

## Growth performance traits of Nigerian improved local and exotic chickens as influenced by breed and hatching egg weight

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### ABSTRACT

This study was conducted to determine the effect of breed and egg size on performance traits of three chicken breeds (Sasso, Shika Brown, and cross breed) raised in South-South Nigeria. A total of 367 fertile eggs (169 Sasso, 130 Shika brown, and 68 Sasso x Shika brown cross) were used. Eggs were classified into three weight groups  $\leq 49$ g, 50 – 59g, and 60 - 69g. Chicks hatched from the eggs were 58 Sasso, 24 Shika Brown, and 17 Sasso x Shika Brown and were raised for 12 weeks during which performance data were collected. The data were analysed using ANOVA of General Linear Model (GLM) procedures of Statistical Analysis System. The results revealed a significant difference in the hatching weight of chicks across the three egg sizes. Heavy-sized eggs had the highest hatch weight ( $41.76 \pm 1.18$ g). The body weight of Sasso ( $39.23 \pm 0.47$ g) was significantly different from Shika Brown ( $36.24 \pm 0.95$ g) and the crosses ( $37.29 \pm 0.59$ ). The mean body weights of birds from the three egg sizes were significantly different ( $p < 0.05$ ) at 12 weeks. The mean body weight of the Sasso ( $590.40 \pm 40.88$ g) was significantly ( $p < 0.05$ ) higher than that of Shika Brown ( $368.88 \pm 34.77$ g) and their crossbred ( $462.01 \pm 26.90$ g). There was a significant difference ( $p < 0.05$ ) in the effect of breed on feed intake but not on feed efficiency. Shika Brown had the highest feed efficiency ( $0.20 \pm 0.04$ ). Conclusively, it was observed from this study that the size of an egg directly determines the performance of the bird and the Nigerian local chickens should be crossed with exotic ones to exploit the possibilities of heterosis.

**Keywords:** Performance, breed, egg weight, feed efficiency, chicken

### INTRODUCTION

There is an increasing demand for poultry and poultry products in Nigeria because of the ban on the importation of poultry and poultry products (Agaviezor *et al.*, 2018). Poultry meat and eggs play very important role in addressing the problems of inadequate animal protein intake and it is a source of income to many. To meet this increasing demand using the Nigerian indigenous breeds, several researches have been carried out using phenotypic and genetic variables to assess and improve the performances of these breeds (Agaviezor *et al.*, 2020; 2018; Alabi *et al.*, 2012). Growth is influenced by nutritional and genetic factors as well as intrauterine conditions. Growth

parameters assessed at birth help predicts subsequent growth, development and risk of disease. Chick hatch weight is primarily determined by initial egg weight, normally being 62-78% of egg weight (Wilson, 1991). Egg weight also plays significant influence in pre-hatch and post-hatch performance of chickens when all other non-genetic factors are under control. Large sized eggs produce chicks with higher hatch-weight than medium and small sized eggs (Abanikannda *et al.*, 2011). Eggs selected at uniform weight produces chicks at same weight and help the farmer to have bird that attained sexual maturity and commence laying at the time due to their relatively same weight. Feed efficiency is

considered as an important parameter for assessing the potential of bird strain or feeding programs. However, many factors such as bird age, sex, health and environmental temperature affects feed intake and growth rate. Although the single largest factor affecting feed efficiency is energy level of the feed. There is a paucity of information in the effect of egg size on performance traits in Sasso and Shika Brown chickens raised in the South-South region of Nigeria. Assessing the performance of these breeds will enhance our understanding on the adaptability of these breeds in the humid tropical environment of Nigeria. Thus, this study was conducted to assess the performance traits of chickens as influenced by breed and hatching egg weight.

