Minufiya J. Agric. Res. Vol.35 No. 1:105-126 (2010) "http://agri.menofia.edu.eg/megla.html"

THE INTERACTION EFFECT AMONG AGE OF LAYER, STRAIN OF CHICKEN AND YEAR OF LAYING ON INTERNAL EGG QUALITY TRAITS

G. M. Gebriel[(1)], M.E. Soltan[(1)], F. H. Abdou[(1)], M. F. Amer[(2)], A.H.A. Essa[(1)] and Samia M.M Mahgoub[(1)]

[(1)]Faculty of Agric. Minufiya Univ. Egypt

[(2)] Faculty of Agric. Ain-Shams University

(Received: Nov. 16, 2009)

ABSTRACT : ***The present study was conducted to compare the internal egg quality traits in two local developed strains (Sinai and Norfa) with two foreign commercial strains (Lohman Selected Leghorn and Lohman Brown) of chicken at sexual maturity, 32, 42, 52 and 62 – wk of age for two consecutive laying years. The results were summarized as follows.***

1. ***Comparison of local versus foreign strains : It was found that foreign strains (L.S.L. and L.B.) had significantly higher values of yolk weight, yolk index, albumen weight, albumen %, albumen height, Haugh units and lower yolk %, yolk color, and yolk : albumen % as compared to local strains (S. and N.).***
2. ***Effect of layer age : It was found that yolk weight, yolk %, albumen weight and yolk : albumen % were increased and lower values of yolk index, yolk color, albumen %, albumen height and Hauh units with advancing age of layer.***
3. ***The interaction effect : The interaction effects between age and strain, age and laying year, strain and laying year or among age, strain and laying year were significant ($P \leq 0.05$) or highly significant ($P \leq 0.01$) for most internal egg quality traits studied.***
4. ***Conclusion : Since, yolk and albumen weights were higher in old layer hens, it may be more beneficial for egg producers and processors to use young hens (32 – 42 wk. old) for table egg production and birds of old age (52 – wk. old or more) for liquid egg production.***

Key words: **Chicken strain, age, year of laying, Internal egg quality traits.**

INTRODUCTION

Egg quality had been defined as the characteristics of an egg that had acceptability to the consumer's. Therefore, the economical success of a laying flock sololy depends on the total number of quality eggs produced (Monira *et al.*, 2003). It is of great importance to produce eggs with high quality in order to sell them at high prices which will cover all production costs and to provide some profit. But now with respect to GAT rules for tradition, quality of eggs is very important in determining the price of eggs.

Commercial poultry farms must develop their productive process to produce eggs with high quality trait in order to face the new rules of GAT (FAO, 1997).

There has been an increasing proportion of eggs broken out for liquid whole egg, liquid albumen, liquid yolk and dried egg products in recent years (Ahn *et al.,* 1997). With this trend, processors have become more concerned about the factors that affect the internal egg quality traits. The age of layer can affect internal egg quality traits and its solids because egg weight increases with advancing age of layers (Suk and Park, 2001). Therefore, the aim of the present experiment is to study the interaction effect among age of layer, strain of chicken and year of laying on internal egg quality traits in chicken eggs.

MATERIALS AND METHODS

The present study was carried out at the poultry Research Farm, Department of Poultry Production, Faculty of Agriculture at Shibin El-Kom, Minufiya University, Egypt. The experiment started from December, 2004 to May, 2007.

1. Chicken stock :

Two local improved strains of chickens, Sinai, (Soltan, 1985) and Norfa, N (Abdou, 1996) and two foreign commercial strains, Lohman selected Leghorn (L.S.L.) and Lohman Brown (L.B) were used in the present study.

2. Experimental design :

A total number of 293 and 337 one day old chicks in the first laying year and 290 and 334 in the second laying year were used in the present study from S. and N. strains, respectively. Also, a total number of 200 one day old female chicks from each of L.S.L and L.B. strain per each laying year were used in the present experiment. Internal egg quality traits were determined at five different ages of laying hens, including age at sexual maturity, 32, 42, 52, and 62 weeks of age for two consecutive laying years.

