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ORIGINAL ARTICLE

Effect of storage period and strain of layer on internal and external quality characteristics of eggs marketed in Riyadh area

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Abstract The study was undertaken to compare the effect of storage period on external and internal quality traits of brown and white shelled eggs produced by commercial layers and marketed in Riyadh area. Two trays each containing 30 eggs from each egg color were randomly collected from supermarket, three times at different time intervals. The eggs of each collection were randomly divided into three groups of 20 eggs. The different egg groups were individually weighed and stored in refrigerator for 0, 10 and 20 days at 7 °C and 60% relative humidity. Egg air cell depth (AC), shape index (SI) and specific gravity (SG) were measured for all of the eggs in each group. Blood (BS) and meat (MS) spots, Haugh unit values (HU), yolk color grade (C), shell weight (SW), shell thickness (ST), egg surface area (SA), shell density (SD) and shell weight per unit of egg surface area (SWUSA) of each individual eggs were measured. The results shows that white shell eggs had significantly higher weight, surface area and lower shape index and blood spot incidence. Storage period had a significant ($P < .05$) adverse effect upon Haugh unit values, specific gravity, air cell depth and shell thickness but a positive effect upon shell density and shell weight per unit of surface area of brown and white shelled eggs but Haugh unit values of white shelled eggs were more adversely affected by prolonged storage period. In conclusion, results showed that brown and white shelled

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eggs stored for 20 days at 7 °C and 60% relative humidity still maintain relatively good internal quality characteristics for human consumption.

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1. Introduction

It is well-known that external and internal egg quality traits have a genetic basis and can be also affected by non-genetic factors. Stadelman (1977) has defined egg quality as the characteristics of an egg that affect its consumer's acceptability. Egg quality has been considered the most important price contributing factors in table and hatching eggs. Therefore, the economic success of a laying flock solely depends on the total number of quality eggs produced. Shell and egg quality characteristics have been shown to be influenced by genotype and age. Several investigators reported significant genotype differences with respect to egg weight (Anderson et al., 2004; Monira et al., 2003; Alsobayel et al., 1991, 2003; Harms and Hussein, 1993; Hussein et al., 1993; Arafa et al., 1982), shell thickness (Curtis et al., 1985a; Doyon et al., 1980; El-Deek et al., 1985; Hassanin, 1990; Harms and Hussein, 1993; Pandy et al., 1988; Monira et al., 2003), egg surface area (Hassanin, 1990; Anderson et al., 2004; Alsobayel et al., 2003), shell weight per unit of surface area (Curtis et al., 1985a; Hassanin, 1990; Arad and Mader, 1982; Alsobayel et al., 2003) and shape index (Arad and Mader, 1982; Anderson et al., 2004; Monira et al., 2003; Arafa et al., 1982) but shell density (Hassanin, 1990; Alsobayel et al., 2003) and specific gravity (Anderson et al., 2004) were not affected by genotype. Shell thickness (Hassanin, 1990; Arafa et al., 1982; Izat et al., 1985; Alsobayel et al., 1991), shell weight per unit of surface area (Hassanin, 1990; Arad and Mader, 1982; Izat et al., 1985) and shell density (Hassanin, 1990) decreased with advancing age, whereas egg surface area increased (Hassanin, 1990; Sauter et al., 1981). However Izat et al. (1985) reported no significant age effect upon shell weight per unit of surface area and shell density. Genotype differences were also found by several investigators with respect to Haugh unit values (Doyon et al., 1980; Hassanin, 1990; Campos and Ferreira, 1981; Renden et al., 1984; Curtis et al., 1985b; Alsobayel et al., 2003; Monira et al., 2003), yolk color (Hassanin, 1990; Kumar et al., 1971; Alsobayel et al., 2003) and blood and meat spots (Aitken et al., 1973; Proudfoot and Gowe, 1973; Alsobayel et al., 2003). On the other hand, Hassanin (1990) did not find genotype differences with respect to blood and meat spots. Similar results were found by Prasad et al. (1982) and Hamilton (1978) with regard to yolk color and blood and meat spots, respectively. Haugh unit values decreased with advancing age (Alsobayel et al., 1991; Hill and Hall, 1980; Hamilton and Sibbald, 1980; Izat et al., 1983; Sang et al., 1983; Lapao et al., 1999), whereas yolk color and meat spots were also affected by age (Hassanin, 1990) and also blood spots as reported by Alsobayel et al. (1991). Storage time had a significant effect upon egg weight, shell thickness, shape index, (Monira et al., 2003), albumen height and Haugh unit (Monira et al., 2003). Similarly found Lapao et al. (1999) with respect to Haugh unit. However, very sparse informations are available on external and internal quality traits of commercial eggs produced locally and little informations published with respect to the effect of storage period on their external and internal quality. Therefore the study was conducted to compare and to assess the effect of storage period on external and internal quality traits of brown and white eggs produced by commercial layers raised under local conditions and marketed in Riyadh area.

2. Materials and methods

A total of 360 brown and white shell eggs were used in this study. Two trays each containing 30 eggs from each egg color were randomly collected from supermarket, three times at different time intervals. The eggs of each collection were randomly divided into three groups of 20 eggs and each group was considered as replicate. The different egg groups were individually weighed to the nearest .01 g and stored in refrigerator for 0, 10 and 20 days at 7 °C and 60% relative humidity. Egg group stored for 10 and 20 days were reweighed and egg air cell depth (AC) was measured in millimeter, using candling light and thin plastic ruler for all of the eggs in each replicate. For egg quality characteristics study, eggs in each replicate of each eggshell color, were broken-out and the presence of blood (BS) and meat (MS) spots visually determined. Haugh unit values (HU) (Haugh, 1937) were directly estimated using micrometer adjustable to egg weight and directly gives Haugh unit value (USDA, 2000). Yolk color (YC) was measured by Roch Color Scale which has 15 color gradation from very pale to deep yellow (North and Bell, 1990). The shell was washed carefully to remove albumen, and dried at 21–24 °C for 24 h and individually weighed (SW) to the nearest .01 g. Shell thickness (ST), expressed in mm × 10 was obtained at three locations, middle and both side of each egg with membrane using dial touch micrometer.

Egg surface area (SA) in cm^2 was calculated for each egg using the following equation suggested by Nordstrom and Qusterhout (1982):

$$SA = 3.9782 \times \text{egg weight}^{0.7056}$$

Shell density (SD) in g/cm^2 was estimated for each egg using the following equation (Curtis et al., 1985a):

$$SD = SW(g)/SA(cm^2) \times ST(cm)$$

Shell weight per unit of surface area (SWUSA) was also determined using the following equation (Nordstrom and Qusterhout, 1982):

$$SWUSA = \text{shell weight}(mg)/\text{surface area}(cm^2)$$

Specific gravity (SG) was measured by method of Archimedes according to the following equation: SG = (weight of air)/(difference between weight of air and water) (North and Bell, 1990, p. 289).

Data obtained were subjected to statistical analysis using the General Linear Models procedures of SAS Institute (SAS, 1998) using the following statistical model:

$$Y_{ijk} = \mu + B_i + S_j + BS_{ij} + e_{ijk}$$

where Y_{ijk} is the kth observation of the ith breed (B), jth storage period. BS_{ij} is the interaction between breed and storage

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