PHENOTYPIC CORRELATIONS BETWEEN SOME EXTERNAL AND INTERNAL EGG QUALITY TRAITS IN THE JAPANESE QUAIL *(Coturnix coturnix japonica)*

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ABSTRACT

This study aimed to determine the internal and external quality traits of the Japanese quail eggs as well as the phenotypic correlation between these traits. Measurement were taken on 1796 Japanese quail eggs obtained from 400 females and 200 males in an experiment conducted at the Quail Unit of Centre Songhai, Porto – Novo, Benin Republic. The data was analysed using PROC SAS. Values of egg weight, egg length, yolk height, albumen height, shell thickness, egg diameter, shape index and Haugh unit were found as 11.21g, 3.17cm, 7.82cm, 1.08cm, 0.58cm, 0.19mm, 2.49cm, 1.27 and 60.13, respectively. Significant ($P<0.001$) correlation values were obtained between albumen height and yolk height; and albumen height and Haugh unit. There was a negative but significant correlation between egg weight and Haugh unit (-0.90). Phenotypic correlations of external quality traits showed that most of the traits considered were positively correlated ($P<0.001$). The results showed that as the egg weight, egg length, egg circumference, shell thickness, egg diameter and shell index increases, the Haugh unit decreases. Most of the external and internal quality traits showed high positive correlations, thus could be easily improved upon. Based on the negative correlation observed between Haugh unit and egg weight in this study, it could be said that increase in egg weight will cause a decrease in Haugh unit which is a quality indicator of eggs.

Keywords: Phenotypic Correlation, Egg weight, Haugh Unit, Japanese quail

INTRODUCTION

Animal protein in sufficient and balanced nourishment is of considerable importance to human health particularly for physical and mental development (Uluocak et al., 1995; FAO, 2002). Poultry production is highly important because it offers the shortest means to bridge protein deficiency within the populace due to its short generation intervals. In recent years, it has been observed in poultry breeding that the quails are as important as much as chickens both for their meat and eggs, therefore commercial quail breeding have become widespread (Altinel et al., 1996;

Kayang et al., 2004). Even though meat production was the main target, the productivity and quality of the breeding eggs are central to the continuity of the flocks (Sogut et al. 2001). External and internal qualities of eggs are important in poultry breeding since they influence the yield of future generations, breeding performances, and quality and growth of the chicks (Altinel et al. 1996).

Researchers have reported the significant effects of the internal and external quality traits of the eggs on the hatchability of incubated and fertile eggs, and weight and development of the chicks resulting from the eggs of chickens (Nordstrom and Ousterhout, 1982) and quails (Peebles and Marks, 1991; Khurshid et al. 2004; Mani, et al. 2008).

Due to the increasing quail breeding activities in Nigeria, there is the need to examine issues concerning the phenotypic and genetic correlations of external and internal quality traits of quail eggs and environmental factors affecting these traits.
This paper enumerates the external and internal quality traits of the quail eggs as well as the phenotypic correlation between these traits.

MATERIALS AND METHODS

A total of 2,489 Japanese quail eggs collected from 400 dams at 10 weeks of age were used for this study. The birds were housed in cages in the ratio of one male: two females at the quail unit of Songhai farms in Porto-Novo, Benin Republic. The quails were given diet containing 28% protein and 2800 Kcal energy. A lighting schedule of 16h light / day was supplied. After collection, the eggs were numbered and individually weighted with 0.01g sensitive electronic scale. The width, length and height of the eggs were measured using Vernier calipers. Each egg was broken on a glass covered table in order to measure the yolk height, yolk diameter and albumen height with Vernier calipers. Each egg shell was well drained and the thickness was measured with a micrometer sensitive to 0.01mm. Some internal and external quality traits of the egg were estimated using the following formulae:

Shape Index (SI) = EL / ED
Where EL = Egg length
ED = Egg diameter

Yolk Index (YI) = YH / YD
Where YH = Yolk height
YD = Yolk diameter

Haugh Unit (HU) = 100 log (H + 7.57 – 1.7 EW0.37)
Where EW = Egg weight

The statistical properties of data collected were determined by PROC MEANS of SAS (2003). The covariance components due to sire and progeny within sire for all pairs of traits were obtained by the nested procedure (PROC NESTED) of SAS (2003). The phenotypic correlations between all pairs of traits based on sire component of variance and covariance were computed by the following formula of Becker (1984):

$$rP\,(x1x2) = \frac{Covw(x_1x_2)Covs(x_1x_2)}{\sqrt{(\sigma^2 w(x^1) + \sigma^2 s(x^1))(\sigma^2 w(x^2) + \sigma^2 s(x^2))}}$$

