Trop. Anim. Prod. Invest. 18 (1): 96-100 (2015)
ISSN: 1115-2540
http://animalsci.agric.ui.edu.ng/TAPI/index.php/tapijournal/index

SHORT COMMUNICATION

Repeatability Estimates of Egg Production and Quality Characteristics of Japanese Quail in A Semi- Arid Area of Nigeria

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ABSTRACT

Repeatability estimates of egg production and quality characteristics of Japanese quail were investigated. Egg number, egg mass and hen-day egg production were the egg production traits considered while the egg quality traits were egg weight, egg length, egg width, shell thickness, yolk height, yolk width, yolk length, albumen height, albumen length, albumen width, shape index, albumen index and Haugh unit. Both the egg production and the quality traits were moderate to highly repeatable. Egg mass (0.569 ± 0.108) had higher estimate among egg production traits and egg number (0.544 ± 0.112) the lowest while for egg quality traits, the highest and lowest estimates were for Haugh unit (0.845 ± 0.037) and albumen length (0.453 ± 0.079), respectively. These high repeatability estimates indicated that fewer records would be required to determine the ability of quail hens to repeat their performance for these traits.

Keywords: Egg number, Albumen quality, Estimates, Haugh unit

INTRODUCTION

Poultry production is an important sector of the Nigerian economy and has experienced significant growth within the last two decades. Production of meat and eggs in poultry has increased by 112 percent over a period of 14 years (egg; 337,000 - 548,000 and meat; 57,000 - 121,000 tonnes); indicating the importance of the industry as an enterprise for employment and income generation (Alimi *et al.*, 2006).

The repeatability (*R*) of a trait describes the proportion of variance in the trait that is due to variation among rather than within individuals (Lessells and Boag, 1987). Okonkwo and Ibe (1994) reported that repeatability is the ability of individuals to repeat their performance and maintain their ranking in a population in successive records. According to Akpa *et al*. (2008) the estimation of the future most probable producing ability of each bird is of immense advantage in terms of shortened generation interval and enhanced expected rate of genetic gain. The importance of repeatability includes setting the upper limit of heritability and predicting future performance from past records (Falconer, 1989). The magnitude of repeatability gives an indication of the number of records required to characterize the inherent transmitting ability of an individual (Akpa *et al*., 2006). Sooncharenying and Edwards (1989) reported that all traits of quail egg had high repeatability estimates. This is corroborated by Akpa *et al*. (2008) who reported repeatability estimates of egg quality traits to range from 0.54 to 0.99. Similarly, Sooncharenying and Edwards (1989) reported repeatability coefficients of 0.80, 0.98 and 0.85 for egg weight, shell weight and shell thickness, respectively in quails. Wilhelmson (1975) earlier reported repeatability estimates of egg traits of quails to range from 0.46 to 0.58. The aim of this study was to estimate repeatability of egg production and quality characteristics of the Japanese quail in a semi-arid area of Nigeria.

MATERIALS AND METHODS

Location of the study

The study was carried out at the Poultry Unit of the University of Maiduguri Livestock Teaching and Research Farm, Maiduguri, Borno State, Nigeria. Maiduguri, the Borno State capital is situated on latitude $11^{0}5^{'}$ N, longitude $13^{0}09^{'}$ E and at an altitude of 354 m above sea level. The area falls within the Sahelian region of West Africa, which is noted for sharp climatic and seasonal variations. It has very short period (3 – 4 months) of rainfall of 645.9 mm/annum with a long dry season of about 8 – 9 months. Relative humidity is usually 45% in August and drops to about 5% in December and January. Day length varies from 11 to 12 hours.

Birds and their management

Three hundred four weeks old Japanese quails (male and female), obtained from the National Veterinary Research Institute (NVRI) VOM in Jos, Plateau state were used for the study. They were housed in labelled cages equipped with feeding and watering troughs. They were first fed on a commercial broiler starter ration containing 23% CP and 3000 Kcal/Kg of ME and later changed to breeders marsh (18% CP and 2800 Kcal/Kg) at 6 weeks. The quails were housed in a male:female ratio of 1:1.

Data collection

A total of 36,520 eggs were collected from 150 female Japanese quails housed individually. Egg production characteristics of the Japanese quail were recorded from the first egg to 60 weeks of age for each hen. Egg Number was measured as the total number of eggs laid by each hen recorded weekly while egg mass was obtained as the number of eggs laid multiplied by the weight of the eggs. Hen day egg production was estimated as number of eggs laid by each hen weekly divided by number of days in a week multiplied by 100. An egg was taken from a week's collection for each hen and used for egg quality determination using the methods described by Altan *et al.* (1995) and Kul and Seker (2004) as follows:

Egg weight was measured with a sensitive weighing balance in grams

Egg length and width were measured using a digital vernier caliper calibrated in millimeters.

Egg shape index was calculated as

$$\text{Egg shape index} = \frac{\text{Egg width}}{\text{Egg length}} \times 100$$

The egg was then broken onto a clean white tile and the albumen and yolk length, height and width measured using the vernier caliper. Shell thickness (in millimeters) was measured with a micrometer screw gauge. Accuracy of shell thickness was ensured by measuring shell samples from broad and narrow ends and, middle portion of egg, and taking the average.

