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Egg Characteristics in Two Strains of Japasese Quail Eggs *(Coturnix coturnix japonica)*

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Authors' contributions

This work was carried out in collaboration among all Authors. Author UJE wrote the manuscript while the other authors AAA and MEN helped in the vetting aspect of this work. All the Authors read this work and approved the final manuscript.

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ABSTRACT

The study evaluated effect of strain on external and internal egg indices of two strains of Japanese quails (Cinnamon Brown (CBS) and Panda White (PWS) Strains)). 300 birds per Strain were reared in a Completely Randomized Design in an intensive system of management practice with *ad libitum* feed and water for 10 weeks. Strains were considered treatments. 300 eggs were used for External (Egg Weight (EW), Egg Length (EL), Egg Width (EW), Eggshell Weight (SW), Shell Thickness (ST) and Internal (Yolk Height (YH), Yolk Diameter (YD), Albumen Weight (AW), Albumen Diameter (AD), Albumen Height (AH), Haugh Unit (Hu)) egg parameters. Data were subjected to ANOVA of SAS Ver.9.2. Strain significantly ($p < 0.05$) affected all external egg parameters of Japanese quails except EW measured. The mean values obtained in EL (2.90 ± 0.01 cm) and ED (2.47 ± 0.01 cm) for PWS were significantly ($p < 0.05$) higher than that of CBS with 2.86 ± 0.01 (EL) and 2.36 ± 0.0 (ED) while 0.82 ± 0.01 g (SW) and 0.11 ± 0.02 cm (ST) for CBS were higher ($p < 0.05$) significantly than 0.80 ± 0.01 g (SW) and 0.07 ± 0.01 (ST) for PWS. Strain significantly ($p < 0.05$) influenced all internal egg parameters of Japanese quails exception of YH and YW measured. CBS had higher mean values of 3.25 ± 0.03 cm (AD), 2.35 ± 0.01 cm

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(YD) and 1.42 ± 0.06 (YC) than PWS with 3.14 ± 0.02 cm (AD), 2.30 ± 0.01 cm (YD) and 1.16 ± 0.03 (YC) while PWS was superior in AH (0.42 ± 0.01 cm), AW (1.77 ± 0.04 g) and Hu (62.10 ± 0.12%) compared to CBS with AH (0.40 ± 0.00 cm), AW (1.66 ± 0.03 g) and Hu (60.67 ± 0.38%). However, CBS had a better external egg quality because of the heavier and thicker shell mean which protect the internal egg contents while PWS performed better in internal egg parameters as Hu qualifies a good quality egg. In conclusion, Cinnamon brown strain of Japanese quails should be reared for egg production purpose as it has better external egg quality to protect the internal egg contents.

Keywords: Egg characteristics; Japanese quail; strain.

1. INTRODUCTION

Quail farming in Nigeria can play a vital role in the food security, health benefit, wealth and employment source creation. Quails are like other poultry birds, but they are highly productive, strong and disease resistant than other birds with less risk in this business [1]. Usually quails are reared for their eggs and meat. But raising layer quails for egg production are more popular than raising meat productive quails. Considering the advantages of quail farming in Nigeria, Femi [1] a researcher reported that quail farming is an uncommon farming business in Nigeria but few people that have embraced it are not only smiling to banks, they are also enjoying both nutritional health benefits derived from consuming it]. It is no doubt one booming business that is gradually taking over chicken poultry business in most part of the North [1]. Quail have been raised all over the world for production especially in countries of Europe, for meat, in East for egg production and dual-purpose birds in other Asian countries [2,3]. In Brazil, the number of birds and egg production in the last few years has almost doubled [4]. Thereby, it is necessary to meet the production needs and consequently to ensure the future of this activity.

The last few decades there have been a transition in poultry genetics from dual-purpose birds to those specialized in meat or eggs [5]. Japanese quail (*Coturnix coturnix japonica*) is one of the diversified poultry species reared for commercial egg and meat production. Its production is favoured because they are generally accepted, requires less time and space, the females are very prolific because they begin laying eggs on the average at 6 weeks and can lay between 250 and 300 eggs a year [6]. It possessed the unique characteristics of fast growth, early sexual maturity, short generation interval and shorter incubation period that makes it suitable for diversified animal agriculture [7]. They are fairly resistant to diseases, and impart less worry for vaccination. Because of low volume, low weight, less feed input and space requirements, the commercial quail farming for table egg and meat production can be started with much lower capital investment as compared to chicken and duck with almost the same profit margin [6,8,9,10,11,12]. They are also used as laboratory animals for researches [13] such as growth, selection, breeding and reproductive performance and for extensive use in many studies [14]. In Nigeria it is used for research purposes and egg production. Raising quail provides a resource for poor families with meat and eggs [1,15]. The economic success of a laying flock solely depends on the total number of quality eggs produced [16].

