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Evaluation of Growth Performance and Egg Quality Traits in Two Strains of Japanese Quails (*Coturnix coturnix japonica*) in Zaria, Nigeria

***Kabir, M., Abubakar, M. M. and Adedibu, I.I.**

Genetics and Animal Breeding Unit, Department of Animal Science, Ahmadu Bello University, Zaria, Nigeria

*Corresponding author: mkabir@abu.edu.ng GSM: 08035926820

Target Audience: Animal breeders/Scientists, Quail breeders/rearers, General poultry farmers

Abstract

A 14 week study was conducted at the teaching and research farm, Department of Animal Science A.B.U Zaria, using 240 two weeks old Japanese quails belonging to two strains (black strain n=120 and brown strain n=120). The aim was to evaluate the effect of strain on the growth performance and egg quality traits of the Japanese quails kept under similar nutritional environment. 90 female quails for each strain were mated to 30 males at a mating ration of 1 male to 3 females. Daily egg collection commenced as from 6 weeks and terminated at week 14. The first three eggs dropped by each quail hen during 80% egg production were used for egg quality analysis (internal and external quality). Parameters considered included body weight, feed intake, feed conversion ratio and Mortality as it occurred. External and internal egg quality traits were also considered. Data collected were subjected to analysis of variance (ANOVA) using the R Core Team. Result obtained indicated variations at all ages (week 2, 6, 10 and 14) in body weight, weight gain and mortality in favor of black strain. Similarly, most of the egg quality traits studied was better in the black than in the brown strain. It was concluded that the two distinctly different strains of quail have different rates of growth and egg quality characteristics indicating the possibility of further improvement in their growth and egg laying performance.

Keywords: Breeder quail; egg quality traits; growth, traits

Description of problem

Quail rearing is becoming a fast growing business in Zaria, justified by the fact that the birds are hardy and well adapted to varying conditions of the northern guinea savannah and possess several other advantages, such as rapid growth, early sexual maturity, high rate of egg production, easy to handle and a short generation interval (1). One of the domesticated subspecies Coturnix coturnix Japonica is called Japanese quail (2). The common quail otherwise called Coturnix coturnix are birds originating from Asia, Africa and Europe. Species or subspecies of the genus Coturnix are native to all continents except the Americas. These birds are mainly produced for their eggs and meat but are also used as laboratory animals (3). Female quail can start laying egg at the age of 42 days and produce from 210–300 eggs per year or average of 250 eggs (4). Egg quality is composed of those characteristics of an egg that affect its acceptability to

consumers, it is therefore important that attention is paid to the problems of preservation and marketing of eggs to maintain the quality (4). Of the many strains available for rearing in Zaria, there is need to evaluate the egg production potentials of these strains so that breeders and quail farmers alike will distinguish between strains for meat and those for egg production. The aim of this study was to assess growth and egg characteristics of two distinctly different strains of Japanese quails kept under similar nutritional environment.

Materials and methods

Experimental Site

The experiment was conducted at the teaching and research farm of the Department of Animal Science, Ahmadu Bello University (ABU) Zaria, Nigeria. Zaria is located between latitude 11^0 and 12^0 N and on altitude of 640m above sea level (5). The area falls within the Northern-Guinea Savannah zone having an average annual rainfall of 1100mm which starts from late April and early May to mid October. The peak of rainy season is between June and September, followed by the harmattan period of cool and dry weather which lasts from October to January. This is then followed by hot-dry weather from February to April. The maximum temperature varies from 26 ^{0}C to 35 ^{0}C depending on the season, while the mean relative humidity during the harmattan period and the wet season are 21% and 72% respectively. Detailed description of the site had been given elsewhere by (6).

Experimental animals and management

A total of 240, two-week old, Japanese quails belonging to two strains (n=120 each for black and brown strain) were used. The black strain (BLACK) has a small and round body with a very short tail and have black coloured plumage with white spots. The plumage of the brown strain (BROWN) is distinctly brown with white fur spots. The male has dark brown coloration in the chest and the area around the head. They were kept in constructed cages measuring 0.30 x 0.61m^2 per bird, sexed at week 5 and mated at a ratio of 1 male to 3 females. They were fed similar straight ration containing 26% CP and 2900 kcal ME and the CP was reduced to 24%CP after first egg. Feed and clean drinking water were provided *ad-libitum* throughout the experimental period of 12 weeks. Routine medication as for chickens was adequately adhered-to as preventive measures, despite their hardy nature.