## MATERIALS AND METHODS

This experiment was conducted at the University of Port Harcourt Demonstration farm Choba. The parent stock consists of 56 Sasso hens, 14 Shika Brown hens, 5 Sasso cocks and 5 Shika Brown cocks as part of those donated by African Chicken Genetic Gains (ACGG) for capacity building in the Department of Animal Science. The hens were artificially inseminated to get pure breeds of Sasso and Shika Brown and their crosses. A total of 367 fertile eggs were collected for this study which comprised of 169 Sasso, 130 Shika brown and 68 Sasso x Shika brown cross. The eggs were classified into three (3) weight groups according to egg weight.  $\leq 49\text{g}$  = Group 1;  $50 - 59\text{g}$  = Group 2 and  $60 - 69\text{g}$  = Group 3. The chicks hatched from the eggs were 58 Sasso, 24 Shika Brown and 17 Sasso x Shika Brown and they were raised for 12 weeks. The birds were fed with starter diet (from 0-4 weeks of age) which contained 20% crude protein and 2800 kcal of metabolizable energy (ME) and growers diet (from 4-12 weeks) that contained 18.5% crude protein and 2920 kcal of ME. The birds had access to water and feed *ad libitum*. Each bird was tagged for identification for easy monitoring. . Data on growth performance were collected weekly from the birds by using electronic scale for body weight and measuring tape for the body measurements - breast girth, body length, wing length, thigh length and keel length according to Sadick *et al.* (2020).

## Data Analysis

Data collected were analysed by using the General Linear Model (GLM) procedures of Statistical Analysis System (SAS, 2008). The Statistical Model used

$$Y_{ijk} = \mu + T_i + B_j + (TB)_{ij} + \sum_{ijk}$$

$Y$  = Overall observation

$\mu$  = Population means

$T_i$  = Effect of different egg sizes

$B_j$  = Effect of different breed of chicken

$TB_{ij}$  = interaction effect of Egg size and breed

$\sum_{ijk}$  = Residual effect

Duncan test for multiple comparisons was used to test significant differences between means at 5% probability level ( $<0.05$ ).

## RESULTS

The effect of egg size on chick hatch weight is shown in Table 1. There was a significant difference among the three egg sizes. The heavy sized eggs had the highest hatch weight ( $41.76 \pm 1.18\text{g}$ ) followed by the medium sized eggs ( $37.92 \pm 0.31\text{g}$ ) while the light sized eggs recorded the least weight ( $32.4 \pm 1.40\text{g}$ ). The effect of breed on chick hatch weight is shown in Table 2. The body weight of Sasso ( $39.23 \pm 0.47\text{g}$ ) is significantly different from Shika Brown ( $36.24 \pm 0.95\text{g}$ ) and the crosses ( $37.29 \pm 0.59$ ). Sasso x Shika Brown had numerical higher body weight than Shika Brown though the difference is not significantly different ( $p > 0.05$ ).

The effect of egg size on average body weight and linear body measurements is as shown in Table 3. The body weights of birds from the three egg sizes were significantly different ( $p < 0.05$ ). Chickens from heavy sized eggs had the highest body weight ( $537.61 \pm 126.72\text{g}$ ) followed by the medium sized eggs ( $455.45 \pm 50.72\text{g}$ ) then the light sized eggs ( $451.81 \pm 27.14\text{g}$ ). The body length of chickens from the heavy and the medium sized eggs were significantly higher than those from light sized eggs. Birds from heavy sized eggs had the highest body length ( $16.93 \pm 1.00\text{cm}$ ) followed by those from the medium ( $16.24 \pm 0.61\text{cm}$ ) and then the light sized eggs ( $16.15 \pm 0.28\text{cm}$ ). The breast girths of the three egg sizes were not significantly different ( $p < 0.05$ ). The heavy sized eggs had the highest numerical breast girth ( $19.36 \pm 2.18\text{cm}$ ) followed by the medium sized eggs ( $17.81 \pm 1.05\text{cm}$ ), then the light sized eggs ( $16.97 \pm 0.28\text{cm}$ ).