Furthermore, the quail is an efficient converter of feed with each egg a female deposits an edible package of 8% of her own body weight as compared to 3% in case of chicken [17]. Egg quality is the more important price contributing factor in table and hatching eggs [18]. In view of this, this study aimed at evaluating the effect of strain on external and internal egg parameters of two strains of Japanese quail.

2. MATERIALS AND METHODS

The experiment was conducted in the poultry unit of the Teaching and Research farm of University of Uyo, Nigeria. It lies within latitude 4°32'N and 5°33'N, and longitudes 7°25'E and 8°25E with annual rainfall of between 800 mm to 3200 mm from March to October. Annual temperature varies between 26°C–28°C. Its soil type is sandy loam soil with the soil pH of 4.5 - 6.5 [19].

2.1 Management Procedures

The experimental site was washed, disinfected and fumigated a week before the arrival of the birds to get rid of pathogens or incidence of pest attack on the experimental birds. A hutch containing 20 cells was constructed for the research. Beddings (wood shavings) were laid on the floor of each cell of the hutch. This served as a source of heat to the birds. Adequate sanitary measures were kept; wood shavings were changed weekly. Feeding troughs, drinkers and other needed equipment for successful rearing of the quail birds were kept clean and also heat source was provided. The temperature of the brooder and rearing pen was monitored through the behavioral reaction of the birds toward the heat source. The birds were kept under intensive management system in a completely Randomized Design.

2.2 Procurement and Management of Experimental Birds

Four hundred fertile eggs per strain were incubated and three hundred and thirty hatched out in each and the unsexed Japanese quail chicks were weighed then kept in their brooders for three weeks with water and starter feed given *ad libitum* in the drinkers and feeders for the purpose of this research. On the fourth week 300 chicks were randomly selected, 250 females and 50 male birds per strain in 5 replicates of ratio of 50:10. Each strain was regarded a treatment and were transferred to the grower pen made of wooden battery cage system (hutch) which comprises of four tiers of 20 cells of 62 cm x 80 cm x 56 cm each. The humidity and light intensity was just the normal day and night time. Water and grower marsh were fed to the birds up to the 5^{th} week. Then layer marsh was given to the birds from 6^{th} week to 10^{th} weeks. The birds started laying at 6 weeks of age where collection of data started till the research terminated (Table 1).

2.3 Vaccination

Glucose and vitamins were added to their drinking water on the first day to cushion the effect of stress due to long transportation. Feed and water were supplied ad libitum. Medications were administered too to prevent/cure diseases. They were vaccinated against Newcastle disease and infectious Bursal disease (Gumboro).

2.4 Data Collection

During the egg production period, 25 eggs per strain per day were collected which were labelled according to their Sire strain and the freshly collected eggs were cracked and analyzed for external and internal egg parameters throughout the study period of 10 weeks of the research in the Animal Science Laboratory. External and internal egg traits from each strain were determined.

2.4.1 Measurement of external egg parameter

Egg weight was individually determined to 0.01 g accuracy using a laboratory digital scale. Egg length (along the longitudinal axis) and egg width (along the equatorial axis) were measured with Venire caliper and was measured in millimeters.

2.4.2 Measurement of the internal egg parameter

Components were obtained by carefully breaking open around the posterior end of the egg, large enough to allow free passage of both the albumen and the yolk through it without mixing their content together. The content was poured on a transparent flat glass plate of dimension 45 cm x 40 cm. Yolk weight was gotten by carefully separating the yolk and then weighed on an electronic scale and recorded in grams. Yolk and albumen width and height were measured using a venire caliper and micrometer. Yolk weight with 0.01 g accuracy was determined using the laboratory scale electronic scale.

Table 1. Chemical composition of the dietary treatment

Composition	Starter mash	Grower mash	Layers mash
Crude Protein (%)	22	15	16.8
Fat (%)	5.1	3.6	3.6
Crude Fibre (%)	4.3	8.6	4.2
Calcium (%)	1.2	1.1	4.2
Available Phosphorus (%)	0.45	0.40	0.5
Methionine (%)	0.56	0.37	0.45
Lysine (%)	1.2	0.7	0.85
Metabolizable Energy Kcal/kg	3000	2500	2650

Source: Vital feed (Commercial feed)

After the eggs were broken and emptied the internal contents, egg shells were then washed with tap water in the laboratory and dried with clean towel in order to clean off the remaining albumen. Following this procedure, shell weight with membrane was measured using Sensitive electronic scale of 2 Kg capacity with accuracy of 0.01 g. The albumen weight was calculated from the difference between the egg weight, and the yolk and shell weight. Yolk weight with 0.01 g accuracy was determined using the laboratory digital scale.