Data collection and parameters considered

Body weight (BW) was measured using a sensitive digital weighing scale in grams (g) at the beginning of the experiment and thereafter on weekly basis. Feed intake (FI) was calculated as the difference between feed offered and feed left-over in grams (g). Feed conversion ratio (FCR) was taken as the ratio of FI and weight gain. Mortality was recorded as it occurred. For egg quality analysis, the first three eggs dropped by each quail hen during 80% egg production were collected and used.

External egg traits

The following external egg traits were considered; egg weight measured using the digital scale; egg length and egg diameter were measured using a vernier caliper (cm); egg shell weight measured after the egg was broken, the albumen

and the yolk carefully removed and then the shell was weighed using a digital scale in grams; egg shell thickness was also taken when the albumen and yolk were removed after the egg was broken and then egg shell thickness was measured using a micrometer screw gauge, it should be noted that the egg shell thickness was taken by measuring sample of shell from the broad end, middle portion and narrow end then taking the average, in accordance with the procedure outlined by (7). Egg shell index was determined using the following relationship

$$\text{Egg shell index} = \frac{\text{Shell weight}}{\text{Egg weight}} \times 100$$

Internal egg traits

The internal egg traits measured include the following: albumen weight measured when the egg was broken unto a clean smooth surface and the yolk removed, the albumen was measured using a digital scale in grams. The bigger the albumen weights of an egg, the smaller the yolk and can be calculated from the following relationships: albumen weight = egg weight – (shell weight + yolk weight); albumen height albumen length were both measured using a vernier caliper in millimeter. Yolk weight makes up about 30-33% of the liquid weight of an egg. The weight was measured using a digital scale in grams. Yolk height and yolk diameter were both measured with the aid of a vernier caliper in millimeter. Haugh unit is a measure of egg protein quality based on the height of its egg white (albumen) and was calculated using the formula according to (8):

Where; HU = Haugh unit, *h* = observed height of the albumen in millimeters, *w* = weight of egg in grams. Both external and internal egg quality analysis were carried out at the Biochemical Laboratory of the Department of Animal Science, Ahmadu Bello University, Zaria, Nigeria.

Statistical model and data Analysis

The statistical model adopted was as shown below;

$$\mathbf{Y_{ijk} = \mu + S_i + e_{ijk}}$$

Where; Y_{ijk} is any observation, μ is the overall mean, S_i is the effect of the i^{th} strain (i = 2 BLACK and BROWN), e_{ijk} is the random error.

Data collected were subjected to analysis of variance (ANOVA) using (9) and significant differences between means were determined by Duncan Multiple Range Test (DMRT) according to (10).

Results and discussion

Growth performance

Result on the growth performance of the two strains of quail is presented in Table 1. The result showed that the average body weight (g) of the BLACK and BROWN obtained were significantly ($P<0.05$) different at all ages (week 2, 6, 10 and 14). The black strain quail consistently maintained its superiority across all ages. The weight gain recorded by the black strain was also significantly ($P<0.05$) higher than the brown strain, despite the fact that the two strains consumed similar quantity of feed from week 2 to week 10 (Table 1). However, at week 14 the brown strain had significantly ($P<0.05$) higher feed intake (FI) (199.86±6.38) than the black strain (197.33±6.75), which translated into no added advantage in weight gain. Similar

result was obtained by (11), who reported significant variation in body weight in two strains of quail at 35, 42 and 49 days of age. The variations in body weight and weight gain in the black and brown strains of Japanese quails observed in this study could be attributed to difference in genetic makeup of these strains. Kabir *et al.,* (12) reported variation in body weight of Anak and Hubbard broiler chickens and attributed it to difference in genetic makeup of the flocks maintained in NAPRI, Shika Zaria. Similarly, Mohammed *et al* (13) described significant effect of genetic group on body weight of indigenous chicken crosses. Variation in body weight due to breed or strain of quails is an indication that selection could influence body weight in Japanese quails (14). Feed conversion ratio was similar (P>0.05) in the two strains during the second week of growth period. However, there was a significant (P<0.05) difference in FCR during laying period (6 to 14 weeks). The brown strain had higher values of FCR than the black strain. These results are in agreement with those of (15); (16) who indicated significant difference in FCR at different ages. No mortality was recorded in the black strain whereas 2% of the brown strain died during the early week of the study period (2 weeks).