The wing length of the heavy sized eggs and medium is significantly different from the light sized eggs. The heavy sized eggs have the highest wing length ( $19.65 \pm 1.55$ cm) followed by the medium sized eggs ( $18.41 \pm 0.39$ cm) then the light sized eggs ( $17.83 \pm 0.85$ cm). The thigh lengths of the three egg sizes were not significantly different ( $p > 0.05$ ). The heavy sized eggs have the highest numerical thigh length ( $9.46 \pm 0.53$ cm) followed by the medium ( $9.25 \pm 0.32$ cm) then light sized eggs ( $9.07 \pm 0.15$ cm). The keel lengths of the three egg sizes were significantly different ( $p < 0.05$ ) from each other. The heavy sized eggs had the highest keel length ( $9.07 \pm 0.15$ cm) followed by the medium ( $8.62 \pm 0.27$ cm) then the light sized eggs ( $8.50 \pm 0.59$ cm).

The effect of breed on body weight and linear body measurements is as shown in Table 4. The body weight of the Sasso ( $590.40 \pm 40.88$ g) is significantly ( $p < 0.05$ ) higher than that of Shika Brown ( $368.88 \pm 34.77$ g) and their crossbred ( $462.01 \pm 26.90$ g) while that of Shika Brown was not significantly different from the crossbred. The body length was significantly different ( $p < 0.05$ ) across breeds. The crossbred has the highest body length ( $16.41 \pm 0.34$ cm) followed by Shika Brown ( $16.10 \pm 0.43$ cm) with Sasso having the least value ( $15.61 \pm 0.52$ cm). The breast girth of the Sasso and the crosses

were significantly different from Shika Brown. The breast girth of Sasso is highest ( $18.31 \pm 0.71$ cm). This was followed by the crossbred ( $16.34 \pm 0.50$ cm) and then Shika Brown ( $16.01 \pm 0.38$ cm). The wing length of the three breeds did not significantly ( $p > 0.05$ ) differ from each other. The wing length of the Sasso was the highest ( $18.97 \pm 0.88$ cm). This was followed by crossbred ( $18.39 \pm 0.47$ cm) and then Shika Brown ( $18.01 \pm 0.60$ cm). The thigh length of Sasso and the crosses were significantly differently from Shika Brown. The thigh length of the Sasso the highest ( $9.39 \pm 0.32$ cm) and was followed by the crossbred ( $9.24 \pm 0.18$ cm) and then Shika Brown ( $8.69 \pm 0.23$ cm). The keel lengths of the three breeds were not significantly different ( $p > 0.05$ ). However, Sasso has the numerical highest keel length ( $8.88 \pm 0.60$ cm) and was followed by the crossbred ( $8.60 \pm 0.31$ cm) and then Shika brown ( $8.49 \pm 0.47$ cm).

The effect of breed on feed intake and feed efficiency is shown in Table 5. There was significant difference ( $p < 0.05$ ) on the effect of breed on feed intake but not on feed efficiency. Sasso breed had the highest feed intake ( $229.69 \pm 40.62$ ) followed by the cross breed ( $120.33 \pm 10.15$ ) and Shika Brown ( $117.54 \pm 41.35$ ). Shika Brown had the highest feed efficiency ( $0.20 \pm 0.04$ ).

**Table 1:** Effect of egg size on chick hatch weight of chickens

Egg size	Chick Hatch Weight (g)
Heavy	$41.76 \pm 1.18^a$
Medium	$37.92 \pm 0.31^b$
Light	$32.4 \pm 1.40^c$

*a,b,c Means within column with different superscripts differ significantly ( $P < 0.05$ )*

**Table 2:** Effect of breed on hatch weight of chickens

Breed	Hatch Body weight
Sasso	$39.23 \pm 0.47^a$
Shika Brown	$36.24 \pm 0.95^b$
Sasso x Shika Brown	$37.29 \pm 0.59^b$

*<sup>a,b</sup> Means within column carrying different superscripts differ significantly ( $P < 0.05$ ).*

