GROWTH PERFORMANCE OF PANDA WHITE AND CINNAMON BROWN STRAINS OF JAPANESE QUAIL

U. C. Isaac*[1], B. U. Okeke[2], C. B. Nwankwo[2]

[1]Department of Animal Science and Technology, Faculty of Agriculture, Nnamdi Azikiwe University, Nigeria
[2]Department of Animal Science and Fisheries, Faculty of Agriculture. Abia State University, Umuahia, Nigeria

***Corresponding author:** Email: uc.isaac@unizik.edu.ng; Phone number: +2348064368510

ABSTRACT
Twelve parent stocks of Japanese quails consisting of two cocks and ten hens from each of Panda White and Cinnamon Brown strains were engaged in straight breeding to produce sixty day-old chicks in three consecutive hatches with thirty quails per strain. The progeny were used in a four-week (3, 4, 5, and 6) experiment to study their growth performance, which was statistically compared with T-test statistic. Results showed no significant difference ($p>0.05$) in average initial body weight, average daily feed intake and feed conversion ratio but differed significantly ($p<0.05$) in average final weight and average daily weight gain with corresponding mean values for Cinnamon Brown (125.14±0.06 g and 2.86±0.06 g respectively) being higher than those of Panda White (101.55±0.07 g and 2.18±0.00 g respectively). Panda White was significantly ($p<0.05$) superior in body length (10.34 ± 0.16 – 16.52 ± 0.23 cm) at 3-6 weeks, body girth (8.33±0.05 cm) at 5 weeks, shank length at 3 (2.25±0.05 cm) and 5 (3.41±0.08 cm) weeks, wing length (6.71±0.19 cm, 8.02± 0.11 cm and 8.24±0.11 cm) and thigh length (2.79 ±0.07 cm, 3.46±0.05 cm and 3.61 ±0.05 cm) at 3, 5 and 6 weeks, respectively. Cinnamon Brown had significantly ($p<0.05$) higher shank length (2.32±0.06 cm) and body girth (3.91±0.42) at 3 and 6 weeks, respectively. Cinnamon Brown possessed higher genetic potential for large body size and should be selected at six weeks using body weight and weight gain to improve heavy breed that tends to broiler strain. Panda White may be selected to improve egg laying strain.
Key words: Production parameters, body weight, conformation traits, *Coturnix coturnix* Japonica.

INTRODUCTION
Quails have potential to provide quality animal protein at less cost. They are small and require less space for production. They have fast growth rate, early sexual maturity, high egg production rates and short incubation period of 17 to 18 days (Nwaogwugwu *et al.*, 2018a). In spite of these merits, quails are still regarded as micro livestock and their production is comparatively lower than that of chicken due to militating factors such as seasonal availability and lack of management expertise including handling technique by the farmers. Their growth and egg production characteristics have not fully been studied, hence they are still reared for both meat and egg production purposes. There is need to identify strains of Japanese quail with meat-type potential in order to expand their genetic base. Body weight, feed intake, weight gain, feed conversion ratio and conformation traits are important parameters for assessment of growth performance of animals (Arthur et *al.*, 2001). These parameters are economically significant as they determine the market value of animals. Gambo *et al*. (2014) reported body weight of Japanese quail at 3 - 6 weeks of age within the range of 34.70 ± 1.18 – 89.80 ± 1.20 g. Conformation traits or linear body measurements allow for comparison of growth in different parts of the body (Abdullah *et al*., 2003). The traits develop at varying rates and these changes determine the shape and the body proportion of the animals at a given time (Olutogun *et al*., 2003). The conformation traits are important predictors of body weight. They are controlled by pleiotropic genes as indicated by the correlation existing among them and between each of them and other traits (Visscher and Yang, 2016). Their correlated responses are useful for indirect selection of other economic characters. Dauda *et al*. (2014) reported ranges of 2.50- 3.93 cm, 4.34- 6.51 cm, 11.49- 17.99 cm and 9.90- 15.00 cm for shank length, breast girth, body length and wing length of Japanese quails at 3 to 6 weeks of age. The egg production characteristics of these two strains had been reported (Nwaogwugwu *et al.*, 2018a). To further characterize these strains, research should

focus on their growth performance. The general objective of this study was to evaluate the growth performance of Panda White and the Cinnamon Brown strains of Japanese quail.

MATERIALS AND METHODS

Experimental Location

The research was conducted at the poultry unit of Teaching and Research farm, Michael Okpara University of Agriculture, Umudike, Nigeria. The University is located on Latitude 05°29′ N, Longitude 07°33′ E, approximately 122 m above sea level within the rainforest zone of Southeast of Nigeria.

