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Effect of strain and storage period on egg quality characteristics of local Iraqi laying hens

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Abstract

This experiment was conducted to study the effect of strains of local hens and egg storage period at temperature (25°C) on egg quality traits. Twenty chickens of each genotype were kept in family pens and randomly distributed into two replicates. Nine eggs from each line were evaluated for external and internal egg quality. The correlations between external and internal egg quality traits were calculated; as well the regression of the traits on storage period was computed. The overall mean of egg weight (EW), egg index (EI), haugh unit (HU), albumin (AP) and yolk (YP) percentages were 58.44 (g), 1.31%, 77.67%, 55.22% and 29.26% respectively. The differences between lines were significant (P<0.01) in EW and EI, while the differences in HU were significant due to storage period only. Differences in EW and EI due to the interaction between lines and storage period were significant, while the differences in HU were significant only between line (3) and (4) at storage period (1 day). It was shown that the differences between lines in albumin (AP) and yolk (YP) percentages were significant. Storage period has no effect on AP, whereas the differences were significant in YP. Also the differences in AP and YP due to the interaction between lines and storage periods were significant. Values of correlation ranged between -0.61 (P<0.01) between EI and AP and 0.44 (P<0.01) between EW and AP. A non-significant regressions on storage period for all lines were -0.09, -0.01, -0.47, -0.16 and 0.07 for EW, EI, HU, AP and YP respectively. Values of the regression on storage period calculated for each line were not significant except of AP in line 3 (-0.62) which indicated that the increase in storage period will decrease AP significantly (P<0.01). It can be concluded that the quality of egg may be affected by lines and length of storage period.

Keywords: Poultry Strains, Storage Period, Egg Quality

Introduction

Several chemical and physical modifications occur inside an egg during the storage period including thinning of the albumen and flattening of the yolk. Egg as a food product is subject to damage and its quality can be lost rapidly during the period between the storage and consumption being affected by environmental conditions such as temperature, moisture and storage period (Decuypere et al., 2001). Scott and Silversides (2000) reported that longer periods of storage resulted in lower albumen weight and albumen height Similar results were observed using brown Hy-line and white Hy-line hens (El-Sheikh and Younis, 2005).

Pandey et al. (1986) and Tumova et al. (2007) showed that strain and genotype significantly affected the egg shape index, yolk and albumen quality and yolk index. Zita et al. (2009) reported that genotype also affected mainly egg weight. Some of the authors have also shown correlation between egg weight and egg quality parameters including yolk percentage, yolk weight and albumin weight (Hartmann et al., 2000; Zhang et al., 2005).

This research aims to compare and evaluate some qualitative traits of eggs in Isa Brown and four local strains of laying hens (Line 1 = Black with Brown Neck, Line 2 = Isa Brown, Line 3 = White, Line 4 = Spotty, Line 5 = Pure Black) as well as the effect of different storage periods on studied traits.

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Materials and Methods

The present study was conducted at Hawler Research Station–Directorate of Agricultural Research-Erbil to study the effect of local chicken strains and storage temperature (25°C) on egg quality characteris- tics. Twenty chickens of each genotype were kept in family pens and randomly distributed into two replicates. A total number of 45 eggs were collected randomly, from each line and were divided into three groups according to storage period (1, 7 and 14 days) for the evaluation of some external and internal egg quality characters. The eggs were numbered and weighed on a sensitive scale to the nearest 0.1 g. The width and length of each egg were measured to determine egg shape index. Each egg was broken out on a table and its contents poured into a flat plate in order to measure the yolk height and diameter and albumen height. The yolk was separated from the albumen and then weighed, while the albumen weight was detected by subtracting the weights of yolk and eggshell from egg weight.

External and internal quality characters of the egg were estimated using the following formula of Singh and Panda (1987).

Egg shape index = length (cm)/width (cm),

Albumen%= [albumen weight (g)/egg weight (g)] x100,

Yolk % = [yolk weight (g) /egg weight (g)] x100,

Haugh unit (H U) = 100 log (H + 7.57 – 1.7w $^{0.37}$) (Haugh, 1937)

Statistical Analysis

Data were analyzed by using the general linear models procedure (SAS, 2005). Duncan Multiple Range Test (Duncan, 1955) was used to test the significant differences between the means of the levels of each factor. The correlations between external and internal egg quality characteristics were detected by simple correlation and regression methods.

Results and Discussion

The overall mean of egg weight was 58.44 gm (Table 1) and it was heavier than that found by Ali (2010) and Al-Rikabi (2000) using Isa Brown and Lohman White. Table (1) showed significant differences between lines in their egg weights, in which the egg weight produced from lines 1 and 4 were heavier than those from lines 2, 3 and 5. Several studies reported significant differences in egg weights between breeds, strains and lines (Monira et al., 2003; Silversides et al., 2006; Zita et al., 2009; Ali, 2010). It was noticed that storage period did not affect egg weight significantly on day 1, 7 and 14 (Table 1). Also Samli et al. (2005) and Ali (2010) did not found significant effect of storage period on egg weight. On the other hand, Silversides and Scott (2001), Monira et al. (2003) and Jones and Musgrove (2005) found significant decrease in egg weight with increasing storage period in several breeds and strains. The interaction between lines and storage period affect egg weight significantly, where egg weight in Line 3 and 5 decreased significantly with increasing storage period from 1 day to 7 and 14 days (Table 1) which is consistent with the results of Ali (2010) who found significant effect of the interaction between strain and storage period.