**Table 3:** Effect of egg size on body weight and linear body measurements of chickens

Egg size	Body weight (g)	Body length (cm)	Breast girth (cm)	Wing length (cm)	Thigh length (cm)	Keel length (cm)
Heavy	$537.61 \pm 126.72^a$	$16.93 \pm 1.00^a$	$19.36 \pm 2.18$	$19.65 \pm 1.55^a$	$9.46 \pm 0.53$	$8.72 \pm 0.96^a$
Medium	$455.45 \pm 50.72^b$	$16.24 \pm 0.61^a$	$17.81 \pm 1.05$	$18.41 \pm 0.39^a$	$9.25 \pm 0.32$	$8.62 \pm 0.27^a$
Light	$451.81 \pm 27.14^b$	$16.15 \pm 0.28^b$	$16.97 \pm 0.28$	$17.83 \pm 0.85^b$	$9.07 \pm 0.15$	$8.50 \pm 0.59^b$

*<sup>a,b</sup> Means within column carrying different superscripts differ significantly ( $P < 0.05$ )*

**Table 4:** Effect of breed on body weight and linear body measurements

Breed	Body Weight (g)	Body Length (cm)	Breast Girth (cm)	Wing Length (cm)	Thigh Length (cm)	Keel Length (cm)
Sasso	590.40±40.88 <sup>a</sup>	15.61±0.52 <sup>b</sup>	18.31±0.71 <sup>a</sup>	18.97±0.88	9.39±0.32 <sup>a</sup>	8.88±0.60
Shika Brown	368.88±34.77 <sup>b</sup>	16.10±0.43 <sup>a</sup>	16.01±0.38 <sup>b</sup>	18.01±0.60	8.69±0.23 <sup>b</sup>	8.49±0.47
Sasso x Shika Brown	462.01±26.90 <sup>b</sup>	16.41±0.34 <sup>a</sup>	16.34±0.50 <sup>a</sup>	18.39±0.47	9.24±0.18 <sup>a</sup>	8.60±0.31

<sup>a,b</sup> Means within column carrying different superscripts differ significantly ( $P < 0.05$ ).

**Table 5:** Effect of breeds on body weight, feed intake and feed efficiency in three genotypes of birds

Breed	Feed Intake (g)	Feed Efficiency
Sasso	229.69±40.62 <sup>a</sup>	0.19±0.02
Shika Brown	117.54±41.35 <sup>b</sup>	0.20±0.04
Sasso x Shika Brown	120.33±10.15 <sup>b</sup>	0.19±0.02

<sup>a,b</sup> Means within column carrying different superscripts differ significantly ( $P < 0.05$ ).

## DISCUSSION

The heavy sized eggs produced chicks with the highest body weight when the chicks were hatched. This revealed a positive correlation between egg size and chick hatching. This observation is in agreement with the findings of Abiola (1999) who reported close correlation between egg and chick hatching weights. However, Sembeta (2017) emphasized a decline in the magnitude of correlation between egg weight and chick body weight with the advancement of the age of chick. Egg weight loss in grams increased significantly from the light egg group to the heavy egg group however, differences in % egg weight losses of weight groups were not significant. Findings of the present study were similar to those reported by Abiola *et al.*, (2008) who reported that weight losses (%) were found to be higher in medium-weight group. The similarity in the results obtained on egg weight loss may suggest that the three egg size categories used for the study probably had equal proportion of pore areas and pore diameter regardless of the size of the egg (Abiola *et al.*, 2008). Effect of egg size on chick hatch weight showed that the heavy sized eggs produced heavy weighted chicks, the same with the medium and small (light) sized eggs. This is similar with the findings of Ramaphala and Mbajjorgu (2013) and Sembeta (2017), where they reported that the largest chick weight was from the large sized eggs, same with the medium and small size. This shows a positive correlation between egg size and chick hatch weight. Sola-Ojo *et al*

(2011), who worked on medium size and small eggs, also reported that the medium sized eggs produced chicks that are heavier than the ones from the small size egg.

