



**Analysis of Body Weight and Egg Production Traits of Shikabrown® Grandparent Chickens after Long-Term Selection**

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**Abstract**

*This study analyzed performance of the sire and dam lines of ShikaBrown® grandparent chickens after a long-term selection. This chicken breed had under gone different generation of selection on growth (body weight) and layer economic traits. The growth and egg production traits considered were body weight, age at first egg, egg weight, egg number and hen-day egg production. The estimation of genetic parameters was also analyzed from a previous pedigree data over five generations. The Least Square Means of combined body weights (cocks + hens) showed that the dam line had a significantly ( $p < 0.05$ ) heavier weight at day old (32.29g) than the sire line (30.29g) while at weeks 8 (576.2g vs 556.71g) and 16 (1684.44g vs 1579.0g), the sire line had a significant ( $p < 0.05$ ) higher body weights than the dam line. The egg production analyses showed that egg number and hen day percent were higher in the dam line in both short- and long-term analyses while sire line had higher egg weight average. The genetic correlation showed that egg number had a negative correlation with age at sexual maturity and egg weight averages in the generations considered. However, the genetic analyses of egg number with body weight were positively correlated in all generations for both lines. The positive genetic correlations suggest the usefulness of body weight as a selection criterion for genetic improvement of egg number in these lines of chickens while the negative genetic correlation which egg number had with ASM and EWTA is an indication of interplay of similar gene flow or some other confounding factors during the selection for the traits.*

**Key words:** Body weight, chicken, genetic correlation, layer reproductive performance.

**Introduction**

In Nigeria, poultry keeping is of great value to the house hold farming systems. Asafa and Ayodele (1997) approximated that about 68% of livestock farmers raise one type of poultry species under semi-intensive production system. This figure is too low to meet the required protein need of the country. This inadequacy in production coupled with continuous growing global human population and the changing socio-demographics increase the gap between supply and demand of meat worldwide. Equally, demand for chicken is increasing day by day due to its wide acceptance as compared to red meat which is driven by increased health and dietary awareness (Henchion *et al.* 2017). To mitigate

this huge gap, intensive poultry production by means of genetic improvement and selection for economic traits was identified as one means of attaining sufficiency in the supply of poultry and animal protein in the diet of an average Nigerian (Ibrahim *et al.*, 2014).

Breeding practices in poultry is directed at genetic improvement of birds for which ever purpose through a successive generation as the objective is to improve those quantities in the birds which have definite market values (Nwagu, 2004; Sharma and Krishna, 1998). Therefore, selective breeding a well-known tool enhances the increase in genetic potential as well as productivity (Rahim *et al.*, 2016).

Selection changes the genetic structure of population by changing gene and genotypic frequencies and hence, the genetic parameters are also liable to change in every generation (Falconer and Mackey, 1996). The main emphasis of commercial breeder largely depends on layer economic traits like body weight, age and weight at sexual maturity, egg production and egg weight etc. Knowledge of genetic parameters like heritability, genetic and phenotypic correlation is essential to evaluate the population under selection in every generation for these traits and is pre-requisite for deciding and formulating the effective breeding strategies.

Therefore, ShikaBrown® egg type chicken was developed through the process of selection by utilizing certain genetic parameters. It is a well-recognized dual-purpose brown-egger chicken breed which was referred to as the future backbone of the poultry industry in Nigeria (Kabir *et al.*, 2007). This breed was developed from generational performance selection in economic traits desired for farmers and was described as an untapped germ plasm because of its great genetic potential for the poultry industry (Olutunmogun *et al.*, 2021). It has gone through long-term selection for over 30 generations on the basis of 40weeks part-period and 72week long term egg production.

Selection based on part period egg production is an important criterion for improving annual egg production in various layer and broiler breeding enterprises and has brought about 85 - 90% change over the last 50years (Sharma and Chatterjee, 2006). Similarly, partial recording of egg production in pullets is used to enhance and to increase the efficiency of genetic selection as well as shorten the generation interval (El-Labban, *et al.*, 2011). Genetic selection can also help in the continuous improvement of laying performance, efficiency, livability and

adaptability of the birds to different environments as well as egg quality (Preisinger and Flock, 2000).