The formula propounded by Haugh [20] was used for determination of Haugh unit %.

$$Hu=100 \log (h +7.5-1.7w^{0.37})$$

Where:

H=height of the thick albumen in mm.
W=weight of the eggs in grams.

Yolk colour was determined with the scale of Hoffman La Roche (Hoffman–La Roche, Switzerland).

2.5 Statistical Analysis

All data collected were analyzed in analysis of variance using Statistical Analysis System software package [21]. The significance of differences between the strains were tested by the Duncan's Multiple Range Test at the levels of 0.05% [22].

3. RESULTS AND DISCUSSION

3.1 Effect of Strain on External Egg Parameters of Two Strains of Japanese Quails (Cinnamon Brown and Panda White Strains)

The result in Table 2 indicated that strain significantly ($p < 0.05$) influenced external egg traits (egg length, shell weight, shell thickness) exception of egg weight at 10 weeks measured in this study.

The results showed that the external egg parameters of Panda white strain were 9.08 g, 2.90 ± 0.01 cm, 2.47 ± 0.01 cm, 0.82 ± 0.01 g and 0.11 ± 0.02 cm for egg weight, egg length, egg width, shell weight and shell thickness while Cinnamon brown recorded 9.01 g, 2.86 ± 0.01 cm, 2.36 ± 0.01 cm, 0.80 ± 0.01 g and 0.07 ± 0.01 cm for the same egg parameters. Panda white strain had significantly ($P < 0.05$) higher mean values in egg length (2.90 ± 0.01 cm) and egg width (2.47 ± 0.01 cm) than the Cinnamon brown with 2.86 ± 0.01 g, 2.36 ± 0.01 cm, for egg length and egg width, respectively while the Cinnamon brown had significantly ($P < 0.05$) higher values in shell weight (0.82 ± 0.01 g) and shell thickness (0.11 ± 0.02 cm) than the Panda white egg with 0.80 ± 0.01 g and 0.07 ± 0.01 cm. The mean values obtained in egg weights for both strains of Japanese quails measured were insignificantly ($P > 0.05$) difference. The results of this study indicated good egg quality as shell weight and thickness assured the protection of the internal egg contents and this confirms the result of Santos et al. [23] which observed that genetic and environmental differences and age of the birds could affect some external egg characteristics. The results of egg weight that ranged between 9.01 g and 9.08 g for the two strains (CBS and PWS) in this study was within the range of the value observed by Asasi et al. [24] who noted that the values for egg weight ranged between 9.76 g and 11.63 g in their study. However, the results of egg weight obtained in this study was not corresponding with the observation of Kumaril et al. [25] who recorded overall least means for egg weight as 13.71 g. Similarly, the results of egg weight obtained in this study is not in agreement with the observation of Elnagar and Abd-Elhady [26] who reported an average of 10.89 g for egg weight. The results obtained for egg width, egg length, shell thickness and shell weight in this study are similar to the findings of Uluocak et al. [27].

3.2 Effect of Strain on Internal Egg Parameters of Two Strains of Japanese Quails (Cinnamon brown and Panda white strains)

The results in Table 3 indicated that strain significantly ($p < 0.05$) influenced some internal egg parameters (Yolk Diameter (YD), Yolk Colour (YC), Albumen Height (AH), Albumen Diameter (AD), Albumen Weight (AW) and haugh Unit (Hu)) in both strains of Japanese Quail, except for Yolk Height (YH) and Yolk Weight (YW) at 10 weeks in this study.

The results showed that Cinnamon brown strain of Japanese quails had 0.85±0.01 cm, 2.35±0.01 cm, 1.42 ± 0.06, 2.76±0.03 cm, 0.40±0.00 cm, 3.25 ± 0.03 cm, 1.66±0.03 cm and 60.67±0.38% for YH, YD, YC, YW, AH, AD, AW and Hu while Panda white strain had 0.83±0.01 cm, 2.30±0.01 cm, 1.16 ±0.03 cm, 2.63±0.04 cm, 0.42±0.01 cm, 3.14 ± 0.02 cm, 1.77±0.04 cm and 62.10±0.12% for the same egg parameters. The mean values of YD (2.35±0.01 cm), YC (1.42±0.06 cm) and

