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*Corresponding author

Okoh JJ, Department of Animal Science, Federal University of Kashere, Nigeria

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Research Article

Study of the Egg Attributes of the Japanese Quail (*Cortunix Cortunix Japonica*) Raised in Gombe State, Nigeria

Okoh JJ[1*], Ibrahim A[1], Abdulkadir SA[1] Putra WPB[2], Dafur BS[3], Kaye J[3], Adejo OC[4], Adepoju AA[5] and Usman D[5]

[1]*Department of Animal Science, Federal University of Kashere, Nigeria*

[2]*Research Center for Applied Zoology, Bogor-Jakarta, West Java, Indonesia*

[3]*Department of Animal Production, University of Jos, Nigeria*

[4]*Department of Animal Science, Kogi State University, Anyigba, Nigeria*

[5]*Department of Animal Health and Production Technology, Federal College of Horticulture, Dadinkowa, Nigeria*

Abstract

The egg attributes of the Nigerian indigenous quail were studied in three agro- ecological zone of Gombe state, namely; Gombe Central, South and North to assess the external and internal attributes of the egg. 90 fresh eggs were randomly collected from these zones comprising of 30 eggs per zone from quail farmers for assessment. Data were collected on egg weight, egg length egg width, egg shell weight, shell thickness and the internal egg characteristics were albumen height, yolk height, albumen weight, yolk weight and Haugh unit. Results indicated that egg weight values were 9.807±0.117, 9.942±0.130 and 10.004±0.114g in Gombe Central, South and North. Shell weights were 1.177±0.009g for Gombe Central, 1.193±0.010g in Gombe South and 1.206±0.012g in the North. Shell thickness showed that Gombe Central recorded 0.035±0.001mm, South 0.0252±0.001mm and North 0.0253±0.001mm with overall mean of 0.0286±0.001. Apart from egg width and shell thickness which were significantly different (P<0.001) by location, other parameters of egg weight and length, shell weight and shell surface area were not affected by location. Albumen weights were 3.308±0.02, 3.288±0.03 and 3.327±0.03mm in Gombe Central, South and North. Yolk weight were 10.390±0.10g in Gombe Central, 9.550±0.12g Gombe South, 9.343±0.13g Gombe North with total average of 9.927±0.084g. Yolk heights were 3.692±0.013, 3.448±0.04, and 3.426±0.03mm in Gombe Central, South and North, respectively. Haugh unit of 80.021±0.26 were recorded in Gombe Central, 78.925±0.26 in the South and 78.614±0.26 in the North of Gombe, the overall Haugh unit was 79.507±0.161, respectively. Apart from egg weight which was not significant, albumen height, yolk weight, yolk height and Haugh unit were significantly (P<0.001) affected by location. Egg weight was correlated with egg length (0.796; P<0.01), shell weight (0.226; P<0.05) and Haugh unit (-0.461; P<0.01). Albumen weight was correlated with Haugh unit (0.240; P<0.05). Yolk weight was correlated with yolk height (0.300; P<0.01), and Haugh unit (0.269; P<0.05). The findings reveal that the quail in the study area has good egg and reproductive attributes and the positive correlated responses can help breeders for quick selection for further genetic improvement.

Introduction

Background of the study

The quail is an efficient biological machine for converting food into animal protein of high biological value having amazing tender taste, game flavour, low caloric value and high dry matter content. It is one of the cheap sources of animal protein for human diets which is fit for children and pregnant women [1].

Quality of an egg is determined by various standards that are imposed on the exterior (quality of the eggshell) and interior (quality of the albumen and yolk) components of the egg. Though eggs are known to possess excellent keeping quality, like all food, they have limited shelf life. Studies have reported that quail eggs contain essential nutrients, which play a vital role in human health and in disease prevention and curing [2].

The Japanese quails egg laying is similar to that of hens [3,4]. A prolonged, year-long laying period and egg production during this period all indicate usefulness of investigations of Japanese quail eggs. It should be stressed that Japanese quails reach sexual maturity very early (approximately at 6th week of life) which can be related to a deteriorating egg quality at the peak of laying [5,6]. In an experiments on quality [6-15], analysed external egg traits as: dimensions (width and length), shape and shell index as well as the internal egg content – yolk and albumen features and based their quality assessment of these eggs on their origin and age. In addition, they also examined the impact exerted by different concentrations in feeds of protein and nutritional additives, example- probiotics as well as different sources of fat. There investigations focused mainly on the evaluation of the eggshell quality which deteriorates significantly at the peak of laying [16]. It is well known, that external and internal egg traits also can be significantly influenced by the storage time and egg size, together with the lengthening of the storage period, unfavourable physicochemical changes of their content [17,18]. When evaluating eggs (small, medium, large and extra-large) of brown-egg layer hens, reports showed that yolk and albumen height increased with egg size. On the other hand, deteriorating egg quality, especially white and shell traits, may be one of the causes of obtaining worse hatching results [19,20]. The reproductive potential of Japanese quails is apparent not only in the number of laid eggs but by also in their high fertilization as well as very good egg hatchability results [3,6]. Alkan et al. [21] reported a significant influence of the weight of Japanese quail eggs on hatchability traits and demonstrated declining values of hatchability traits together with the increase of egg weight over 12 g. Similar relationships between the weight of Japanese quail (meat type) eggs and hatchability results were found by Petek et al. [22] and Petek et al. [23]. The impact of egg weight on hatchability