Similarly, genetic correlations estimates are of great interest to the breeder as it assists in genetic improvement and monitoring of selected traits. The information obtained from various generations becomes more relevant especially in flocks that is undergoing selection and to evaluate if there are gains been made. This is in view of the fact that continued selection tends to bring about change in the genetic correlations among traits (Sharma and Krishna, 1998; Yahaya *et al.*, 2009). Thus, this present study was aim at assessing the growth, production and layer economic traits after long-term selection of ShikaBrown® parent chickens.

### Materials and Methods

The experiment was conducted at the Poultry Breeding Unit of the Poultry Research Programme farm, National Animal Production Research Institute (NAPRI), Ahmadu Bello University, Shika, Zaria, Kaduna State, Nigeria. Shika is geographically situated in the Northern Guinea Savannah zone between latitude 11° 12' 42" N and longitude 7° 33' 14" E at an altitude of 640m above sea level (Ovimaps, 2017).

### Experimental birds and genetic background

The chickens used for the study were from a random-bred population of two lines which forms part of the poultry breeding flocks maintained at the research institute. Adeyinka (1998) had earlier reported details of hatching procedure and management of the birds while Nwagu (2004) gave further descriptions of the mating formation and selection for the traits during the formation of these genetic material. For this study, 576 ShikaBrown® parent chickens (288 sire line and 288 dam lines) were randomly picked and used. Each line had

32♂ and 256♀. After mating and hatching of fertile eggs, the resulting 2000 chicks (1000 from each line) were winged banded. The chicks used for the study was from a single hatch. The pullets used were under selection for part period (280day) and full period (505days) egg production selection.

### Management and feeding of experimental birds

The day-old chicks were duly vaccinated with Newcastle Disease Vaccine (i/o) and Marek vaccine (SC) and subsequently through all other necessary vaccinations and medications. All the hatched chicks were properly wing-banded for proper recording at hatchery before been transferred to clean brooder house. At 16weeks, the pullets were transferred into laying cages from deep litter for recording of individual egg production until they attained 72weeks of age.

Fresh clean water and feed were provided *ad-libitum* in the morning and evening hours daily. Birds were fed *ad-libitum* with chick mash (Crude Protein - 20.99%, Metabolized Energy - 2652.45Kcal/Kg) between 0-8weeks, grower mash (Crude Protein - 16.08%, Metabolized Energy - 2400.18Kcal/Kg) between 9-18weeks and breeder mash (Crude Protein - 18.05%, Metabolized Energy - 2520.08Kcal/Kg) above 18weeks.

### Data collection and analysis

Data on body weights were collected for both sexes up to 16 weeks of age. Subsequently, egg production data were collected from 508 sire line pullets and 520 dam line pullets.

Data were on the following traits:

- 1) **Body weight (BW):** Body weights were taken at day-old (chick), 8 (start of grower), 16, 40 (matured weight) and 72 (end of production) weeks in the morning hours before feeding using a Camry sensitive weighing scale to the nearest 0.01grams.

- 2) **Age at first egg (AFE):** This is the period from hatch still the day the first egg was laid in days. It is also referred to as age at sexual maturity (ASM).
- 3) **Egg weight (EW):** This was measured on individual pullets as the average weight of eggs produced using a Camry sensitive weighing scale to the nearest 0.01grams.
- 4) **Egg number (ENo):** This was the total number of eggs laid from first day of first egg to 280days (part period production) and extended to 505days (full period production).
- 5) **Hen-day egg production (HDEP):** This was calculated in percentage (%) as number of eggs laid by the flock during the period divided by the number of hens 'day in the flock during the period multiplied by days in lay.

### HDEP (%) =

$$\frac{\text{Number of eggs lay}}{\text{Number of birds in flock}} \times \text{Number of days in lay}$$

Prior to collection of the data, fertility parameters recorded from the parents were: number of egg set, number and percent fertile eggs and percent hatchability.