Table 1: G rowth performance of two strains of Japanese quails under similar nutritional environment

Parameter	Age (Weeks)	Strain of quail	
		BLACK	BROWN
Body weight (g)	2	47.29±3.39^{a}	45.14±3.11^{b}
	6	104.66 ±4.51^{a}	95.39 ±4.92^{b}
	10	152.83±7.77^{a}	134.69±6.54^{b}
	14	198.58±6.28^{a}	171.23±5.35^{b}
Weight gain (g)	2	47.29±3.39^{a}	45.14±3.11^{b}
	6	57.37±3.11^{a}	50.25±2.88^{b}
	10	48.17±2.49^{a}	39.30±2.06^{b}
	14	45.75±2.75^{a}	36.54±3.04^{b}
Feed intake (g) (FI)	2^{ns}	19.57±2.75	19.31±2.15
	6^{ns}	117.28±5.66	111.09±5.93
	10^{ns}	163.44±5.32	165.90±6.04
	14	197.33±6.75^{b}	199.86±6.38^{a}
Feed conversion ratio (FCR)	2^{ns}	0.41±0.17	0.43±0.39
	6	2.04±0.38^{b}	2.21±1.64^{a}
	10	3.39±1.75^{b}	4.22±1.55^{a}
	14	4.31±1.96^{b}	5.47±1.37^{a}
Mortality (%)	2	0^{a}	2.0^{b}
	6^{ns}	-	-
	10^{ns}	-	-
	14^{ns}	-	-

$^{a,b:}$ = means with different superscripts along the same row for a particular parameter are significantly different (P<0.05); ns = not significant

Egg quality characteristics

Means (±SE) for external and internal quality traits are presented in Table 2. The mean values obtained in the two strains for most external egg traits are significantly (P<0.05) different in favor of the black strain. However, egg shell weight was similar in both black and brown strains. This is an indication that the black strain has more potential for production of good quality eggs than the brown strain. Report by Silverside and Scott (17) indicated variations in egg quality traits for two lines of hens. In a study on black and brown Japanese quails, Punya *et al.,*(18) reported significant strain, generation and hatch effect on majority of egg quality traits, with values similar to those obtained in this study. The results obtained from the present work for external and internal quality traits were in agreement with those reported by (19) in chicken layer egg; (6) in two strains of layer chickens; (4). Generally, differences in the values for egg quality parameters may result from differences in genetic structure, health condition, flock age, use of different diets and husbandry management conditions of the birds.

Table 2: Egg quality traits of two strains of Japanese quails under similar nutritional environment

	Strain of quail	
Parameter	**Black**	**Brown**
External egg quality		
Egg weight (g)	8.37±0.06[a]	7.09±1.04[b]
Egg length (cm)	2.65±0.34[a]	2.43±0.65[b]
Egg diameter (cm)	1.58±0.28[a]	1.23±0.35[b]
Egg shell weight (g)	0.76±0.39	0.75±0.37
Egg shell thickness (cm)	0.29±0.21[a]	0.24±0.24[b]
Egg shell index (%)	11.97±4.53[b]	12.66±4.62[a]
Internal egg quality		
Albumen weight (g)	4.57±0.17[a]	3.48±0.15[b]
Albumen height (cm)	3.69±0.39	3.72±0.62
Albumen length (cm)	3.41±0.34[b]	3.50±0.24[a]
Albumen index (%)	13.43±2.45[b]	13.62±2.66[a]
Yolk weight (g)	2.93±0.14	2.91±0.20
Yolk height (cm)	3.62±0.92[b]	3.71±0.75[a]
Yolk diameter (cm)	0.88±0.21	0.84±0.23
Yolk index (%)	11.74±2.66[b]	12.58±2.64[a]
Haugh unit	59.59±6.52[a]	58.27±6.55[b]

[a,b:] = means with different superscripts along the same row for a particular parameter are significantly different (P<0.05);

Conclusion and applications

1. Considerable variations in body weight and weight gain were observed in the two distinctly different strains of quail (black and brown) during the course of this study indicating the possibility of further improvement in their growth performance.

2. The black strain performed better in almost all the egg quality traits studied than the brown strain of quails. This also indicated that the black strain of quail showed more prominence for egg production than the brown strain.
3. Based on the result of this study, the black strain is hereby recommended to quail breeders in Zaria and the northern guinea savanna zone of Nigeria, as strain of choice for egg production.

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