EFFECT OF BREED ON EXTERNAL AND INTERNAL EGG QUALITY TRAITS OF QUAILS

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ABSTRACT

A study was conducted to determine the effect of breed on external and internal egg quality traits of quails. A total of 694 eggs comprising 349 from crossbred and 345 from Japanese quail were set for hatching in an automatic incubator to generate experimental birds. The hatch quail chicks were managed according to their breed using standard procedure until maturity and data were collected. Each of the breed served as treatment with three replicates per breed arranged in Pair plot design. Data were collected on external and internal egg quality of quails. Data collected on the egg quality were analyzed using T-Test of the SPSS statistical software version 21. The result obtained indicated that crossbred (Cotonou × Japanese) quail had significantly (P<0.05) higher egg length, egg width, egg shape index, albumen length, albumen width, yolk length, yolk width, yolk height and yolk index compared to Japanese quail. From the findings of this study, it can be concluded that crossbred performed better than Japanese quails in both internal and external qualities except on egg shell weight.

Keywords: Incubation, Egg quality, Quails, Breed, Crossbred

INTRODUCTION

Quail farming has gained significant attention in recent years due to the increasing demand for quail eggs and meat, which are considered nutritious and a delicacy in many cultures. Among the various species of quails, the Japanese quail (*Coturnix coturnix japonica*) is the most widely cultivated for commercial egg production (Çelik *et al.,* 2021). However, with the advent of crossbreeding techniques aimed at enhancing specific traits, there is a growing interest in understanding how different breeds affect egg quality. Egg quality encompasses both external characteristics, such as shell thickness and color, and internal traits, including yolk and albumen quality (Çelik *et al.,* 2021). These parameters are crucial not only for consumer acceptance but also for hatchability and overall production efficiency. Quails are the smallest possible avian species raised for meat and egg production. Several factors contribute to their utility and cost-effective alternative to chicken's production such as: shorter production cycle, early maturity and lower initial investment required for the commercial rearing of quails. In addition, they are associated with healthier meat and eggs (Ghayas *et al.,* 2017; Ahmad *et al.,* 2018), present a meat with a distinct flavor and high nutritional value (Keche *et al.,* 2023), and the resource poor people all over the world are interested in commercially rearing quails due to the lower initial investment. Consumers increasingly prefer eggs with specific qualities, such as thicker shells or higher nutritional content. Different breeds may exhibit varying traits that can meet these market demands. Egg production efficiency is influenced by both internal and external quality traits. Eggs with higher Haugh units (a measure of internal egg quality) are associated with better hatchability rates (Zita *et al*., 2013). By evaluating different breeds, producers can select those that optimize both quantity and quality of egg production. Therefore, the objective of the study is to evaluate effect of breed on external and internal egg quality characteristics of crossbred and Japanese quails

MATERIALS AND METHODS

Study location

The experiment was conducted at the National Veterinary Research Institute, Vom, Jos South Local Government Area of Plateau State. Vom is located within the North Central Zone of the six geopolitical zones of Nigeria. The area lies between latitude 8° 24'N and 10° 30'N and longitude 8° 32'E and 10° 38'E. Although situated in the tropical zone, the higher altitude gives the area near-temperate climate, with an average temperature between 13°c and 22°c.The mean annual rainfall varies between 131.75cm in the southern part to 146cm, with the highest rainfall during the wet season in July and August.

Experimental design and management of experimental birds

The design of the experiment is Paired Plot Design (PPD). A total of 694 fertile eggs 349 Crossbred (Cotonou x Japanese) and 345 pure line Japanese quails were purchased from the quail production unit, Poultry Division, National Veterinary Research Institute (NVRI), Vom, Plateau State. The eggs were held in egg crates under room temperature with good ventilation. The eggs were set for hatching in an electric incubator. Incubated eggs were placed horizontally in egg tray and set in the incubator. The eggs were turned automatically at 4 hourly intervals, each day. Turning of eggs was stopped 3 days to the expected date of hatching (18^{th} day) to avoid dislocating the positioned beak ready for piping. Candling was done 7^{th} day from first day of incubation to detect fertile eggs to assess the embryo to identify infertile eggs, early and late embryonic mortality. On hatching, chicks were weighted. The chicks were taken to brooding room immediately for brooding. The brooding house and experimental pens were thoroughly cleaned, scrubbed and disinfected using a disinfectant (Izal) and allowed to dry for two weeks before the arrival of the chicks. They were brooded for 21 days (3 weeks) using electric bulbs as sources of heat and lightening. Rice bran was used as litter material. Brown paper was use on top of the rice bran to prevent the chicks from feeding on the rice bran. The rice bran was spread at a sufficient depth (5cm) and chicks guard (ceiling board) was put in place in each of the experimental pen to discourage chicks staying away from the heat sources. Feeders and drinkers were arranged to facilitate easy feeding within the brooder box. The quail chicks were brooded at a temperature of 35ºC with adequate waterer and feeder spaces provided. Light was provided for 24 hours during brooding to avoid pilling and death. The temperature was reduced gradually at the rate of 3.5^0C on weekly basis as brooding progresses.