Only pullets with all the parameters measured were used in the data analysis while those with less than ten eggs to 280days were excluded.

### Estimation of genetic parameters

In estimating the genetic parameters (genetic, ( $r_g$ ), phenotypic ( $r_p$ ) and environmental ( $r_e$ ) correlations) full model was used in computing the variance components. The model fitted was of the nested design partitioned into those due to sire, dam or environment (Henderson, 1953). In the design, each sire was mated to several dams and each mating produced several progenies.

### Statistical model

$$Y_{ijk} = \mu + L_i + S_j + e_{ijk}$$

Where;  $Y_{ijk}$  = observation on the  $i^{\text{th}}$  line of the  $j^{\text{th}}$  age on the  $l^{\text{th}}$  random error,  $\mu$  = overall

population mean,  $L_i$  = fixed effect of lines ( $i$  = sire and dam),  $A_j$  = fixed effect of sex ( $j$  = male and female) and  $e_{ijk}$  = Random error due to uncontrolled environmental and genetic deviations attributed to the individuals.

### Estimation of variance component

The variance component was estimated using Harvey (1990) while the mixed model least squares analysis was performed by SAS, 2002.

### Estimation of genetic correlation

The genetic ( $r_g$ ), phenotypic ( $r_p$ ) and environmental ( $r_e$ ) correlations between two traits were obtained by using variance component analysis of Becker, (1975) as shown below:

$$r_{g\ xy} = \frac{4cov(s)\ xy}{2Var\ sx * 2Var\ sy}$$

$$r_{p\ xy} = \frac{Covwxy + Covsxy}{Var\ wx + (Var\ sx)(Var\ sy) + Var\ sy}$$

$$r_{e\ xy} = \frac{Cov\ wxy + 3covs\ xy}{Var\ wx - 3(Var\ sx)(Var\ sy) - Var\ sy}$$

Where;  $r_{xy}$  = correlation of traits  $x$  and  $y$ ,  $Cov_{xy}$  = covariance of trait  $x$  and  $y$ ,  $Var\ s$  = sire variance,  $Var\ w$  = variance within.

## Results and Discussions

**Fertility and hatchability parameters:** Out of a total of 1330 and 1410 eggs set for both sire and dam lines respectively as shown in Table 1, 1245 and 1301 fertile eggs were

transferred to the hatcher, representing 93.61 and 92.27% fertility rates. The respective corresponding percent hatchability of fertile eggs set were 85.46 and 84.40%. The fertility and hatchability estimate from this study differed from the reports of Kabir and Mohammad (2012) who reported lower values in the same parent stock over some hatching years. The results from this study were also higher than the 78.13 and 57.22% reported (fertility and hatchability) by Rahim *et al.* (2016) in Rhode Island Red chickens. The report of Zelleke *et al.* (2005) on pure Rhode Island Red chicken line had percent fertility of 82.97% which was slightly lower to this result and the percent hatchability of 59.49% was also lower. Some other works like Bhardwaj *et al.* (2006) reported higher percent fertility 75.21% in RIR, however the hatchability percentage were slightly lower. Rahim *et al.* (2016) was of the position that selection improved fertility and hatchability in RIR chicken indicating their higher reproductive fitness under long-term selection. This agrees with this study as both lines displayed a considerable high fertility and hatchability. The variations can be attributed to different years of hatching, age of the grandparents' chickens, efficiency of the incubator and hatcher, handling of the fertile eggs, climatic changes and other environmental factors which can limit the hatchability performance as observed by Kabir and Mohammad (2012).

