Scientific Journal of Biological Sciences (2014) 3(6) 69-72
ISSN 2322-1968
doi: 10.14196/sjbs.v3i6.1538

Contents lists available at Sjournals
Scientific Journal of
BiologicalSciences
Journal homepage: www.Sjournals.com

Original article

Genetic correlation between egg quality traits

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ARTICLE INFO

Article history,
Received 06 May 2014
Accepted 28 May 2014
Available online 26 June 2014

Keywords,
Correlation
Egg quality traits
Genetic gain and selection

ABSTRACT

Genetic correlation coefficients between egg quality traits were studied using fifty- six harco pullets raised under standard management practices. The estimates were carried out at 22-week, 26-week, 30-week and 32-week of age. Egg quality traits studied include egg weight (EW), shell thickness (ST), haugh unit (HU), yolk index (YI) and shape index (SI). Zero to slight negative correlation coefficients was observed between EW and HU, EW and YI, EW and SI, ST and SI, and HU and YI. This implies that selection for any of the character entails minimal retrogressive response on corresponding trait. Conversely, zero to slight positive correlation coefficients was recorded between EW and SI, SI and YI, and HU and SI. Again, selection for any of this character will bring about a slight genetic gain on the corresponding trait. Furthermore, the study maintained that the genetic correlation coefficients between egg quality traits are independent of the laying age, and for faster genetic response in egg quality traits, independent culling method. Again, since genes governing the expression of these egg quality traits appear to be independent of each other, it is possible to localize, isolate and intersperse these genes simultaneously in foundational poultry lines using biotechnological tools for faster genetic gain.

1. Introduction

As early as 1900, egg number and egg quality have become important parameters for poultry breeding and in poultry industry. Increasing interest in egg quality especially in the developed world has resulted in numerous indices for characterizing egg quality. Several factors related to egg quality such as egg size, shell thickness, haugh unit, shape index as well as egg number and number of blood spots are known to have heritable basis, and medium to high repeatability (Okonkwo and Ibe, 1994; Ibe and Okonkwo, 1994). Egg production accounts for roughly 90% of variations in economic return to farmers, and therefore occupies an outstanding position in poultry breeding (Chatterjee et al. 2007a; Sharma et al., 2006). It is a measure of the number of eggs produced by a hen or flock in a specified time interval, preferably under a defined environmental conditions and expressed either as hen-day or hen house percentage. Though negative genetic and phenotypic correlations exist between egg number and egg weight, sometimes, the total weight of eggs produced in a defined interval (egg mass) is used to access the egg production. Generally, there is a positive correlation between body weight, feed consumption, sexual maturity and egg weight. Also, negative genetic correlation exists between body weight and egg production, although positive environmental correlation exists between egg weight and egg production (Parmar et al., 2006; Chatterjee et al. 2007a). So, what is desirable in economic ground is contrary to the direction of selection.

Though a number of studies have been carried out to determine the percentage heritability and repeatability of some egg quality traits (Hartmann et al., 2002; Parmar et al., 2006; Padhi et al., 1998; Sakunthaladevi and Reddy, 2004; Wani et al., 2007; Singh et al., 2000) and other aspects of egg quality traits (Ledur et al., 2000; Chatterjee et al., 2006; Chatterjee et al., 2007b; Szwaczkowski et al., 2000), there is scarcity of information on the relationship between these egg quality traits which will enable poultry breeders in selection for faster genetic gain. This study therefore was designed to provide this useful information. The information reported in this study may be appropriated in application of biotechnology in improving egg quality characteristics.

2. Materials and methods

Fifty-six day old Harco chicks constituted the experimental subjects. They were brooded under standard management practices for four weeks in deep litter system, and 0.91m2 floor space was provided per chick. Continuous light and constant temperature of 35 0C were maintained. The chicks were vaccinated against Newcastle disease. Feeding and management were uniform during the six weeks. Ad libitum feeding was practiced during this period with conventional feed mash. The feeding spaces of 11.5cm and 14.1cm were provided per bird at 1-4 weeks, and 4-6 weeks, respectively. Drinking space of 5.4cm was also provided. At six weeks, the feeder and watering spaces were increased to 18.4cm and 13.73cm per bird all through the rearing period.