3. Experimental stock management :

All chicks were wing banded for identification at one day old. All chick were brooded in floor brooder for 6 to 7 weeks of age then, all chickens were moved to rearing house at 8-wks of age to 18-wks of age. At 18-wks of ags, chickens were individually housed in individual cages with increasing artificial light gradually to reach 16 – hrs light a day. All chickens were fed *ad libitum* during brooding and rearing periods on a diet contaning 21.98 and 15.87 % crude protein and 2721 and 2853 Kcal / Kg diet, respectively. At 18-wks of age, pullets were fed on a diet containing 17.46 % crude protein and 2769 Kcal ME / Kg diet throughout the experimental period. All chickens were vaccinated against diseases and were treated similarly during the experimental period.

4. Samples of eggs collected :

Samples of eggs were chosen at random. Each sample contains 20 eggs from each strain (Sinai, Norfa, L.S.L and L.B.), at each age for two consecutive laying years.

5. Studied traits and measurements :

5. 1. Yolk quality traits :

5.2. 1. Yolk weight (Y.W.) : Yolk weight was determined using electronic balance to the nearest 0.01 g.

5.1.2. Yolk percentage (Y %) : Yolk (%) was determined by the following equation.

$$Y\ (\%) = \frac{\text{Yolk weight (g)}}{\text{Egg weight (g)}} \times 100$$

5. 1.3. Yolk index (Y.I.) : Yolk index was determined by using the following formula according to Well (1968).

$$Y.I. = \frac{\text{Yolk height (mm)}}{\text{Yolk diameter (mm)}} \times 100$$

5. 1.4. Yolk color (Y.C.) : Yolk color was determined by using Roche color fan, as described by Carter (1968).

5. 2. Albumen quality traits :

5.2.1. Albumen weight (Al.W.) : Weight of albumen in grams was calculated by subtracting yolk and dried shell weight from total egg weight.

Al.W (g) = Egg weight –(Yolk weight + dried shell weight)

5.2.2. Albumen percentage (Al. %) : Albumen percentage was calculated by the following equation :

$$Al.\ \% = \frac{\text{Albumen weight (g)}}{\text{Egg weight (g)}} \times 100$$

5.2.3. Albumen height (Al.H.) : Albumen height was measured at half way between the yolk and the edge of the inner thick albumen by using an Ames.

5.2.4. Haugh units (H.U.) : Haugh units was calculated by using the following equation according to Haugh (1937).

$$H.U = 100 \log (H + 7.57 - 1.7\ W^{0.37})$$

Where : H is the albumen height in mm., W is the egg weight in grams and 7.57, 1.7 and 0.37 are constants.

5.2.5. Yolk : Albumen ratio (Y : Al %) : The ratio of yolk to albumen was calculated by the following equation :

$$Y : Al\ (\%) = \frac{\text{Yolk weight (g)}}{\text{Albumen weight (g)}} \times 100$$

6. Statistical analysis :

Data obtained were statistically analyzed using the SPSS PC (1997) computer programs. Duncan's Multiple Range Test was used for comparisons of means (Duncan, 1955). All percentages data were converted to the corresponding arcsine prior statistical analysis according to Snedecor and Cochran (1977). Data were computerized and analyzed by using the following model .

$$y_{ijkl} = \mu + A_i + S_j + Y_k + (AS)_{ij} + (AY)_{ik} + (SY)_{jk} + (ASY)_{ijk} + e_{ijkh}$$

