestock choices to reduce the protein deficit. This recommendation stems from various factors, including their brief generation interval, increased productivity rate, rapid turnover rate, enhanced feed efficiency, and comparatively modest labour and land demands (Alphonsus *et al.*, 2012; Essien *et al.*, 2022; Sam and Okon, 2022).

The evaluation of growth performance and morphometric traits are crucial parameters employed in studying livestock anatomy, the quality of livestock productivity, and growth rate. Growth constitutes one of the principal characteristics of all living organisms. It

encompasses dynamic physiological changes commencing from zygote formation at fertilization and persisting until individual maturity. Hristakieva *et al*. (2014) observed that growth in all animals, aside from its association with bodily cell and volume expansion, represents a multifaceted process regulated by both genetic and non-genetic factors. Animal growth is dependent upon age, nutrition, breed, husbandry system, and health management practices, among myriad of other variables, and different animal strains exhibit different live weights, providing useful information for the selection process (Udeh *et al*., 2011). Animals' body weight (BW) constitutes the most dependable measure of growth performance.

Morphometric traits serve as excellent indicators in describing animal production as they dictate the market values of the animals (Ebong *et al*., 2023). Morphometric trait measurements have been utilized to depict body conformation and carcass composition, assess strain performance, predict live weight gain (WG) and reproductive performance, and explore interrelations among morphometric characteristics, in an attempt to study the interactions between heredity and the environment in several animals (Egena *et al*., 2014). Although BW typically serves as a measure of growth in farm animals, numerous studies have demonstrated that other growth traits of the body morphometric measurements such as body length, shank length (SL), and breast girth (BG) can function as reliable growth indicators.

The BW at the onset of egg laying determines its age at the first egg, age at peak production, and overall hen performance (Olawumi, 2011). A hen attaining sexual maturity earlier will yield more eggs compared to one attaining maturity later. Growth performance during different production phases (starter phase and grower phase) holds significant importance in selecting for high-producing hens (Rondelli *et al*., 2003). The effect of bird strains has been reported in the literature as a factor affecting growth and laying performance in birds. There is a paucity of information on which strain is best in the study area. Therefore, this research aimed to evaluate the BW and morphometric traits performance of two strains of chicken in Obio Akpa, Akwa Ibom State.

MATERIALS AND METHODS

Location of the Experiment: This experiment was conducted at the Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture, Akwa Ibom State University, Obio Akpa campus between April 24 – July 2, 2023. The area is located between latitudes 4º30ºN and 5º00N and longitudes 70º30ºE and 80º00E. The area is characterized by an annual rainfall ranging from 3500 – 5000 mm, a monthly temperature of about 25^0C, and relative humidity between 60 – 90% (Sam and Okon, 2022). It is in the tropical rainforest zone of Nigeria. The people in the study areas depend on livestock and crop production (AKSG, 2024).

Experimental Birds and Management: Isa Brown and Nera black commercial layer strains were purchased from a CHI Hatchery, Ibadan, Oyo State, Nigeria. A total of 90-day-old pullets comprising 45 each of Isa brown and Nera black commercial strains were allocated into two treatments (according to strain) with three replications and 15 pullets per replicate in a completely randomised design (CRD). Each strain was identified by a wing tag and assigned to a pen in a brooder house. Chicks were brooded for two weeks in the restricted brooding section of the Teaching and Research Farm of the Department of Animal Science, Akwa Ibom State University. 200 watts of electric bulbs and charcoal stoves were used as a source of heat. After brooding birds were transferred to the rearing house.

All chicks were fed *ad libitum* with a commercial starter mash diet (Top Feeds Super Starter, Premiere Feed Mills Company Limited, Nigeria) containing 2600 kcal/kg Metabolizable energy and 17% crude protein up to eight weeks of age. Thereafter the birds were given grower mash ration (Top Feeds Broiler Finisher, Premiere Feed Mills Company Limited, Nigeria) containing 16% crude protein and 2500 kcal/kg metabolizable energy up to the end of the experiment. Fresh drinking water was given *ad libitum* to the birds throughout the experimental

period. All necessary routine management practices and the recommended vaccination schedule were strictly observed throughout the period of the study (10 weeks).

Data Collection: A Camry top loading weighing scale of 20 kg capacity and a tailor measuring tape with a side graduated in cm were used to measure BW and five morphometric traits respectively. The morphometric trait measurements were taken according to the procedure described by Sam and Okon (2022).

Growth Performance Traits: Data was collected on the BW, WG, feed intake (FI) and feed conversion ratio (FCR) as follows:

Body weight (BW): BW was measured using a sensitive digital weighing scale in grams (g) at the beginning of the experiment and thereafter weekly.