Where:
Covs(x1x2) = Sire component of covariance of the 1st trait (x1) with the 2nd trait (x2)
Covw(x1x2) = Within sire component of covariance of the first trait (x1) with the second trait (x2)
σ2s(x1) = Sire component of variance of trait x1
σ2s(x1) = Sire component of variance of trait x2
σ2w(x1) = Within sire component of variance of trait (x1)
σ2w(x1) = Within sire component of variance of trait (x2)

RESULTS

The means of the egg quality traits are shown in Table 1. The mean values related to egg weight, egg length, yolk height, albumen height , shell thickness , egg diameter , shape index and Haugh unit were found to be 11.21g, 3.17cm, 7.82cm, 1.08cm, 0.58cm, 0.19mm, 2.49cm, 1.27 and 60.13 respectively. The phenotypic correlations of external quality traits are shown on Table 2. Almost all the traits considered were positively correlated ($P<0.001$). Pairs of traits such as egg weight and egg length, egg weight and egg diameter had high values; egg length and egg circumference, shape index and egg length had medium values while egg weight and shape index, shell thickness and egg diameter had low values.

Table 1: Means± standard deviations of egg quality characteristics

Variable (n=1796)	Mean ± SD
Egg weight (EW)	11.21±1.1
Egg length (EL)	3.17±0.14
Egg Circumference (EC)	7.82±0.27
Yolk Height (YH)	1.08±0.08
Albumen Height (AH)	0.58±0.07
Shell thickness (ST)	0.19±0.05
Egg diameter (ED)	2.49±0.09
Shape index (SI)	1.27±0.06
Haugh Unit (HU)	60.14±1.59

Table 2: The phenotypic correlations between external egg quality traits

Traits	EW	EL	EC	ST	ED
EL	0.80**				
EC	0.73**	0.58**			
ST	0.14**	0.09**	0.12**		
ED	0.73**	0.58**	1.00**	0.12**	
SI	0.24**	0.57**	-0.29**	0.00	·0.29**

** P<0.001

Correlation among the internal egg quality traits are shown in Table 3. Significant correlation values were obtained between albumen height and yolk height; albumen height and Haugh unit.

The phenotypic correlations between external and internal quality traits of eggs are shown on Table 4. There was a negative but significant correlation between egg weight and Haugh unit (-0.90), egg length and Haugh unit (-0.73) and egg circumference and Haugh unit (-0.63). These results showed that as the egg weight, egg length, egg circumference, shell thickness, egg diameter and shape index increases, the Haugh unit decreases.

DISCUSSIONS

In this study, the average values that were determined related to both the external and internal quality traits of the egg in agreement with the many previous reports (Nazligul et al., 2001; Ozcelik, 2002; Kul & Seeker, 2004) but also differ in some other traits (Nagarajan et al., 1991; Altan et al., 1998; Uluocak et al., 1995; Nazligul et al., 2001; Kul & Seeker, 2004). The differences between the results of this research and results of previous researchers might be due to genetic structure, health condition, flock age, differences in feed ingredients, and differences in the care and management conditions of the quail.

The significant but negative phenotypic correlation value (-0.29) obtained between the shape index and egg circumference in this study is in conformity with the phenotypic correlation values obtained by Iscan and Akcan (1995) in the hen eggs and by Ozcelik (2002) in the quail eggs.

Table 3: The phenotypic correlations between internal egg quality traits

Traits	YH	AH	HU
YH			
AH	0.28**		
HU	-0.41**	0.13**	

** P<0.001

Table 4: The phenotypic correlations between external and internal quality traits of eggs

Internal Qualities	External Qualities					
	EW	EL	EC	ST	ED	SI
YH	0.52**	0.48**	0.39**	0.07**	0.39**	0.19**
AH	0.31**	0.23**	0.29**	0.11**	0.29**	0.00
HU	-0.90**	-0.73**	-0.63**	-0.09**	-0.63**	-0.25**

** P<0.001

The significant correlation values obtained between albumen height and yolk height, and albumen height and Haugh unit were in accordance with the findings of Akbas et al., 2004 but the negative correlation observed in this study between yolk height and Haugh unit was at variance with his findings.

The phenotypic correlation values between the internal qualities traits and external quality traits were significantly positive and ranges from low to high correlation values except for the haugh unit which had negative correlations with all the external quality traits.

CONCLUSION

Most of the external and internal quality traits showed high positive correlations, thus, can be easily improved upon. Based on the negative correlation observed between Haugh unit and egg weight in this study, it can be concluded that selecting quails for increased egg weight might invariably lead to a decrease in Haugh unit which may have an adverse effect on the egg quality.

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