Where

y_{ijkh} = observation of the (k) from A_i ages, S_j strain and Y_k year
μ = Overall mean
A_i = Fixed effect of (i) layer age
S_j = Fixed effect of (j) strain
Y_k = Fixed effect of (k) year
$(AS)_{ij}$ = Interaction effect of A_i and S_j
$(AY)_{ik}$ = Interaction effect of A_i and Y_k
$(SY)_{jk}$ = Interaction effect of S_j and Y_k
$(ASY)_{ijk}$ = Interaction effect of A_i, S_j and Y_k
e_{ijkl} = Residual effect

RESULTS AND DISCUSSION

1. Yolk quality traits :

1.1. Yolk weight (Y.W) :

It was found that the average of yolk weight was increased with advancing age of hen, which is equally dependent upon increasing egg weigh or increasing age of layers (Table 1). The average of yolk weight was 10.85 vs. 11.44, 12.34 vs. 12.54, 14.95 vs. 13.84, 15.95 vs. 14.09 and 15.62 vs. 15.03 g. in the first and second years of laying at sexual maturity, 32, 42, 52 and 62 weeks of age, respectively. Also, yolk weight was significantly affected by strains of chickens (Table 1). Eggs of local, Sinai and Norfa, strains had lower yolk weight than foreign, L.S.L and L.B, strains. The averages of yolk weight at 52 weeks of age were 15.65 vs. 13.06, 15.11 vs. 13.95, 16.35 vs. 15.20 and 16.68 vs. 14.16 g. in the first and second year of laying for Sinai, Norfa, L.S.L and L.B strains, respectively.

There were highly significant ($P \leq 0.01$) differences among ages of layers (A), strains of chickens (S) and years of laying (Y) in yolk weight. Also, highly significant ($P \leq 0.01$) differences were found with respect to the interactions between (A x S), (A x Y) and (A x S x Y), while, the interaction between (S x Y) was not significant. The present results are harmony with the observations reported by Fletcher *et al.* (1983), Hussein *et al.* (1993), Rossi and Pompei (1995), Scott and Silversides (2000), Silversides and Scott (2001) and Suk and Park (2001). They reported that increasing yolk weight was equally dependent upon increasing layer age or increasing egg weight and the effect of age of layer on the average of yolk weight was highly significant ($P \leq 0.01$).

Table (1) : Effect of layer age, strain and year of laying on yolk weight trait (means ± S.E)

Age (WK)	Strain	No. of eggs	Means ± S.E (g)*	
			1st year	2nd year
S.M.				
	Sinai	20	10.19 ± 0.27 ^{b}	11.39 ± 0.27 ^{b}
	Norfa	20	10.72 ± 0.27 ^{ab}	11.18 ± 0.27 ^{b}
	L.S.L	20	11.53 ± 0.27 ^{a}	10.80 ± 0.27 ^{b}
	L.B	20	10.98 ± 0.27 ^{ab}	12.29 ± 0.27 ^{a}
Total average		80	10.85 ± 0.13 D	11.41 ± 0.13 ^{D}
32 WK				
	Sinai	20	11.92 ± 0.27 ^{b}	12.60 ± 0.27
	Norfa	20	12.17 ± 0.27 ^{b}	12.24 ± 0.27
	L.S.L	20	11.86 ± 0.27 ^{b}	12.70 ± 0.27
	L.B	20	13.40 ± 0.27 ^{a}	12.64 ± 0.27
Total average		80	12.34 ± 0.13 ^{C}	12.54 ± 0.13 ^{C}
42 WK				
	Sinai	20	14.67 ± 0.27 ^{bc}	13.44 ± 0.27
	Norfa	20	14.37 ± 0.27 ^{c}	13.95 ± 0.27
	L.S.L	20	15.57 ± 0.27 ^{a}	14.40 ± 0.27
	L.B	20	15.18 ± 0.27 ^{ab}	13.57 ± 0.27
Total average		80	14.95 ± 0.13 ^{B}	13.84 ± 0.13 B
52 WK				
	Sinai	20	15.65 ± 0.27 ^{bc}	13.06 ± 0.27 ^{c}
	Norfa	20	15.11 ± 0.27 ^{c}	13.95 ± 0.27 ^{bc}
	L.S.L	20	16.35 ± 0.27 ^{ab}	15.20 ± 0.27 ^{a}
	L.B	20	16.68 ± 0.27 ^{a}	14.16 ± 0.27 ^{b}
Total average		80	15.95 ± 0.13 ^{A}	14.09 ± 0.13 ^{B}
62 WK				
	Sinai	20	15.16 ± 0.27 ^{b}	14.19 ± 0.27 ^{b}
	Norfa	20	14.98 ± 0.27 ^{b}	14.80 ± 0.27 ^{b}
	L.S.L	20	16.74 ± 0.27 ^{a}	16.21 ± 0.27 ^{a}
	L.B	20	15.60 ± 0.27 ^{b}	14.94 ± 0.27 ^{b}
Total average		80	15.62 ± 0.13 ^{A}	15.03 ± 0.13 ^{A}