Feed intake (FI): FI was calculated as the difference between the quantity offered the previous day and the quantity left over in grams (g), (FI = quantity of feed given – quantity of feed left over feed).

Weight gain (WG): WG was calculated as the difference in live weight between the current and the previous weights (WG = final live weight – initial weight).

Feed conversion ratio (FCR): FCR was calculated by dividing the FI by WG.

Morphometric Traits: The following morphometric traits were measured as follows:

Body length (BL): BL was measured as the distance between the tip of the rostrum maxillare (beak) and that of the caudal (tail without feathers).

Wing length (WL): WL was measured between the tip of the phalanges and coracoids – humorous joint.

Shank length (SL): SL was measured as the length of the tars-metatarsus from the hock joint to the metatarsal pads.

Breast girth (BG): BG was taken as the circumference of the breast around the deepest region of the breast using measuring tape in cm.

Neck length (NL): NL was considered as the distance between the occipital condyle and the cephalic borders of the coracoids.

Statistical Analysis: Data collected in the experiment were subjected to an independent T-test to compare means between the two strains using SPSS (2011) version 20. The statistical model used is as shown below: $Y_{ik} = \mu + A_i + e_{jk}$, where; Y_{ik} = Record of measurable traits, μ = population mean, Ai = effect of strain (i = 1 and 2), and ei = random error.

RESULTS AND DISCUSSION

Influence of Strain on Growth Performance Traits of Isa Brown and Nera Black Pullets: The growth performance of Isa brown and Nera black pullets at weeks 2, 4, 6, 8 and 10 showed that there was a significant difference ($p<0.05$) between the two strains of chicken in BW at all ages (Table 1). Nera black had a higher BW than Isa brown, the values obtained for Nera black were 100.32 ± 0.35, 168.50 ± 0.25, 360.00 ± 0.32, 520.52 ± 0.45 and 760.52 ± 0.35 g for weeks 2, 4, 6, 8 and 10 respectively, whereas, Isa brown recorded 98.63 ± 0.32, 151.32 ± 0.01, 270.50 ± 0.21, 480.42 ± 0.52 and 720 ± 0.25 g for weeks 2, 4, 6, 8 and 10 respectively. The result of this study agrees with the reports of Olawumi (2011) who reported a significant ($p<0.05$) strain effect on BW at weeks 4 – 20 for Isa brown, Bovan Nera and dominant black chickens in the derived savannah zone of Nigeria. The variation observed at different ages in this study may be associated with the genetic constitution of the individual strain assessed. It was observed for both strains, that there was a progressive increase in BW with advances in age.

Table 1: Growth performance of two strains of pullets at different ages

Parameter	Age (weeks)	Isa Brown	Nera Black
Body weight (g)	0	30.30 ± 0.21	29.86 ± 0.25
	2	98.65 ± 0.32	100.32 ± 0.35*
	4	151.35 ± 0.01	168.50 ± 0.25*
	6	270.50 ± 0.21	360.00 ± 0.32*
	8	480.42 ± 0.52	520.52 ± 0.45*
	10	720.66 ± 0.25	760.52 ± 0.35*
Weight gain (g)	2	40.31 ± 0.21	39.97 ± 0.24 *
	4	43.72 ± 0.22	53.10 ± 0.21 *
	6	72.10 ± 0.31	120.00 ± 0.35*
	8	120.09 ± 0.24	170.00 ± 0.41*
	10	200.14 ± 0.35	239.90 ± 0.55 *
Feed Intake (g)	2	20.15 ± 0.24 *	19.31 ± 0.23
	4	32.20 ± 0.35 *	29.06 ± 0.21
	6	44.56 ± 0.43 *	37.54 ± 0.24
	8	54.26 ± 0.35 *	46.86 ± 0.35
	10	60.22 ± 0.35 *	54.00 ± 0.42
Feed Conversion Ratio	2	0.49 ± 0.21 *	0.47 ± 0.25
	4	0.73 ± 0.23 *	0.54 ± 0.24
	6	0.61 ± 0.21 *	0.31 ± 0.21
	8	0.45 ± 0.32 *	0.28 ± 0.21
	10	0.30 ± 0.25 *	0.22 ± 0.35 *

** mean on the same row with an asterisk (*) is significantly different (p<0.05) using t-test pairwise comparison*

This agrees with the report of Ajayi *et al.* (2008), who reported a significant difference (p<0.05) in two commercial meat-type chickens. This result compares with the findings of Crawford (1990), Giordani *et al.* (1993), and Ebangi and Ibe (1994) who reported differences in the growth rate of chickens as a result of genotype and age. Olawumi (2011) also reported a significant genotype effect on BW of three strains of layer chicken (Isa brown, Bovan Nera and Dominant black) studied.