The maximum and minimum daily temperatures of the area range from 27-36 °C during the hot dry season of the year (November -April) and 20-26 °C during the cold rainy season (May- September), respectively. It has a relative humidity of 57% to 91%, total annual rainfall of 1700-2100 mm and a bimodal rainfall pattern.

Experimental animals and their management

Twenty-four parent stocks consisting of 12 quails each of Panda White and Cinnamon Brown strains were procured from the ongoing research in the University. The quails were kept in two experimental pens in a well constructed poultry house. Each pen contained 2 cocks and 10 hens of each strain. The maximum and minimum ambient temperatures of the pens were 24 and 32° C, respectively. The parents were fed layer ration containing 2500 kcal metabolizable energy (ME)/kg and 16.5% crude protein (CP). An average of 17 hours of light was provided to the parents to facilitate oviposition. The parents of each strain were mated by straight breeding in the ratio of 1 cock: 5 hens to produce fertile eggs. The first set of the eggs were collected when the parents were 9 weeks old to achieve maximum fertility and hatchability (Daikwo, 2011). Eggs were collected on daily basis, identified with permanent markers and held in egg crates under room temperature with good ventilation. Eggs were set in three consecutive batches at weekly intervals in an incubator at the temperature of 37 °C and relative humidity of 56 %. Incubation period lasted between 17 and 18 days. A total of 60 quails were produced in three hatches with 10 quails per hatch and 30 quails per strain. The chicks were brooded for 14 days in a brooding box measuring 0.84 m long, 0.12 m wide and 0.64 m high. Heat was supplied with kerosene lanterns supplemented with electric bulbs. The brooding temperature was 35 °C in the first week, which was reduced by 3.5 °C in subsequent weeks. Clean water was provided with small drinkers. For the first two weeks, stones were placed in the drinkers to stabilize them and prevent the quails from drowning. The F_1 quails were fed commercial feed containing 2800 kcal ME/kg and 20% CP at chick phase (0-3 weeks) and 2550 kcal ME/kg and 15% CP at grower phase (3-6 weeks). Vaccination and other biosecurity measures were taken to ensure survivability of the quails.

Data Collection

Data were collected on growth parameters which were grouped into production parameters and conformation traits. All production parameters were calculated per strain on average basis and consisted of the following with their descriptions.

Average initial body weight. This was measured in gram (g) at 3 weeks as the total body weight of all quails divided by the number of quails.

Average final weight. This was calculated in gram as the total body weight of quails at 6 weeks divided by the total number of quails at that week.

Average daily weight gain. This was obtained in gram as the difference between the average final body weight and average initial body weight divided by number of days of the study.

Average daily feed intake. Feed intake was taken on daily basis and averages calculated on weekly basis for four weeks. The weekly averages were then summed to get the total feed intake. Total quantity of feed consumed for the 4-week period (28 days) was divided by the product of the number of quails and number of days to get the average daily feed intake in grams.

Feed conversion ratio. This was obtained as average daily feed intake divided by average daily weight gain.

The conformation traits were measured weekly in centimeter (cm) on individual quail and consisted of the following:

Body length, taken as the distance from the tip of the base of the comb over the neck through the body trunk to the tail, **wing length**, taken as the length of the wing from the scapula joint to the last

digit of the wing, **body girth**, taken as the circumference of the breast region, **keel length,** measured as the length of the keel bone from the V- joint to the end of the sternum**, thigh length**, measured as the distance from the beginning of the fibula to the hock joint and **shank length**, measured as the distance from the hock joint to the tarsal-metatarsal pad.

Statistical analysis

T-test statistic was used to compare the growth performance of Panda White and Cinnamon Brown strains of the Japanese quails. Data were analysed using IBM SPSS statistics (2011).

The t-test formula used for the comparison is provided in expression (1).

$$t_{cal} = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_p^2}{n_1} + \frac{S_p^2}{n_2}}} \qquad \ldots(1)$$

$$S_p^2 = \frac{(n_1\text{-}1)s_1^2 + (n_2\text{-}1)s_2^2}{n_1 + n_2 - 2}$$

$$S_i^2 = \frac{\Sigma x^2{}_i - \frac{(\Sigma x)^2}{n}}{n-1}$$

where $\bar{x}_1$ and $\bar{x}_2$ are means of observations from Panda White and Cinnamon Brown, respectively, n_1 and n_2 are number of observations in Panda White and Cinnamon Brown, respectively, s_1^2 and s_2^2 are variances of observations from Panda White and Cinnamon Brown, respectively and S_p^2 is the pooled variance.