* a,b,c = Means have the same superscript in each strain are not differ significantly at $P \le 0.05$

* A,B,C,D = Means have the same superscript in each layer age are not differ significantly at $P \le 0.05$

In addition, the present results are in good agreement with those reported by many investigators with respect to strain effect. Stino *et al.* (1982) found that yolk weight for white Baladi eggs ranged from 15.32 to 15.61 g., while, it was ranged from 16.77 to 17.09 g. for Fayoumi eggs. In foreign strains, Pandey *et al*. (1989) concluded that strains of White Leghorn had a significant effect on the weight of yolk. However, Soltan (1992) concluded that the average yolk weight for Sinai control eggs (13.6 g.) was the highest followed by Baladi (12.5 g) and Fayoumi (12.2 g). Moreover, Mahgoub (2002) found that yolk weight for untreated Sinai chickens (control) was 15.32 g.

1.2. Yolk percentage (Y. %) :

It was found that the effect of age of layers on yolk percentage had similar trend as yolk weight (Table 2). Yolk percentage was increased with advancing of layer age. The averages yolk percentage were 26.04 vs. 26.69, 27.44 vs. 27.25, 28.20 vs. 27.56, 29.32 vs. 28.22 and 28.34 vs. 29.07 % in the first and second years of laying at sexual maturity, 32, 42, 52 and 62 weeks of age, respectively. The percentage of yolk was affected by egg weight and the proportion of yolk is less in small eggs than in larger ones.

However, the yolk percentage of local strains usually was higher than those of commercial strains (Table 2). It was found that the yolk percentages of Sinai and Norfa strains were higher than that of L.S.L and L.B strains at any age of layers. The averages of yolk percentage were 28.08 vs. 28.65, 28.43 vs. 29.32, 24.36 vs. 23.82 and 23.29 vs. 24.97 % in the first and second years of laying at sexual maturity for Sinai, Norfa, L.S.L and L.B strains, respectively. Similar trend was observed for yolk percentage for Sinai, Norfa, L.S.L and L.B strains at all ages of layers in both first and second year of laying.

There were highly significant ($P \leq 0.01$) differences in yolk percentage among ages of layer (A) and among strains of chicken (S). While, the differences between years of laying (Y) were not significant. Also, highly significant differences were observed with respect to the interactions between (A x S) and (A x Y). While, insignificant differences were observed by (S x Y) and (A x S x Y) interactions.

The present results are supported the findings reported by Marion *et al.* (1966), Kaminska and Skraba (1991), Mohan *et al.* (1992) and Rossi and Pompei (1995). They cocluded that the increasing egg weight with increasing layer age was accompanied by increase in percentage of yolk. The present results are supported the results reported by Ezzeldin and El-Labban (1989) and Mahapatra *et al.* (1989). They found that eggs of local strains had higher percentage of yolk than the standard strains. The same results were reported by El-Sharkawy (1991), who found that yolk percentage for Fayoumi, Matrouh, L.S.L and Hisex which being 35.15, 32.56, 29.28 and 28.12 %, respectively.