It has been reported that egg-type chickens must reach a minimum age and BW before they can commence egg production (Sigel, 1987). Olawumi (2011) also reported that the BW of laying birds determines the age at which the first eggs are laid and not the age of the birds. Generally, birds increased in BW consistently with advancing age in the strains studied. This, therefore, suggests that chicken strains that reach the maturity BW earlier will begin laying and may lay for a longer period than those that reach that weight at a later age. Moreover, chickens with bigger BW at the laying phase have also been reported to lay heavier eggs which is one of the desires of the farmer.

The values obtained for WG (g/bird/day) for Isa brown were 40.31 ± 0.21, 43.72 ± 0.22, 72.10 ± 0.31, 120.09 ± 0.24 and 200.14 ± 0.35 g for weeks 2, 4, 6, 8 and 10 respectively (Table 1). The values for Nera black were 39.97 ± 0.24, 53.10 ± 0.21, 120.00 ± 0.35, 170.02 ± 0.41 and 239.90 ± 0.55 g for weeks 2, 4, 6, 8 and 10 respectively. Kabir *et al.* (2010) reported variation in BW gain of Anak and Hubbard broiler chickens and attributed it to the differences in the genetic makeup of the flock. Mohammed *et al.* (2005) opined that variation in BW gain due to strain is an indication that could influence BW. The birds in the two experimental groups were given the same quantity of feed and the amount increased as they advanced in age. The result of this study agrees with the reports of Leeson *et al.* (1997) and Taha *et al.* (2010), who reported marked differences in WG of different strains of chicken.

There was a significant difference in FI of the two strains of chicken at all ages (Table 1). The FI values recorded for weeks 2, 4, 6, 8 and 10 were 20.15 ± 0.24, 32.20 ± 0.35, 44.56 ± 0.43, 54.26 ± 0.35 and 60.22 ± 0.35 g for Isa brown, while the values for Nera black were 19.31 ± 0.23, 29.06 ± 0.21, 37.54 ± 0.24, 46.86 ± 0.35 and 54.00 ± 0.42 g. Nera black consumed less feed than the Isa brown irrespective of the fact that (Nera black) had the highest BW and WG than the Isa brown hen. The explanation for the observation probably may be that Nera black utilizes feed better than Isa brown. The differences may be due to genetic makeup. These results are in agreement with the report of Oyeagu *et al.* (2015) who reported a significant (p<0.05) and less FI of Nera black layers compared to Black shaver.

There was a significant difference in FCR between the two strains (Table 1). Values were 0.49 ± 0.21, 0.73 ± 0.23, 0.61 ± 0.21, 0.45 ± 0.32 and 0.300.25 for Isa brown chicken. The

values for Nera black were 0.47 ± 0.25, 0.54 ± 0.24, 0.31 ± 0.21, 0.28 ± 0.21 and 0.22 ± 0.35 for weeks 2, 4, 6, 8, and 10 respectively. The Nera black strain had a better FCR than the Isa brown. This indicates that Nera blacks are better converters of feed to BW. This result agrees with the reports of Rondelli *et al.* (2003) who worked with two commercial broiler lines in Brazil. This finding is also in agreement with the reports of Ajayi and Ejiofor (2009) and Sam and Okon (2022) who reported significant differences ($p<0.05$) in the FCR of different strains of birds studied. FCR is one of the major criteria used in defining the performance of domestic animals (Sam *et al.*, 2010). Skinner-Noble and Teeter (2003) described FCR as FI per WG which measures how efficiently the feed is utilized. However, it has been indicated that the lower the FCR, the better the performance of birds.

Influence of Strain on Body Weight and Morphometric Traits of Isa Brown and Nera Black Pullets: The influence of strain on morphometric traits of pullets at different ages is shown in Table 2. The results indicate that strain had no significant ($p>0.05$) influence on morphometric traits at all ages. There was no significant difference ($p<0.05$) observed in the BL of the two strains of birds studied. However, the values increased as the age of birds increased. The values for Isa brown at weeks 2, 4, 6, 8 and 10 were 8.62 ± 0.36, 11.56 ± 0.03, 13,26 ± 0.06, 15.40 ± 0.11 and 17.26 ± 0.03 cm respectively. The values for Nera black were 8.85 ± 0.22, 11.75 ± 0.15, 11.75 ± 0.13, 15.60 ± 0.23 and 17.53 ± 0.23 cm (Table 2). These values were similar to the values reported by Fayeye *et al.* (2014) for the BL of Isa brown and Ilorin ecotype chickens.