**Table 1: Fertility and hatchability parameters in ShikaBrown® parent lines**

Parameters	Sire Line	Dam Line
Number of egg set	1330	1410
Number of egg fertile	1245	1301
Percent fertile (%)	93.61	92.27
Percent infertile (%)	6.39	7.73
Number hatched	1064	1098
Percent hatched (%)	80.0	77.87
Percent hatchability (%)	85.46	84.40

**Body weight:** The least squares means and standard errors of various body weights as

influenced by line, sex (Tables 2 and 3) and egg production phase (short and long-term)

Table 4. The body weight at day-old (BWDO) and those of 8 (BW 8), 16 (BW 16), 20 (BW 20), 24 (BW 24), 40 (BW 40) weeks of age and the short- and long-term egg production were significant ( $p<0.05$ ) different by line and sex. The dam line (cocks = 33.12g and hens = 32.18g) had a significantly ( $p<0.05$ ) higher body weight at day-old than the sire line (cocks = 31.11g and hens = 29.87g) which continued for the hens up to 8 weeks (Table 2). The body weight from 20 – 40weeks was then significant ( $p<0.05$ ) higher in the sire line (Table 3). During egg production phase, chickens at short-term had a higher significant ( $p<0.05$ ) body weights (sire line 2085.0g vs dam line 1930.3g) than long term (sire line 1961.1g vs dam line 1784.7g) Table 4.

The superiority of the dam line over the sire line on body weights at day-old did not follow the selection purpose of the two lines where sire line was selected for higher body weight. This might be connected to a better response to selection over a long term and a likely better pedigree record. Regardless of that, the body weights at day-old conforms with the findings

of Khawaja *et al.* (2012) who reported day-old body weights of 25.9g, 20.90g and 31.30g for parent stock chicks of Desi, Fayoumi and Rhode Island Red (RIR) breed of laying birds irrespective of sex. Balami *et al.* (2018) reported similar day-old weights of 29.83 to 31.75g for the ShikaBrown® dam line and 30.25 to 32.83g for the sire line under varying mating ratios. Further age-related body weight measured in this study as depicted from the result on layers (8 – 40 weeks) showed that the sire line was generally superior in this trait at all the ages. This conforms the reports of Momoh *et al.* (2010), Rahim *et al.* (2016) and Das (2013) that explained growth differences among different genetic groups of egg type chickens. However, the means observed differed, the general trend of rising growth during the early ages and decline at advanced ages as exhibited by body weight measures were similar among the two lines. The differences at all growth phases between the two lines might also be as a result of generational differences due to selection response in the lines as the populations were still undergoing continuous selection.

**Table 2: Effect of body weight as affected by line and sex of ShikaBrown® parents**

Traits (g)	Line/Sex					
	Sire line (±SE)			Dam line (±SE)		
	Males	Females	Combine sex	Males	Females	Combine sex
BW DO	31.11±4.22 <sup>b</sup> (n = 492)	29.87±4.09 <sup>b</sup> (n = 508)	30.29±5.47 <sup>b</sup> (n = 1000)	33.12±4.3 <sup>a</sup> (n = 480)	32.18±4.06 <sup>a</sup> (n = 520)	32.29±5.45 <sup>a</sup> (n = 1000)
BW 8	614.01±12.22 <sup>a</sup> (n = 444)	511.36±12.24 <sup>b</sup> (n = 435)	576.2±12.04 <sup>a</sup> (n = 879)	556.03±12.19 <sup>b</sup> (n = 424)	534.11±12.01 <sup>a</sup> (n = 441)	556.71±12.01 <sup>b</sup> (n = 865)
BW 16	1780.0±19.30 <sup>a</sup> (n = 426)	1301.02±21.04 <sup>b</sup> (n = 408)	1684.44±19.31 <sup>a</sup> (n = 840)	1532.1±22.03 <sup>b</sup> (n = 397)	1339.2±22.0 <sup>a</sup> (n = 428)	1579.0±20.04 <sup>b</sup> (n = 830)

<sup>ab</sup> = Means with different superscripts within the same row differ significantly ( $p<0.05$ ), BW = Body weight, DO = Day-Old, SE = Standard error, n = number of sample population

### Hens' reproductive traits

The least squares mean analysis and standard errors for the hen's reproductive traits viz-a-viz layer's body weights, age at first egg, egg number, egg weight averages and hen day egg

production in relation to short- and long-term production are presented in Tables 3 and 4. Relationship between body weight and the ASM and egg number (ENo) showed the dam line commenced egg production at earlier age



and weigh than the sire line. This was not expected as body weight was not much of a priority for the dam line which was genetically engineered for more egg as against the sire line

which was selected for body weight and egg size/egg weight. The result of this study agrees with early works of Oni *et al.* (2003), Nwagu, (2004) and Yahaya *et al.* (2009).