Table 2. Effect of strain on external egg parameters of two strains of Japanese quails (Cinnamon Brown and Panda White Strains) (LSM±SE)

Strain	N	EW (g)	EL (cm)	ED (cm)	SW (g)	ST
CBS	150	9.08±0.07[a]	2.86±0.01[b]	2.36±0.01[b]	0.82±0.01[a]	0.11±0.02[a]
PWS	150	9.01±0.07[a]	2.90±0.01[a]	2.47±0.01[a]	0.80±0.01[b]	0.07±0.01[b]

CBS = Cinnamon brown strain, PWS = Panda white strain, N = No of observations, EW = Egg weight, EL= egg length, ED = egg width, SW = Shell weight, ST = Shell thickness, [a,b] = Means with different superscripts within the same column are significantly different

Table 3. Effect of strain on the internal egg (yolk) parameters two strains of Japanese quails (Cinnamon Brown and Panda White Strains) (LSM±SE)

Strain	N	YH (cm)	YD (cm)	YC	YW (g)
CBS	150	0.85±0.01[a]	2.35±0.01[a]	1.42±0.06[a]	2.76±0.03[a]
PWS	150	0.83±0.01[a]	2.30±0.01[b]	1.16±0.03[b]	2.63±0.04[a]

N = No of observations, CBS = Cinnamon brown strain, PWS = Panda white strain, YH = Yolk height, YD = Yolk diameter, YC = Yolk colour, YW = Yolk weight, [a, b] = Means with different superscripts within the same column are significantly different

Table 3. Contd': Effect of strain on the internal egg (albumen) parameters two strains of Japanese quails (Cinnamon Brown and Panda White Strains) (LSM±SE)

Strain	N	AH (cm)	AD (cm)	AW (g)	Hu (%)
CBS	150	0.40±0.00[b]	3.25±0.03[a]	1.66±0.03[b]	60.67±0.38[b]
PWS	150	0.42±0.01[a]	3.14±0.02[b]	1.77±0.04[a]	62.10±0.12[a]

AH = Albumen height, AD = Albumen diameter, AW = Albumen weight, Hu = Haugh Unit. [a,b] = Means with different superscripts within the same column are significantly different

AD (3.25±0.03 cm) for cinnamon brown strain was significantly ($p < 0.05$) higher than that of panda white strain with 2.30±0.01 cm, 1.16±0.03, 3.14±0.02 cm for the same parameters. The mean values of AH (0.42±0.01 cm), AW (1.77±0.04 cm) and (62.10±0.12) recorded for Panda white strain of Japanese quails were significantly ($p<0.05$) higher than those of Cinnamon brown strain with 0.40±0.00 cm, 1.66±0.03 cm and 60.67±0.38 cm for the same parameters measured. This indicated that Cinnamon Brown Strain had larger yolk and albumin in addition to light yellow yolk colour than Panda White Strain of Japanese quail. The yolk colour in this study ranged between pale yellow to yellow (1.16±0.03 to 1.42±0.06) which is in agreement with the results of Odunsi et al. [28] who observed light yolk colour in a range between 1.2 and 1.5 but differs from the results of Nazligul et al. [29] who had lighter yolk colour with average of 5.4.

The mean values of YH and YW of both Cinnamon brown and Panda white Strains of Japanese quail were observed to be statistically (P > .05) similar in this study. This implies that both strains (CBS and PWS) of Japanese quails had similar grade in internal egg contents. The result obtained in this study confirms the observation of Selium and Ibrahim [30] which noted that quail eggs have higher proportions of yolk than those from fowl hens. The results of this study showed higher proportions of albumen than those observed by Zita et al. [31]. A higher percent Hu of Panda White Strain than Cinnamon brown strain implied a better quality egg than those of Cinnamon brown strain in this study. Adeogun et al. [32] Observed that the higher the Haugh unit, the more desirable the egg quality.

4. CONCLUSION

Identification of the strain which produces quality eggs is essential as it will guide the farmers in the choice of strain which will satisfy ones desire when consumed. It was found that Cinnamon Brown Strain had heavier and thicker egg shell than Panda White Strain, It was also observed that Panda White Strain of Japanese quails had good internal egg quality as shown by higher Haugh unit percentage than Cinnamon Brown Strain in this study. Hence, Cinnamon Brown Strain of Japanese quails should be bred and kept for egg production purpose for both commercial and domestic utilization.

ETHICAL APPROVAL

The three authors have declared that, "principle of laboratory animal care" (NIH publication 85-23 revised 1985) were followed as well as the University law. All the experiment have been examined and approved by the University law.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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