At twenty weeks of age, the pullets were transferred into battery cages where they were housed individually to minimize spatial environmental differences and to ensure uniform feeding, watering and management practices.

2.1. Data collection and analysis

Eggs were picked daily between 1400 hours and 1500 hours, identified and recorded against the particular hen. Thirty week egg production and twenty-two, twenty-six, thirty and thirty-two weeks egg quality traits namely; egg weight, shape index, haugh unit, and yolk index and shell thickness were determined using the first three eggs laid during the week. The total number of eggs laid per week constitutes a record for egg number of a hen.

Egg weights were obtained using Metter P.163 electric weighing balance of 160 grammes capacity. Shape index was calculated as the ratio of egg width to its length. While the egg length was taken as the distance between the broad and the narrow ends, the width was taken as the widest cross-sectional region of the egg. Both the length and the width were determined using venier calipers. Haugh unit was obtained using United State Department of Agriculture (USDA) interior egg quality calculator, which relates egg weight to the albumen height. Yolk index was calculated as the ratio of the yolk width to the height of the yolk. Graduated venier caliper and micro-meter screw gauge were used to measure the width and the height of the yolk, respectively. The shell minus membrane thickness of an egg was taken as the average of three measurements taken around the middle of the dried shell, with membrane removed. A paper-thickness gauge was used for the measurement.

2.2. Statistical procedure

Harvey (1990) mixed model least squares and maximum likelihood computer programme was used to obtain the various correlation coefficients between the various traits.

3. Result

The correlation coefficients between egg quality traits at 22, 26, 30 and 32 weeks of age are given in Table 1.

Table 1
Genetic correlation coefficients between egg quality traits at 22, 26, 30 and 32 weeks of age.

Traits		22-Week	26-Week	30-Week	32-Week
EW	ST	0.08	0.04	0.16	0.05
EW	HU	0.03	0.06	-0.04	-0.23
EW	YI	-0.08	-0.03	-0.04	-0.08
EW	SI	-0.05	-0.18	0.04	-0.02
ST	HU	-0.16	-0.14	-0.01	-0.04
ST	YI	0.00	0.13	0.16	-0.14
ST	SI	-0.08	-0.20	-0.01	-0.18
HU	YI	-0.29	-0.17	-0.24	-0.21
HU	SI	0.03	0.31	0.11	0.20
YI	SI	-0.08	-0.12	-0.13	-0.07

0.04 to 0.16 correlation coefficient of was observed between egg weight and shell thickness, while the range of -0.23 to 0.03 was observed between egg weight and haugh unit. Negative correlation coefficient ranges of 0.08 to 0.03, 0.16 to 0.01, 0.20 to 0.01 and 0.29 to 0.17 were observed between EW and YI, ST and HU, ST and SI, and HU and YI, respectively. Genetic correlation coefficients of -0.20 to 0.04, -0.14 to 0.00, 0.03 to 0.31, and -0.12 to 0.13 were recorded between EW and SI, ST and YI, HU and SI, and YI and SI, respectively.

4. Discussion

The genetic correlation coefficients obtained in this study between various egg qualities traits were low. Okonkwo and Ibe (1994), Ibe and Okonkwo (1994) and Niranjan et al. (2008) reported similar results working with different breeds of poultry. This implies that selection or breeding for a particular egg quality trait exhibits infinitesimal effect on other egg quality traits.

As laying age advanced (from 22-week to 32-week), the genetic correlation between egg quality traits remained fairly constant, and changes in numerical values did not follow any definite pattern. This indicates that laying age has no meaningful effect on the correlation between egg quality; consequently, selection for egg quality traits may be done in 22 weeks of age with high accuracy.

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