Yolk and Albumen indices were determined as

$$\text{Yolk index} = \frac{\text{Yolk height}}{\text{Yolk width}} \times 100$$

$$\text{Albumen index} = \frac{\text{Albumen height}}{\text{Albumen width}} \times 100$$

Data analysis

Estimates of variation between and within individuals were obtained by equating their mean squares to the expectations from the ANOVA table and the resulting equations solved.

Repeatability coefficient was estimated from the variance component estimates using the following expression according to Becker (1985):

$$R = \frac{\sigma^2{}_w}{\sigma^2{}_w + \sigma^2{}_e}$$

where R = Repeatability

$\sigma^2{}_w$ = Variation between individual

$\sigma^2{}_e$ = Variation between measurements within individual

The standard error was calculated as reported by Becker (1985) as follows:

$$S.E.(R) = \sqrt{\frac{2(1-R)[1+(K-1)R]^2}{K(K-1)(N-1)}}$$

Where

S.E. (R) = standard error of repeatability

K = number of measurements

N = number of individuals

RESULTS AND DISCUSSION

Repeatability estimates for egg production and quality traits are presented in Tables 1 and 2, respectively. Estimates for egg production traits ranged from moderate. The highest value (0.569) was for egg mass and lowest (0.544) was for egg number. However, Udeh (2010) reported low repeatability estimates for egg production traits in chickens. The author concluded that in view of low repeatability values improvement in accuracy of predicting breeding values of birds requires collection of additional records and improvement of non-genetic factors influencing egg production.

Repeatability estimates for egg quality traits ranged from moderate to high. The highest estimate (0.845) was for Haugh unit and lowest (0.453) for albumen length. Wilhelmson (1975) and Minvielle and Oguz (2002) also reported repeatability of egg quality traits to be moderate to high (0.46 to 0.58) while Akpa *et al.* (2008) reported high values (0.58 – 0.99). High repeatability estimates suggest that few records would be required to determine the inherent transmitting ability of quail hens and this would save cost (Ibrahim, 2001) and time of collecting additional data (Akpa *et al*., 2008). The repeatability estimate (0.531) for egg weight is similar to 0.58 reported by Ingram *et al.* (1989) in bobwhite quail but lower than 0.80 and 0.77 obtained by Sooncharenying and Edwards (1989) and Akpa *et al.* (2006) in Japanese quail. Similarly, repeatability estimates (0.802 and 0.450) for egg length and width respectively are lower than 0.95 and 0.77 reported by Akpa *et al.* (2006).

Table 1: Repeatability estimates of egg production traits of Japanese quails

Traits	Repeatability (R ± SE)
Egg number	0.544 ± 0.112
Egg mass	0.569 ± 0.108
Hen-day egg production	0.547 ± 0.111

Table 2: Repeatability estimates of egg quality traits of Japanese quails

Traits	Repeatability (R ± SE)
Egg weight	0.531 ± 0.077
Egg Length	0.802 ± 0.046
Egg width	0.450 ± 0.079
Shell Thickness	0.810 ± 0.044
Yolk Height	0.619 ± 0.071
Yolk Width	0.466 ± 0.079
Yolk Length	0.756 ± 0.053
Albumen Height	0.564 ± 0.075
Albumen Length	0.453 ± 0.079
Albumen Width	0.601 ± 0.072
Shape Index	0.469 ± 0.079
Yolk Index	0.743 ± 0.055
Albumen Index	0.483 ± 0.079
Haugh Unit	0.845 ± 0.037

Repeatability of shell thickness (0.810) is similar to 0.85 obtained by Sooncharenying and Edwards (1989) but higher than 0.40 and 0.67 by Ingram *et al.* (1989) and Akpa *et al.* (2006). Albumen related traits; albumen height, width and index had repeatability estimates (0.564, 0.601 and 0.483) which are lower than 0.96, 0.76 and 0.98 obtained by Akpa *et al.* (2006). On the other hand, repeatability of Haugh unit (0.845) was higher than 0.71 reported by the same authors. Generally, yolk related traits are highly repeatable compared with the albumen related traits. This suggests that more gain would be made when selection is made on albumen related traits. With the exception of egg length and shell thickness, external traits had lower repeatability estimates than internal and this is an indication of low maternal influence on these traits. Differences in reported estimates of repeatability for Haugh unit by various authors could be a reflection of the differences in species, breeds, ages of birds used and various environmental factors affecting the experimental animals (Akpa *et al.*, 2006).

CONCLUSION

Repeatability estimates for egg production and egg quality traits of Japanese quail were generally moderate to high indicating that fewer records would be required to characterize the inherent transmitting ability of laying hens. This would save cost and time of collecting additional data. In addition, the external egg quality traits were less repeatable than their corresponding internal traits, an indication of low genetic influence on the traits. Thus, selection for improvement on these traits (external egg quality traits) would yield higher genetic gain.

CONFLICT OF INTEREST

The authors declare that there is no known conflict of interest as regards the conduct of this study and the data reported in this work.

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