Table (2) : Effect of layer age, strain and year of laying on yolk percentage trait (means ± S.E)

Age (WK)	Strain	No. of eggs	Means ± S.E (%)*	
			1st year	2nd year
S.M.				
	Sinai	20	28.08 ± 0.44 a	28.65 ± 0.44 a
	Norfa	20	28.43 ± 0.44 a	29.32 ± 0.44 a
	L.S.L	20	24.36 ± 0.44 b	23.82 ± 0.44 b
	L.B	20	23.29 ± 0.44 b	24.97 ± 0.44 b
Total average		80	26.04 ± 0.22 C	26.69 ± 0.22 D
32 WK				
	Sinai	20	29.75 ± 0.44 a	29.65 ± 0.44 a
	Norfa	20	30.64 ± 0.44 a	30.26 ± 0.44 a
	L.S.L	20	24.75 ± 0.44 b	25.12 ± 0.44 b
	L.B	20	24.62 ± 0.44 b	23.96 ± 0.44 b
Total average		80	27.44 ± 0.22 B	27.25 ± 0.22 CD
42 WK				
	Sinai	20	31.18 ± 0.44 a	29.76 ± 0.44 a
	Norfa	20	30.29 ± 0.44 a	29.98 ± 0.44 a
	L.S.L	20	27.00 ± 0.44 b	26.94 ± 0.44 b
	L.B	20	24.31 ± 0.44 c	23.57 ± 0.44 c
Total average		80	28.20 ± 0.22 B	27.56 ± 0.22 BC
52 WK				
	Sinai	20	32.22 ± 0.44 a	29.92 ± 0.44 a
	Norfa	20	31.35 ± 0.44 a	30.30 ± 0.44 a
	L.S.L	20	28.25 ± 0.44 b	27.50 ± 0.44 b
	L.B	20	25.47 ± 0.44 c	25.15 ± 0.44 c
Total average		80	29.32 ± 0.22 A	28.22 ± 0.22 B
62 WK				
	Sinai	20	31.75 ± 0.44 a	31.71 ± 0.44 a
	Norfa	20	30.01 ± 0.44 a	31.36 ± 0.44 a
	L.S.L	20	27.36 ± 0.44 b	27.97 ± 0.44 b
	L.B	20	24.24 ± 0.44 c	25.25 ± 0.44 c
Total average		80	28.34 ± 0.22 B	29.07 ± 0.22 A

*** a,b,c = Means have the same superscript in each strain are not differ significantly at $P \leq 0.05$**

*** A,B,C,D = Means have the same superscript in each layer age are not differ significantly at $P \leq 0.05$**

1.3. Yolk index (Y.I.) :

It was found that the yolk index has different values at different ages of layers, which were decreased with advance age of hen (Table 3). The percentages of yolk index were 45.70 vs. 46.53, 44.62 vs. 45.94, 44.00 vs. 45.26, 43.22 vs. 45.23 and 41.13 vs. 42.73 % in the first and second years of laying at sexual maturity, 32, 42, 52 and 62 weeks of age, respectively. Also, significant differences were observed among different strains of chickens, ranging from 39.82 to 44.90, 40.05 to 45.18, 42.25 to 46.99 and 42.38 to 48.31% for Sinai, Norfa, L.S.L and L.B strains during the two years of laying from sexual maturity to 62 weeks of age, respectively. The foreign commercial strains, L.S.L and L.B. had significantly higher yolk index percentages than the local, Sinai and Norfa, strains (Table 3). There were highly significant differences (P ≤ 0.01) among ages, strains and years of laying, as well as their interactions.