traits was also determined in other poultry species (among others, in turkey, guinea fowl and geese) [6,20,24-26]. Hence, this research assesses the external and internal characteristics of quail eggs and the relationships that exist amongst characteristics.

Methods and Methodology

Location of the study area

The study was conducted in Gombe. Gombe state is located in the Sudan Savannah zone in the North Eastern part of the country. It falls on longitude 11°10'E and latitude 10°17'N. It has annual rainfall of between 850-1500mm that falls between mid - May and terminating in October. The annual maximum temperature is 41°C obtained mostly in April and minimum annual temperature of 13°C obtained mostly in January (Mohammed, 2011). The state covers a total area of about 20,265sq. km. The approximate altitude of Gombe ranges from 400-500m above mean sea level.

Climate and vegetation of the study area

The climate is described as tropical continental climate. The temperature is high all year round with a mean annual temperature of 30^{0}C. The highest temperature is recorded during the dry hot months of March, April and May with maximum temperature above 370C. During the rainy season, the temperature drops considerably due to the cloud cover between July and August as well as during the Harmattan periods of November to February. The area records about three to four months of rainfall and is concentrated in the months of July, August and September with the average annual rainfall of 951mm per annum. The soil is very fertile, sandy loam of varying colours from dark, brownish, grey and red. The vegetation cover of Gombe comprises of sparsely-dense trees with shrubs and sparse grasses to a more open grass of less height and stunted trees. The most common trees found this area includes; Mango, Guava, Cashew, locust-bean, tamarind among others.

Data collection

Gombe state was divided into three agro-ecological zones namely: Gombe North, South and Central.

A total of 30 quail eggs were collected per zone making up a total of Ninety eggs in the zone. 15 per LGAs per zones in a nested (hierarchical balanced) design to assess the external and internal egg quality of the domestic quail.
Data were generated on external and internal characteristics of the quail eggs as follows;

External egg parameters

i. Egg weight: the eggs were collected, numbered, labelled and weighed using a digital electronic scale to the nearest 0.01g.
ii. Egg length: was measured using a vernier calliper to the nearest 0.01m.
iii. Shell weight: eggs were carefully broken and poured inside a clean glass surface for the shell to be weighed with a digital electronic scale to the nearest 0.01g.
iv. Shell thickness: the eggs were oven dried for 24 hours after which a micrometer screw gauge was used to measure the thickness of the shells to the nearest 0.01mm.

Internal egg parameters measurement

Yolk height, Yolk diameter, Albumen height: were measured using a vernier calliper to the nearest 0.01mm.

Yolk weight: the yolk was carefully separated from the albumen by spoon-scooping it to a plate and then weighed using a digital electronic scale to the nearest 0.01mm.

Albumen weight: were obtained by subtracting the shell value from the yolk weight.

Haugh unit: is a measure of egg protein quality based on the height of its egg and it is measured based on the height of the albumen. The higher the number, the better the quality of the egg. It was measured using the formula;

$$HU = 100 \times Log (h+7.57) - (1.7 \times W\ 0.37)$$

Where;
HU= Haugh unit
h = observed height of the albumen in millimetres
w = weight of egg in grams

Statistical analysis

Data obtained were analysed by ANOVA using Statistical Package for Social Science SPSS version 23 (2015). Significantly different means in a subset were separated using Ryan Einot Gabriel Welsh F- Test. Person's Correlation co-efficient were computed to test the relationship between the egg traits.