**Table 3: Least squares mean for layers' body weight and age at first egg of ShikaBrown® parents as affected by line**

Traits (g)	Sire Line ( $\pm$ SE)	n	Dam Line ( $\pm$ SE)	N
BW DO	29.84 $\pm$ 4.09 <sup>b</sup>	508	32.18 $\pm$ 4.06 <sup>a</sup>	520
BW 8weeks	511.36 $\pm$ 12.24 <sup>b</sup>	435	534.11 $\pm$ 12.01 <sup>a</sup>	441
BW 16weeks	1301.01 $\pm$ 22.04 <sup>b</sup>	408	1339.20 $\pm$ 22.0 <sup>a</sup>	428
BW 20weeks	1886.03 $\pm$ 22.09 <sup>a</sup>	406	1624.01 $\pm$ 22.89 <sup>b</sup>	427
BW 24weeks	2017.01 $\pm$ 22.22 <sup>a</sup>	406	1784.04 $\pm$ 23.20 <sup>b</sup>	427
BW 40weeks	2085.00 $\pm$ 23.65 <sup>a</sup>	406	1961.02 $\pm$ 23.88 <sup>b</sup>	425
Age at first egg (days)	171 $\pm$ 4.21 <sup>a</sup>		160 $\pm$ 4.28 <sup>b</sup>	

<sup>ab</sup> = Means with different superscripts within the same row differ significantly ( $p < 0.05$ ), BW = Body weight, DO = Day-Old, SE = Standard error, n = number of sample population

The result on age at first egg (AFE) differs from the reports of Nwagu (2004) that obtained in five generations of ShikaBrown® parent line a slightly higher (late) ASM of 203 – 222days in whole population, 194 - 212days in selected population and 200 – 221days in control population in sire line. The author also reported 208 – 224days (whole population), 197 – 214days (selected population) and 201 – 237days (control population) in the dam line.

The low AFE in this study is anticipated as selection is still on going in the population. The reports of Nwagu *et al.* (2007) on the same genetic group of chicken and those of John *et al.* (2000) also showed declining age at sexual maturity due to negative genetic association between age at sexual maturity (ASM) and egg number (Nwagu *et al.*, 2007). Similar results on declining ASM in three generations among different crosses of the ShikaBrown® parent chicken were earlier reported by Yahaya *et al.* (2009).

Egg number obtained in the long-term differed significantly from reports of Goger *et al.* (2014) that obtained egg numbers of 127.01, 135.54, 125.81 and 127.06 in four grandparent lines which showed that the ShikaBrown®

parental layers are better layers as a result of the continuous selection for egg number.

The egg weight results for the short- and long-term periods were within the range of 50 – 56g of performance (FAO, 2003). Furthermore, the performance of the two lines during the long-term period were in consonance with the values of 53.03g, 55.40g, 58.59g and 62.14g reported for grandparent (GP) stock of Brown layers (Goger *et al.*, 2014) while Ojedapo *et al.* (2008) reported mean egg weight of 56.15g with a range of 43.70 – 81.30g in Brown Shaver layers.

The observed differences in hen day production between the lines can be attributed majorly to their selection criteria as the dam line was genetically selected for more egg while the sire line was for egg weight. Observed results in hen-day egg production agreed with the report of Ayorinde and Oke, (1995) that obtained 70.06%, 67.43% and 54.06% at 33–46, 47–59 and 60–72 weeks respectively in Black Olympian pullets. Chineke (2001) also obtained 55.2% hen house (HH) egg production and 69.33% hen-day egg production in Black Olympian pullets. Al-Samarai *et al.* (2008) hypothesized that a

typical egg production curve of a flock increases rapidly during the first eight or nine weeks of production and then decreases at a

constant rate to the end of the production period due to age.