The present results are in good agreement with those reported by Shawer *et al.* (1991), premavalli and Viswanathan (2004) and Radwan (2007). They concluded that yolk index significantly decreased with progressive age of hen. However, the present results are in agreement with those reported by El-Sharkawy (1991) who concluded that Fayoumi eggs differed significantly from those of Matrouh, L.S.L and Hisex for yolk index, which being 0.403, 0.392, 0.377 and 0.379, respectively. In contrast, Mahapatra *et al.* (1989) reported that there were no significant differences for yolk index between native and farm – bred chickens and Soltan (1992) among Sinai control group, Baladi and Fayoumi.

1.4. Yolk color (Y.C.) :

The present results cleared that yolk color was decreased with age of layers (Table 4). The average scores of yolk color in the first year of laying were 5.11, 4.81, 4.72, 4.58 and 4.29 at sexual maturity, 32, 42, 52 and 62 weeks of age, respectively. Similar trend was observed in the second year of laying. Also, It was observed that the local strains, Sinai and Norfa, tend to have higher scores of yolk color than that of commercial strains, L.S.L and L.B, specially at 42, 52 and 62 weeks of age. The average scores of yolk color were 5.85 vs. 5.86, 5.76 vs. 5.80, 4.15 vs. 4.60 and 4.66 vs. 4.70 at sexual maturity in the first and second years of laying for Sinai, Norfa, L.S.L. and L.B strains, respectively (Table 4).

The statistical analysis of yolk color scores were highly significant (P ≤ 0.01) among ages of layers (A), strains (S) and between years of laying as well as their interactions. The present results support those reported by Mahapatra *et al.* (1989) who found that eggs of native chicken was higher for yolk color score than in farm – bred (White Leghorn and Red Cornish) chicken. Also, Goher *et al.* (1995) observed that yolk color score of local breeds was darker than that of foreign breeds, which being 8.6, 7.6, 6.5 and 6.3 for Silver Montazah, Matrouh, Rhode Island Red and White Leghorn, respectively.

Table (3) : Effect of layer age, strain and year of laying on yolk index trait (means ± S.E)

Age (WK)	Strain	No. of eggs	Means ± S.E (%)*	
			1st year	2nd year
S.M.				
	Sinai	20	44.90 ± 0.72 b	44.65 ± 0.72 b
	Norfa	20	45.15 ± 0.72 b	45.18 ± 0.72 b
	L.S.L	20	46.49 ± 0.72 a	47.99 ± 0.72 a
	L.B	20	46.25 ± 0.72 a	48.31 ± 0.72 a
Total average		80	45.70 ± 0.36 A	46.53 ± 0.36 AB
32 WK				
	Sinai	20	43.36 ± 0.72 b	44.60 ± 0.72 b
	Norfa	20	44.03 ± 0.72 b	45.16 ± 0.72 b
	L.S.L	20	45.27 ± 0.72 a	46.84 ± 0.72 a
	L.B	20	45.82 ± 0.72 a	47.17 ± 0.72 a
Total average		80	44.62 ± 0.36 AB	45.94 ± 0.36 A
42 WK				
	Sinai	20	42.82 ± 0.72 b	43.17 ± 0.72 b
	Norfa	20	42.76 ± 0.72 b	43.96 ± 0.72 b
	L.S.L	20	44.96 ± 0.72 a	46.85 ± 0.72 a
	L.B	20	45.47 ± 0.72 a	47.05 ± 0.72 a
Total average		80	44.00 ± 0.36 BC	45.26 ± 0.36 AB
52 WK				
	Sinai	20	40.97 ± 0.72 b	43.54 ± 0.72 b
	Norfa	20	41.84 ± 0.72 b	43.67 ± 0.72 b
	L.S.L	20	44.89 ± 0.72 a	46.67 ± 0.72 a
	L.B	20	45.16 ± 0.72 a	47.04 ± 0.72 a
Total average		80	43.19 ± 0.36 C	45.24 ± 0.36 AB
62 WK				
	Sinai	20	39.82 ± 0.72 b	40.72 ± 0.72 b
	Norfa	20	40.05 ± 0.72 b	41.13 ± 0.72 b
	L.S.L	20	42.25 ± 0.72 a	44.41 ± 0.72 a
	L.B	20	42.38 ± 0.72 a	44.66 ± 0.72 a
Total average		80	41.13 ± 0.36 D	42.73 ± 0.36 B