Table 1: Effect of lines, storage periods and their interaction on egg weight, egg index and Haugh unit of eggs

Effects	No.	Egg Weight (g)	Egg Index	Haugh Unit %
Overall mean	45	58.44 ± 0.93	1.31 ± 0.01	77.67 ± 1.47
Lines				
Line 1 (L1)	9	64.59 ± 1.39^{a}	1.29 ± 0.02^{b}	77.19 ± 3.41^{a}
Line 2 (L2)	9	55.97 ± 1.36^{b}	1.30 ± 0.01^{b}	80.32 ± 2.27^{a}
Line 3 (L3)	9	54.47 ± 2.02^{b}	1.38 ± 0.02^{a}	71.39 ± 3.48^{a}
Line 4 (L4)	9	61.64 ± 1.91^{a}	1.28 ± 0.02^{b}	81.16 ± 3.93^{a}
Line 5 (L5)	9	55.52 ± 1.62^{b}	1.32 ± 0.01^{b}	78.30 ± 2.78^{a}
Storage Period				
1 day	15	59.69±1.19^{a}	1.32±0.01^{a}	82.39±2.80^{a}
7 day	15	57.20±1.85^{a}	1.32±0.02^{a}	74.63±2.79^{b}
14 day	15	58.42±1.77^{a}	1.30±0.01^{a}	75.99±1.51^{b}
Interaction				
L1 X 1 day	3	64.43±2.90^{a}	1.29±0.04^{bc}	87.22±3.47^{ab}
L1 X 7 day	3	63.67±2.95^{abc}	1.33±0.05^{abc}	72.03±5.59^{ab}
L1 X 14 day	3	65.67±2.32^{a}	1.26±0.02^{c}	72.31±4.56^{ab}
L2 X 1 day	3	57.97±2.58^{abcde}	1.32±0.02^{abc}	84.17±5.09^{ab}
L2 X 7 day	3	53.87±2.39^{cde}	1.29±0.04^{bc}	78.30±3.61^{ab}
L2 X 14 day	3	56.07±2.35^{abcde}	1.29±0.01^{bc}	78.50±3.41^{ab}
L3 X 1 day	3	59.40±0.11^{abcde}	1.36±0.02^{abc}	68.71±0.49^{b}
L3 X 7 day	3	51.80±4.36^{e}	1.40±0.04^{a}	70.06±7.42^{ab}
L3 X 14 day	3	52.20±3.41^{e}	1.38±0.05 ab	75.40±1.58^{ab}
L4 X 1 day	3	58.17±3.64^{abcde}	1.31±0.02 abc	88.21±9.01^{a}
L4 X 7 day	3	62.93±4.15^{abcd}	1.25±0.02 c	76.45±7.68^{ab}
L4 X 14 day	3	63.83±1.94^{ab}	1.29±0.04 bc	78.81±2.45^{ab}
L5 X 1 day	3	58.50±2.57^{abcde}	1.31±0.02^{abc}	83.65±5.53^{ab}
L5 X 7 day	3	53.73±2.40^{de}	1.34±0.02^{abc}	76.33±4.05^{ab}
L5 X 14 day	3	54.33±3.49^{bcde}	1.30±0.02^{abc}	74.93±4.91^{ab}

$^{a-e}$Means of in each column with different letters differ significantly(P<0.05)

Egg shape index averaged 1.31 (Table 1). Line 3 recorded significantly higher egg index (1.38) than all other lines, while the storage period didn't affect egg index. The differences in egg index due to the interaction between lines and storage period were significant (Table 1). This result could be attributed to the genotype effect of each group (Tumova et al., 2007).

Average Haugh Unit fell within the preferred range (72-100) mentioned by many researchers (Izat et al., 1985; Lapao et al., 1999). Haugh Unit decreased significantly from 82.39 at one day storage to 74.63 and 75.99 at 7 and 14 days of the storage (Table 1). Earlier studies reported that increasing storage period decreased Haugh Unit significantly in different breeds and strains (Tona et al., 2004; Jones and Musgrove, 2005; Akyurek and Okur, 2009; Ali, 2010). Differences between line 3 and 4 at one day of egg storage were significant, while the differences between the values of the interaction were not significant (Table 1). These results disagree with earlier studies indicating significant effect of the interaction between breed and storage period on Haugh unit (Monira et al., 2003; Ali, 2010).