**Table 4: Least squares mean ( $\pm$ SE) for short- and long-term egg production traits in ShikaBrown® parents**

Trait	Line	Egg production phase	
		Short-term (280days)	Long-term (505days)
Body weight (g)	Sire	2085.0 $\pm$ 23.65 <sup>a</sup>	1930.3 $\pm$ 23.2 <sup>a</sup>
	Dam	1961.1 $\pm$ 23.88 <sup>b</sup>	1784.7 $\pm$ 24.0 <sup>b</sup>
Egg number	Sire	73.8 $\pm$ 1.17 <sup>b</sup>	159.3 $\pm$ 3.20 <sup>b</sup>
	Dam	77.5 $\pm$ 1.29 <sup>a</sup>	174.5 $\pm$ 3.42 <sup>a</sup>
Egg weight average (g)	Sire	49.17 $\pm$ 0.20 <sup>a</sup>	54.29 $\pm$ 0.30 <sup>a</sup>
	Dam	47.49 $\pm$ 0.22 <sup>b</sup>	51.5 $\pm$ 0.33 <sup>b</sup>
Hen day (%)	Sire	66.90 $\pm$ 0.80 <sup>b</sup>	69.27 $\pm$ 0.74 <sup>b</sup>
	Dam	70.04 $\pm$ 0.78 <sup>a</sup>	75.34 $\pm$ 0.88 <sup>a</sup>

<sup>ab</sup> = Means with different superscripts between sire and dam rows differ significantly ( $p < 0.01$ ) higher

**Genetic Correlations:** The genetic correlations of egg number with some other traits in different generations for male and female lines are shown in Tables 5 and 6 respectively. In both lines, ASM and EWTAV were negatively correlated and high while BWT280 and BWT505 were positively correlated and ranging from low to medium. The genetic correlation values from the sire + dam component variance could not be given for two generation 4 and 5 as they were not estimated for dam component of variance (Tables 5 and 6). The genetic correlation between egg number and egg weight was small and not significant. This is an indication that in the two populations, an increase in the number of eggs does not have any appreciable depression on egg weight. This suggest that the independent culling level applied against egg weight at selection could be responsible for the non-significant correlation.

**Tables 5: Genetic correlation ( $\pm$ SE) of egg number with some traits by generation in the sire line (male line) from sire + dam component of variance**

Generation	BWT280	BWT505	ASM	EWTAV
1	0.35 $\pm$ 0.23	0.27 $\pm$ 0.20	-0.73 $\pm$ 0.34	-0.67 $\pm$ 0.39
2	0.24 $\pm$ 0.16	0.21 $\pm$ 0.26	-0.51 $\pm$ 0.33	-0.43 $\pm$ 0.20
3	0.27 $\pm$ 0.29	0.32 $\pm$ 0.22	-0.72 $\pm$ 0.40	-0.40 $\pm$ 0.24
4	-0.25 $\pm$ 0.21	0.14 $\pm$ 0.19	NA	-0.58 $\pm$ 0.37
5	0.35 $\pm$ 0.27	0.30 $\pm$ 0.20	NA	-0.09 $\pm$ 0.27

BWT = Body weight, ASM = Age at sexual maturity, EWTAV = Egg weight average, NA = Not available

**Tables 6: Genetic correlation ( $\pm$ SE) of egg number with some traits by generation in the dam line (female line) from sire + dam component of variance**

Generation	BWT280	BWT505	ASM	EWTAV
1	0.34 $\pm$ 0.34	0.23 $\pm$ 0.30	-0.77 $\pm$ 0.44	-0.52 $\pm$ 0.47
2	-0.41 $\pm$ 0.17	0.27 $\pm$ 0.25	-0.75 $\pm$ 0.40	-0.68 $\pm$ 0.54
3	0.38 $\pm$ 0.20	0.18 $\pm$ 0.23	-0.64 $\pm$ 0.35	-0.58 $\pm$ 0.34
4	0.41 $\pm$ 0.32	0.20 $\pm$ 0.25	-0.55 $\pm$ 0.37	NA
5	0.24 $\pm$ 0.50	0.21 $\pm$ 0.22	NA	NA