The values for WL at weeks 2, 4, 6, 8 and 10 were 4.22 ± 0.61, 6.36 ± 0.03, 7.50 ± 0.05, 7.86 ± 0.03 and 9.20 ± 0.05 cm respectively for Isa brown chicken. The values for Nera black were 4.42 ± 0.01, 6.56 ± 0.21, 6.56 ± 0.21, 8.26 ± 0.36 and 9.50 ± 0.25 cm for weeks 2, 4, 6, 8 and 10 respectively (Table 2). There was no significant difference ($p>0.05$) observed between the two strains when WL was considered. Okpeku *et al.* (2003) also reported a non-significant difference in WL of two different strains of chicken.

Table 2: Morphometric traits measurements of two strains of layer birds at different ages as affected by strains

Parameter	Age	Isa Brown	Nera Black
BW (g)	0	30.30 ± 0.15	29.86 ± 0.34
	2	98.65 ± 0.02	100.32 ± 0.01*
	4	151.35 ± 0.01	168.50 ± 0.02*
	6	270.50 ± 0.01	360.00 ± 0.01*
	8	480.42 ± 0.03	520.52 ± 0.03*
	10	720.66 ± 0.02	760.52 ± 0.01*
BL (cm)	2	8.62 ± 0.36	8.85 ± 0.22
	4	11.56 ± 0.03	11.73 ± 0.13
	6	13.26 ± 0.06	11.94 ± 0. 15
	8	15.40 ± 0.11	15.60 ± 0.23
	10	17.26 ± 0.03	17.53 ± 0.23
WL (cm)	2	4.22 ± 0.61	4.42 ± 0.01
	4	6.36 ± 0.03	6.56 ± 0.21
	6	7.50 ± 0.05	6.50 ± 0.21
	8	7.86 ± 0.03	8.26 ± 0.36
	10	9.20 ± 0.05	9.56 ± 0.25
SL (cm)	2	4.62 ± 0.52	4.82 ± 0.02
	4	5.60 ± 0.02	5.43 ± 0.03
	6	6.36 ± 0.03	5.60 ± 0.02
	8	6.63 ± 0.12	6.83 ± 0.03
	10	7.36 ± 0.08	7.53 ± 0.24
BG (cm)	2	8.32 ± 0.34	8.62 ± 0.01
	4	9.90 ± 0.05	9.91 ± 0.03
	6	11.40 ± 0.05	10.96 ± 0.03
	8	12.20 ± 0.10	12.53 ± 0.29
	10	12.93 ± 0.29	13.13 ± 0.13
NL (cm)	2	2.41 ± 0.62	2.66 ± 0.02
	4	4.80 ± 0.05	4.90 ± 0.57
	6	5.30 ± 0.05	5.36 ± 0.08
	8	6.43 ± 0.03	6.63 ± 0.13
	10	7.33 ± 0.07	7.56 ± 0.24

** mean on the same row with asterisk (*) is significantly different ($p<0.05$) using t-test pairwise comparison, BW= Body weight, BL = Body length, WL= WL, SL= Shank length, BG= Brest girth, NL= Neck length*

There were no significant differences ($p>0.05$) observed in the SL, BG and NL of the two strains of birds at different ages. The values of SL for weeks 2, 4, 6, 8 and 10 were 4.62 ± 0.52, 5.60 ± 0.20, 6.36 ± 0.03, 6.63 ± 0.12 and 7.36 ± 0.08 cm respectively for Isa brown. Whereas, the values for Nera black were 4.82 ± 0.02, 5.43 ± 0.03, 5.60 ± 0.02, 6.83 ± 0.08 and 7.53 ± 0.24 cm respectively.

Generally, all the morphometric trait measurements increased with age of the birds in each of the strains. Giordani *et al.* (1993) reported differences in these traits, was in contrast to the findings of this study. Pingel *et al.* (1990) reported

that age is a major determinant of growth and physiological development. Omeje and Nwosu (1986) opined that these traits could be utilized in genetic improvement of growth through selection.

Conclusion: Strain had Significant influence on all growth performance traits studied (BW, WG and FCR), but did not have any effect on morphometric trait measurements at all the ages (0 – 10 weeks) studied. The Nera black performed better in all the growth performance traits studied at different ages. It is recommended that Nera black should be used since it offers a better growth performance at the early phase of production which may eventually leads to better lay during the laying phase.

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