The percentages of albumin and yolk percentages reported in this study averaged 55.22 and 29.26 %

Table 2: Effect of lines and storage period on albumin and yolk percentage of eggs

Effects	No.	Albumin %	Yolk %
Overall mean	45	55.22±0.53	29.26±0.38
Lines			
Line 1 (L1)	9	55.04±1.25[ab]	29.18±0.74[b]
Line 2 (L2)	9	55.20±1.29[ab]	28.39±0.97[b]
Line 3 (L3)	9	53.20±1.37[b]	29.68±0.76[ab]
Line 4 (L4)	9	58.02±0.53[a]	27.45±0.29[b]
Line 5 (L5)	9	54.63±0.91[b]	31.61±0.79[a]
Storage Period			
1 day	15	56.24±0.88[a]	28.32±0.64[b]
7 day	15	55.29±0.92[a]	30.17±0.62[a]
14 day	15	54.13±0.94[a]	29.29±0.67[ab]
Interaction			
L1 X 1 day	3	57.39±1.51[a]	27.05±0.11[c]
L1 X 7 day	3	53.36±2.82[ab]	30.25±1.11[abc]
L1 X 14 day	3	54.37±2.05[ab]	30.24±1.38[abc]
L2 X 1 day	3	53.64±3.57[ab]	27.55±1.37[bc]
L2 X 7 day	3	55.79±1.81[a]	30.48±1.67[abc]
L2 X 14 day	3	56.17±1.45[a]	27.12±1.80[c]
L3 X 1 day	3	56.73±0.08[a]	28.11±0.14[abc]
L3 X 7 day	3	54.11±2.33[ab]	30.63±1.51[abc]
L3 X 14 day	3	48.76±0.69[b]	30.29±1.65[abc]
L4 X 1 day	3	57.33±1.10[a]	27.02±0.27[c]
L4 X 7 day	3	59.19±1.01[a]	27.56±0.70[bc]
L4 X 14 day	3	57.54±0.27[a]	27.77±0.58[abc]
L5 X 1 day	3	56.10±2.46[a]	31.86±2.02[ab]
L5 X 7 day	3	53.98±0.68[ab]	31.95±1.31[a]
L5 X 14 day	3	53.81±1.38[ab]	31.03±1.25[abc]

Means of same factor in each column with different letters differ significantly (P<0.05) using Duncan (1955).

Table 3: Simple correlation coefficient between studied traits

	Egg Index	Haugh unit	Albumin %	Yolk %
Egg weight	-0.52**	-0.16	0.44**	-0.54**
Egg Index		-0.10	-0.61**	0.37*
Haugh unit			0.14	-0.02
Albumin %				-0.48**

Table 4: Simple regression coefficient (b) of studied traits on storage period

Traits	All lines	Line 1	Line 2	Line 3	Line 4	Line 5
Egg weight	-0.09	0.10	-0.13	-0.54	0.43	-0.31
Egg Index	-0.01	-0.01	-0.01	0.01	-0.01	-0.01
Haugh unit	-0.47	-1.11	-0.42	0.52	-0.69	-0.66
Albumin %	-0.16	-0.22	0.19	-0.62**	0.01	-0.17
Yolk %	0.07	0.24	-0.05	0.16	0.06	-0.07

respectively (Table 2). Ali (2010) using Isa Brown and Lohman White revealed a higher albumin (67.74%) and lower yolk (22.13%) percentages. Cunningham et al. (1960) noticed that albumin percentage in large eggs was higher than that in small eggs. The differences between lines for albumin percentage and yolk percentage were significant. Line 4 recorded higher albumin percentage while the line 5 recorded higher yolk percentage (Table 2). Earlier studies found significant differences in these parameters in different breeds and strains (Silversides and Scott, 2001; Akyurek and Okur, 2009; Ali, 2010).

Different storage period did not affect albumin percentage significantly, whereas the differences were significant in yolk percentage (Table 2). Scott and Silversides (2000) and Silversides and Scott (2001) noticed that increasing storage period will decrease albumin percentage and increase yolk percentage significantly, whereas Ali (2010) found that storage period affected albumin percentage significantly but not yolk percentage. It was found that the differences in both traits due to the interaction between lines and storage periods were significant (Table 2). Scott and Silversides (2000) and Ali (2010) didn't found any significant effect for the interaction between breeds and storage period in both traits. The result of this study could be due to the differences in storage conditions comparing to earlier studies.

It was shown from Table (3) that the values of correlation were (-0.61) (P<0.01) between egg index and AP and (0.44) (P<0.01) between egg weight and AP. Several studies reported a significant correlation between egg weight and its components (Hafez et al., 1954; Scott and Silversides, 2000; Silversides and Scott, 2001; Ali, 2010).

Regression coefficient of each trait on storage period was calculated for all lines and for each line (Table 4). The values of regression for all lines arranged between -0.47 and 0.07 for HU and YP respectively and were not significant. Also for each line, the values of the regression on storage period were insignificant except the regression of AP (-0.62) which indicated that increasing storage period will decrease AP significantly (P<0.01). This is because these losses cause mucin fibre to loss their structure and so the albumen and yolk becomes watery (Mountney, 1976). The general decline in albumen quality as eggs aged is in agreement with the findings of Monira et al. (2003) and Miles and Henry (2004). It can be concluded that the quality of egg may be affected by lines and length of storage period.

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