BWT = Body weight, ASM = Age at sexual maturity, EWTAV = Egg weight average, NA = Not available

The genetic, phenotypic and environmental correlations of egg number with some other traits are for male and female lines as shown in Tables 7 and 8 respectively. The results for the two lines were mostly negative and high for age at sexual maturity and egg weight averages. The genetic correlations were low in generation 5 in both lines. However, body weight at 280days had positive correlations ranging from low to moderate in both lines. Podisi *et al.* (2011) discussed that critical age of the hen, body weight and composition traits

are necessary correlation factors on sexual maturity and layers performance. Yahaya *et al.* (2022) observed similar negative genetic and phenotypic correlations in similar traits in two lines of layer type chickens under reciprocal crossing and attributed it to the presence of additive and maternal gene effect for these traits. Sanda *et al.* (2014) also reported similar negative genetic and phenotypic correlations between egg weight and egg production up to 280days in two chicken genotypes.

**Tables 7: Genetic, phenotypic and environmental correlation ( $\pm$ SE) of egg number with some traits by generation in the sire line (male line) from one-way analysis**

Traits	Source	Generation				
		1	2	3	4	5
ASM	r <sub>g</sub>	-0.73	-0.51	-0.72	-0.63	-0.56
	r <sub>p</sub>	-0.67	-0.58	-0.68	-0.65	NA
	r <sub>e</sub>	-0.66	-0.61	-0.68	-0.56	-0.30
EWTAV	r <sub>g</sub>	-0.67	-0.43	-0.40	-0.58	-0.09
	r <sub>p</sub>	-0.14	-0.13	-0.17	-0.03	-0.05
	r <sub>e</sub>	-0.01	-0.02	-0.43	-0.08	-0.04
BWT280	r <sub>g</sub>	0.35	0.24	0.27	-0.25	0.35
	r <sub>p</sub>	0.20	0.17	0.15	0.04	0.10
	r <sub>e</sub>	0.14	0.15	0.12	0.06	-0.02

BWT = Body weight, ASM = Age at sexual maturity, EWTAV = Egg weight average, r<sub>g</sub> = genetic correlation, r<sub>p</sub> = phenotypic correlation, r<sub>e</sub> = environmental correlation



**Tables 8: Genetic, phenotypic and environmental correlation ( $\pm$ SE) of egg number with some traits by generation in the dam line (female line) from one-way analysis**

Traits	Source	Generation				
		1	2	3	4	5
ASM	$r_g$	-0.77	-0.75	-0.64	-0.55	-0.55
	$r_p$	-0.67	-0.63	-0.63	-0.64	-0.64
	$r_e$	-0.63	-0.62	-0.63	-0.67	-0.67
EWTAV	$r_g$	-0.12	-0.44	-0.37	-0.06	-0.11
	$r_p$	-0.08	-0.63	-0.05	-0.03	-0.01
	$r_e$	-0.07	-0.62	-0.08	-0.07	-0.12
BWT280	$r_g$	0.34	-0.41	0.38	0.41	0.24
	$r_p$	0.20	0.15	0.24	0.12	0.19
	$r_e$	0.16	0.41	0.19	0.07	0.18

BWT = Body weight, ASM = Age at sexual maturity, EWTAV = Egg weight average,  $r_g$  = genetic correlation,  $r_p$  = phenotypic correlation,  $r_e$  = environmental correlation

## Conclusion

This study demonstrated that ShikaBrown® parents' chicken had potential for better body weight, fertility and hens' reproductive performance after a long term of selection. The negative genetic correlation which egg number had with ASM and EWTAV is an indication of interplay of similar gene flow or some other confounding factors during the selection for the traits though did not affect the body weight of the birds which had positive correlations with egg number in series of generations. Hence improved breeding protocols or more selection intensity is required to increase the genetic variability which will these traits as they are of economic concern.

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