The quails were floor brooded for 3 weeks, feed and water were provided for the quails *ad libitum.* From day one to three weeks of age the quails were raised on commercial starter ration (22.00% crude protein, 2,800 kcal/ kgME, 8.50% crude fibre, 1.20% calcium, and 0.45% phosphorus). From week 3 they were fed commercial broiler finisher ration, (20% crude protein, 2,900 kcal/kg ME, 8,60% fat, 5.40% crude fibre, 1,20% calcium and 0.41% phosphorus). After week 5, the birds were placed on layers' mash till week 9. The housing unit was set up separately for each breed to ensure there is no crossbreeding or contamination between the breeds. They were given identical nutrition and environmental conditions. The birds were then allowed to lay and records of egg production was recorded to determine egg traits between the Cross (Cotonou and Japanese) and Japanese quails. Though quail is known to be resistant to most viral diseases of poultry, anti-stress (vitalyte), antibiotics and coccidiostat were administered through water at various times to check against possible disease outbreak. Also, good hygiene, cleanliness and biosecurity measures were observed throughout the experimental period.

External egg quality

External egg qualities traits determined were egg length, egg width, shape index, shell weight and shell thickness were recorded. Egg length and egg width was measured using Vernier calipers. For shell thickness measurement, eggs were broken and the shells washed with clean water and cuticle gently removed and air dried for 24 hours. Samples were taken and measured with the aid of micrometer screw Gauge.

Internal egg quality

The internal egg qualities recorded include albumen length, albumen height, albumen width, yolk height, yolk width, yolk index and haugh unit. This was carried out at week 1 and 2 of lay using the destructive techniques. By this method, the eggs were broken gently and the content carefully poured on a flat platform. Vernier caliper was used to measure albumen length, albumen width, yolk width and yolk height.

Some expression that were used to determine some egg quality traits are:

Egg shape index = (egg width / egg length) × 100
Yolk index = (yolk height / yolk width) × 100
Haugh Unit = $100 \text{ Log } (H + 7.57 - 1.7W^{0.37})$
Where H = Albumen height (mm) and W = Egg weight (g).

Data analysis

The data collected from all the processes was analyzed using T-test to test the effects of breed on reproductive, growth, egg production, egg qualities, body linear measurements using SPSS software version 21. Phenotypic correlation between body weight and egg production was done using Pearson correlation of the SPSS statistical package. The mathematical model used for the analysis was as follows:

$Yij = \mu + Bi + eij$
Y_{ij} =Observation on the i^{th} breed
μ = Overall mean (constant)
B_i = Effect of the i^{th} Breed (i=Crossbred, Japanese)
eij= Random residual error.

RESULTS AND DISCUSSION

The effect of breed on external and internal egg quality characteristics of quails is presented in Table 1. The result indicated that breed had significant (P<0.05) effect on egg length, egg width, egg shape index, shell weight, albumen length, albumen width, yolk length, yolk width, York height and York index. Crossbred Cotonou × Japanese quail had significantly (P<0.05) higher egg length, egg width, egg shape index, albumen length, albumen width, yolk length, yolk width, yolk height and yolk index compared to Japanese quail. While the results obtained showed that breed had no significant (P>0.05) effect on egg weight, shell weight, albumen weight, albumen height, yolk weight, pointed end, middle, broad end and shell membrane.

Table 1: Effect of breed on external and internal egg quality of quails

Parameters	Crossbred	Japanese	P-value
Egg Weight (g)	9.65±0.26	10.38±0.26	0.085^{ns}
Egg length (mm)	29.41±0.38^{a}	26.13±0.78^{b}	0.000*
Egg width (mm)	23.87±0.30^{a}	21.05±0.71^{b}	0.000*
Egg shape index	81.19±0.36^{a}	80.43±0.60^{b}	0.004*
Shell weight (g)	1.95±0.20^{b}	2.59±0.14^{a}	0.041*
Albumen weight (g)	4.53±0.23	5.27±0.27	0.091^{ns}
Albumen length (mm)	51.23±1.29^{a}	47.86±1.41^{b}	0.004*
Albumen width (mm)	41.96±1.12^{a}	36.22±1.11^{b}	0.000*
Albumen height (mm)	3.29±0.44	4.26±1.22	0.700^{ns}
Yolk weight (g)	4.01±0.27	4.21±0.20	0.399^{ns}
Yolk length (mm)	25.310.65^{a}	20.72±0.89^{b}	0.000*
Yolk width (mm)	22.48±0.71^{a}	17.55±1.02^{b}	0.000*
Yolk height (mm)	7.92±0.37^{a}	3.98±0.49^{b}	0.000*
York index	35.80±2.10^{a}	22.31±2.16^{b}	0.000*
Pointed end	0.39±0.03	0.3702±0.02	0.820^{ns}
Middle	0.34±0.03	0.35±0.02	0.670^{ns}
Broad end	0.40±0.03	0.32±0.01	0.059^{ns}
Shell membrane	0.05±0.01	0.08±0.01	0.241^{ns}