Results and Discussion

External egg quality characteristics

Table 1 Showed the external egg characteristics of the quail in the study area. Results revealed that that egg weight value was 9.807±0.1117, 9.942±0.130 and 10.004±0.114g in Gombe Central, Gombe South and Gombe North. The mean average egg weight in the study area was 10.056±0.007g. However, the Analysis of variance showed that egg weight was not significant for the study location. The results for the mean average egg length, shell weight and shell surface area were 3.284±0.024mm, 1.204±0.006g and 23.256±0.095 and were not significant. Egg width was significantly (P< 0.001) affected by location with values of 21.575±0.214, 22.292±0.193 and 23.132±0.148mm and overall of 22.584±0.126mm. Shell thickness was also significantly (P< 0.001) affected by location with mean average of 0.030±0.00mm respectively. Shell surface area was not affected by the study location.

Internal egg quality characteristics

Results on internal egg characteristics are presented in Table 2. The results indicated that albumen height, yolk weight, yolk height and Haugh unit were affected significantly (P< 0.001) by study location, except for albumen weight which was not affected. The mean average value of 2.608±0.020mm albumen height, 9.927±0.084g yolk weight, 3.566±0.022mm yolk height, 79.507±0.161 haugh unit and 3.344±0.018g albumen weight were recorded.

Table 1: External egg quality of quails.

	Location				
Parameters	**Gombe Central**	**Gombe South**	**Gombe North**	**Total**	**LSD**
Egg weight(g)	9.807±0.117	9.942±0.130	10.004±0.114	10.056±0.007	NS
Egg length (mm)	3.189±0.043	3.280±0.036	3.239±0.043	3.284±0.024	NS
Shell weight(g)	1.177±0.009	1.193±0.010	1.206±0.012	1.204±0.006	NS
Egg width(mm)	21.575±0.214c	22.292±0.193b	23.132±0.148a	22.584±0.126	***
Shell surface area	22.883±0.187	22.223±0.159	23.093±0.147	23.256±0.095	NS
Shell thickness(mm)	0.035±0.001b	0.252±0.001b	0.253±0.0056a	0.030±0.001	***

Note: NS = Not significant, Significant at *** = P < 0.001. Means in row with different superscripts are significantly different.

Table 2: Internal egg quality of quails

Location					
Parameters	**Gombe Central**	**Gombe South**	**Gombe North**	**Total**	**LSD**
Albumen height (mm)	2.671±0.032^{b}	2.533±0.033^{b}	2.498±0.033^{a}	2.608±0.020	***
Albumen weight(g)	3.308±0.029	3.288±0.035	3.327±0.031	3.344±0.018	NS
Yolk weight(g)	10.390±0.100^{b}	9.550±0.124^{b}	9.343±0.133^{a}	9.927±0.084	***
Yolk height(mm)	3.692±0.013^{b}	3.448±0.043^{b}	3.426±0.030^{a}	3.566±0.022	***
Haugh unit	80.021±0.264^{b}	78.925±0.266^{b}	78.614±0.246^{a}	79.507±0.161	***

Note: NS = Not significant, Significant at *** = P < 0.001. Means in row with different superscripts are significantly different.

Correlation of egg characteristics

Correlation of egg characteristics are presented in Table 3. This showed that they were positive and significant correlation for egg length (0.796**) and shell weight (0.226**). However, egg width (-0.010**), shell thickness (-0.006**), albumen height (-0.018***), albumen weight (-0.083**), yolk weight (-0.114**), yolk height (-0.136**) and haugh unit (-0.461**) were also correlated.

Discussion

The results of this study indicated good egg quality as good shell weight and thickness assured the protection of the internal egg contents. The results of egg weight that ranged between 9.8g, 9.9g and 10.0g in this study was within the range of the value observed by Asasi et al. [27] who noted that the value 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 differ from the observation of Kumaril et al. [28] who recorded overall least means for egg weight as 13.71g. Similarly, the results of egg weight obtained in this study are not in agreement with the observation of Elnagar and Abd-Elhady [29] who reported an average of 10.89g 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. [30]. The results showed higher proportions of albumen than those observed by Zita et al. [31]. A higher percent Haugh unit implied a better quality egg. Adeogun et al. [32] Observed that the higher the Haugh unit, the more desirable the egg quality, hence the high haugh unit in the study is an indication of good egg quality in the quail population.

The good correlations imply that increase in egg weight will lead to increase in the egg length and shell weight. Selection for better egg weight will invariably select eggs with better length. Shell weight was influenced by the weight of egg. The findings of current study differ from that of Nwagu et al. [33], Obike and Azu [34] who reported of highly significant correlation between egg weight and egg width in chicken and Guinea fowl. There was a positive correlation between egg length and shell weight (0.231), as well as shell surface area (0.212).

Conclusion

Conclusively, the quail in the study area exhibit good external and internal egg qualities and the correlation responses suggest that further egg improvement can be achieved as correlated responses could hasten selection processes for egg improvement.

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