Sasso has the highest body weight between the three breeds. This may be attributed to differences in breed performance and the fact that Sasso is a dual-purpose breed. Significant effects of egg weight on body weight were also reported by Yildirim and Yetişir (1998). Petek *et al.* (2003) reported that hatching egg weights affected the growth performance of chickens until the slaughter of hens. Furthermore, Asuquo and Okon (1993) reported that eggs within the intermediate weight range of 45-56g hatched heavier chicks than small and large eggs. The effect of breed on chick hatch weight showed that Sasso had the highest weight, followed by the cross between Sasso and Shika Brown and then Shika brown with the least, showing a significant difference between the breeds. Ojedapo *et al.* (2012) and Liu (2015) both worked on different pure breed of chickens, reported a significant difference in the chick hatch weight of the different breeds. Alsobayel *et al.* (2013) also worked on different breeds, Arbor acres, Cobb and Ross and observed that the weights are statistically different for the breeds. Bayesa *et al* (2020) reported that the cross between Koekoek cockerel and Sasso breed had the highest chick weight (40.54±0.80), followed by the Sasso breed (38.84±0.78), cross between Sasso cockerel and Koekoek pullet (37.87±0.84) and the least in the Koekoek breed (36.52±0.86). The results further revealed that chick weight and chick body length increased with increase in egg size. Decuypere *et al.* (2002) revealed that chick weight is the most widely used indicator for day-old chick quality assessment. It is known that a positive correlation exists between egg size and chick weight in broiler chickens (Abiola *et al.*, 2008). Vieira *et al.* (2005) found that more chick weight (53.4 vs. 41 g) obtained from large egg size (72.7 ± 2.5

g) as compared to small egg size ( $57.7 \pm 1.8$  g) in 40-weeks-old Ross-38 breeders objectives for meat producing poultry and as a result, major gains have been made. In the findings of Adenaike *et al.* (2015), the Marshall breed had the highest body length, body weight, breast girth, wing length, thigh length and keel length, followed by Marshall x Normal feathered chicken, Marshall x Naked neck, Naked neck and the least was recorded in the Normal feathered breed. Ojedapo *et al.* (2012) worked on two breeds; Nera black and Brown shevar and reported that Nera black had the highest body weight, body length, breast girth and keel length when compared to the Brown shevar. Okafor (2019) working on FUNAAB Alpha, Shika brown and a local chicken reported that the FUNAAB Alpha had the highest value, followed by Shika brown and the local chicken for the body length, breast girth, wing length and thigh length. Ahmad *et al.* (2019) observed that the cross breed had the highest values when compared to the pure line, NN. This showed that there are significant differences between the breed for the body weight and body measurements.

From the results, the highest body weight ( $1015.23 \pm 169.23$ ) was found in Sasso, which also had the highest feed intake, but the feed efficiency was the least. The least body weight ( $592.81 \pm 91.72$ ), found in Shika brown, had the lowest feed intake but its feed efficiency was the highest. The higher the body weight, the higher the feed intake, the lower the feed efficiency/feed conversion ratio. This is in corroboration with Okafor (2019) who worked on FUNAAB Alpha, Shika brown and local chicken. He observed that FUNAAB alpha had the highest body weight and feed intake but had the least feed conversion ratio while the local chicken had the least body weight and feed intake but had the highest feed conversion ratio. Bayesa *et al.* (2020) also reported the same trend that the breed chicken with the highest feed intake (Sasso-  $40.15 \pm 3.48$ ), had the least feed conversion ratio while the breed with the lowest feed intake (Koekoek-  $34.45 \pm 3.46$ ), had the highest feed conversion ratio.

## CONCLUSIONS

From this research, it is shown that the weight and performance of chicks are directly related to the breed and the size of the egg they are hatched from. The effect of heterosis was also observed in this study and the cross of the exotic Sasso and the Improved local (Shika brown) did better than Shika brown in most of the performance traits studied in this work.

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