RESULTS AND DISCUSSION

The results in Table 1 showed that average final weight and average daily weight gain of Cinnamon Brown were significantly ($p<0.05$) higher than those of Panda White strain. The average initial weight, average daily feed intake and feed conversion ratio of the two strains did not differ significantly ($p>0.05$). These results indicated that Cinnamon Brown could grow faster and attain large body size than Panda White strain at the period studied. Since the growth phase of quails is as short as 0 - 6 weeks (Nwaogwugwu *et al*. 2018b), the results truly depicted Cinnamon Brown strain as a potential meat- type quail. The results also indicated that final weight and daily feed intake might serve as the best traits for evaluating the growth performance of these two strains.

The means of the conformation traits (Table 2) indicated that Panda White strain had significantly ($p<0.05$) longer body length at 3, 4 and 5 weeks, body girth at 5 weeks, wing length at 5 and 6 weeks, thigh length at 3, 5 and 6 weeks and shank length at 5 weeks.

Cinnamon Brown had significantly ($p<0.05$) longer shank length at 3 weeks and larger body girth at 6 weeks, although the body girth of Panda White was significantly ($p<0.05$) larger than that of Cinnamon Brown at 5 weeks. These results indicated that Panda White quails were taller and slender than the Cinnamon Brown quails. This implied that the strain had small body size, an attribute that is associated with high egg laying ability in poultry (Nwaogwugwu *et al*., 2009; Isaac and Obike, 2020; Isaac *et al*., 2020). The greater egg-laying attributes of this Panda White over Cinnamon Brown had been reported (Nwaogwugwu *et al*., 2018a). On the other hand, the larger body girth of Cinnamon Brown strain at final week further indicates its meat-type potential since large body girth is a good indicator of large body size and selection criterion for broilers in poultry (Ibe, 1989; Ige, 2013; Mahboob *et al*., 2017). The significant difference ($p<0.05$) between the two strains in body length, body girth, wing length, thigh length and shank length mostly at week 5 (Table 2) implied that response to selection for growth could best be achieved with these traits at 5 weeks in Japanese quails regardless of their strain.

CONCLUSION

The study indicated that Cinnamon Brown quail attained significantly heavier body weight and weight gain while Panda White had significantly longer conformation traits. The Cinnamon Brown may further be improved as heavy or meat-type breed and Panda White as a light or egg-type breed.

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Table 1. Means (±SE) of production parameters of Panda White and Cinnamon Brown strains of Japanese quails

	Strain	
Parameter	**Panda White**	**Cinnamon Brown**
Average initial weight (g/bird)	25.57±0.15	25.00±0.08
Average final weight (g/bird)	101.55^{b} ±0.07	125.14^{a} ±0.06
Average daily weight gain (g/bird)	2.18^{b} ±0.00	2.86^{a} ±0.06
Average daily feed intake (g/bird)	2.28±0.13	2.45±0.14
Feed conversion ratio	1.01±0.01	1.17±0.07

^{a,b} Means in the same row with different superscripts are significantly different ($p<0.05$)
SE = Standard error.

Table 2. Means (±SE) of conformation traits of Panda White and Cinnamon Brown strains of Japanese quails

	BL (cm)		BG (cm)		KL (cm)		WL (cm)		TL (cm)		SL (cm)	
Week	PW	CB	PW	CB	PW	CB	PW	CB	PW	CB	PW	CB
3	10.34^{a} ±0.16	8.66^{b} ±0.15	2.48 ±0.06	2.37 ±0.05	5.55 ±0.24	3.67 ±0.14	6.71^{a} ±0.19	5.89^{b} ±0.06	2.79^{a} ±0.07	2.26^{a} ±0.04	2.25^{b} ±0.09	2.32 ^{a} ±0.06
4	13.14^{a} ±0.23	10.92^{b} ±0.09	2.89 ±0.05	2.79 ±0.04	3.73 ±0.24	4.14 ±0.17	7.64 ±0.12	6.61 ±0.14	3.09 ±0.06	2.66 ±0.03	2.75 ±0.09	2.72 ±0.08
5	16.52^{a} ±.0.23	15.3^{b} ±0.13	3.33^{a} ±0.05	3.14b ±0.05	4.07 ±0.22	4.29 ±0.17	8.02^{a} ±0.11	6.78^{b} ±0.14	3.46^{a} ±0.05	3.05^{b} ±0.03	3.41^{a} ±0.08	3.17 ^{b} ±0.07
6	19.37^{a} ±0.46	19.50 ±0.14	3.71^{b} ±0.05	3.91^{a} ±0.42	5.12 ±0.21	4.10 ±0.15	8.24^{a} ±0.11	7.04^{b} ±0.15	3.61^{a} ±0.05	2.94^{b} ±0.06	3.95 ±0.07	3.94 ±0.04

^{a,b} Means in the same row with different superscripts are significantly different ($p<0.05$)
SE = Standard error.
PW = Panda White, CB = Cinnamon Brown
BL = Body length, BG = Body girth, KL = keel length, WL = Wing length, TL = Tail length, SL = Shank length