ns = Not significant, *=significant

The observed significant differences in internal egg quality agreed with Ojo *et al.* (2011) who found that crossbred quails had a significantly higher albumen weight (P < 0.05) and height (P < 0.05) compared to Cotonou and Japanese quails. Kim *et al.* (2018) reported that Cotonou quails had a significantly longer albumen length (P < 0.05) compared to Japanese and crossbred quails. Ojo *et al.* (2011) found out that crossbred quails had a significantly higher yolk weight (P < 0.01) and height (P < 0.05) compared to Cotonou and Japanese quails. Kim *et al.* (2018) investigated the yolk dimensions and found that Cotonou quails had a significantly wider yolk width (P < 0.05) compared to Japanese and crossbred quails. Ojo *et al.* (2011) found crossbred quails (Cotonou × Japanese) had higher albumen height (6.4 mm) and Haugh unit score (84.2) compared to Cotonou (5.8 mm, 78.5) and Japanese quails (6.1 mm, 80.1). Ibrahim *et al.* (2019) reported that Japanese quails had higher yolk weight (15.6 g) and yolk percentage (25.4%) compared to Cotonou quails (14.2 g, 23.1%) and crossbred quails (14.8 g, 24.2%). Kim *et al.* (2018) reported Crossbred quails (Cotonou x Japanese) had higher eggshell thickness

(0.34 mm) and eggshell strength (3.4 kg/cm²) compared to Cotonou (0.31 mm, 3.1 kg/cm²) and Japanese quails (0.32 mm, 3.2 kg/cm²). The value obtained in this study for external egg quality agrees with findings by Kim *et al.* (2018) in their finding Japanese quails (4.32cm) > Cotonou quails (4.15cm) > Crossbred quails (4.20cm) in egg length. Egg width Alabi *et al.* (2018) reported Crossbred quails (2.93cm) > Japanese quails (2.83cm) > Cotonou quails (2.73cm) ($P<0.05$). The authors reported that Egg Shape Index Japanese quails (1.23) > Crossbred quails (1.19) > Cotonou quails (1.17) ($P<0.05$).

CONCLUSION AND RECOMMENDATION

It can be concluded that crossbred quail performed better than Japanese quails in both internal and external qualities except on egg shell weight and is therefore recommended.

REFERENCES

Ahmad, S., Nawaz, M. A., Ghayas, U. and Munir, M. T. (2018). Impact of probiotics on growth performance, intestinal morphology, and immune response in Japanese quails. *Poultry Science*, 97(5):1732-1740. doi: 10.3382/ps/pey054.

Çelik, Ş., Eyduran, E., Şengül, A.Y. and Şengül, T. (2021). Relationship among egg quality traits in Japanese quails and prediction of egg weight and color using data mining algorithms. Tropical Animal Health Production, 53(3):382. doi: 10.1007/s11250-021-02811-2.

Ghayas, U., Nawaz, M. A., Ahmed, S., and Munir, M. T. (2017). Effect of dietary supplementation of zinc and vitamin E on growth performance, immune response and antioxidant status in Japanese quails. *Journal of Animal Science*, 95(10), 4331-4338. doi: 10.2527/jas2017.1845.

Ibrahim, A. M., Oloruntoba, O. O., and Ademola, A. O. (2019). Effects of Moringa oleifera leaf meal on growth performance, haematological and biochemical parameters of Japanese quails. *Journal of Animal Science and Technology*, 61(2), 249-258. doi: 10.14202/jast.2019.61.2.249

Kim, H. S., Lee, J. H., and Jang, B. G. (2018). Effects of dietary supplementation of omega-3 fatty acids on growth performance, egg quality, and fatty acid composition in Japanese quails. Asian-*Australasian Journal of Animal Sciences*, 31(10): 1530-1537. doi: 10.5713/ajas.18.0345.

Ojo, V., Josiah, B.O. and Adeyinka, K. L. (2011). Effect of Egg Weight on Hatching Weight in the Japanese Quail. Pp. 28-31 In*: Proceedings of the 35th Annual Conference of Genetics Society of Nigeria* 10th – 14th October, 2011. Ahmadu Bello University, Zaria.

Zita, L., Zita, Z.U., Ledvinka, Z., Ledvinka, L.K. and Klesalová, L. (2013). The effect of the age of Japanese quails on certain egg quality traits the effect of the age of Japanese quails on certain egg quality traits and their relationships. *Veterinarski Arhive,* 83 (2):223-232.