* a,b,c = Means have the same superscript in each strain are not differ significantly at P ≤ 0.05

* A,B,C,D = Means have the same superscript in each layer age are not differ significantly at P ≤ 0.05

Table (4) : Effect of layer age, strain and year of laying on yolk color trait (means ± S.E)

Age (WK)	Strain	No. of eggs	Means ± S.E 1st year	Means ± S.E 2nd year
S.M.				
	Sinai	20	5.85 ± 0.14 ^{a}	5.86 ± 0.14 ^{a}
	Norfa	20	5.76 ± 0.14 ^{a}	5.80 ± 0.14 ^{a}
	L.S.L	20	4.15 ± 0.14 ^{b}	4.60 ± 0.14 ^{b}
	L.B	20	4.66 ± 0.14 ^{a}	4.70 ± 0.14 ^{b}
Total average		80	5.11 ± 0.07 A	5.24 ± 0.07 ^{A}
32 WK				
	Sinai	20	4.99 ± 0.14 ^{a}	5.65 ± 0.14 ^{a}
	Norfa	20	5.05 ± 0.14 ^{a}	5.56 ± 0.14 ^{a}
	L.S.L	20	4.65 ± 0.14 ^{b}	4.45 ± 0.14 ^{b}
	L.B	20	4.55 ± 0.14 ^{b}	4.55 ± 0.14 ^{b}
Total average		80	4.81 ± 0.07 ^{B}	5.05 ± 0.07 ^{A}
42 WK				
	Sinai	20	5.11 ± 0.14 ^{a}	5.50 ± 0.14 ^{a}
	Norfa	20	4.98 ± 0.14 ^{a}	5.45 ± 0.14 ^{a}
	L.S.L	20	4.45 ± 0.14 ^{b}	4.65 ± 0.14 ^{b}
	L.B	20	4.35 ± 0.14 ^{b}	4.35 ± 0.14 ^{b}
Total average		80	4.72 ± 0.07 ^{B}	4.99 ± 0.07 ^{AB}
52 WK				
	Sinai	20	4.95 ± 0.14 ^{a}	5.25 ± 0.14 ^{a}
	Norfa	20	4.80 ± 0.14 ^{a}	5.20 ± 0.14 ^{a}
	L.S.L	20	4.40 ± 0.14 ^{b}	4.10 ± 0.14 ^{b}
	L.B	20	4.15 ± 0.14 ^{b}	4.30 ± 0.14 ^{b}
Total average		80	4.58 ± 0.07 ^{B}	4.71 ± 0.07 ^{B}
62 WK				
	Sinai	20	4.65 ± 0.14 ^{a}	4.81 ± 0.14 ^{a}
	Norfa	20	4.75 ± 0.14 ^{a}	4.83 ± 0.14 ^{a}
	L.S.L	20	4.00 ± 0.14 ^{b}	4.15 ± 0.14 ^{b}
	L.B	20	3.75 ± 0.14 ^{b}	4.12 ± 0.14 ^{b}
Total average		80	4.29 ± 0.07 ^{C}	4.48 ± 0.07 ^{B}

* a,b = Means have the same superscript in each strain are not differ significantly at P ≤ 0.05

* A,B,C = Means have the same superscript in each layer age are not differ significantly at P ≤ 0.05

2. Albumen quality traits :

2. 1. Albumen weight (Al.W.) :

It was found that albumen weight was increased with advancing age of layer, which is due to increasing of egg weight (Table 5). The means of albumen weight were 26.82 vs. 27.60, 29.10 vs. 29.45, 33.55 vs. 31.81, 33.96 vs. 32.14 and 34.77 vs. 32.36 g. in the first and second years of laying at sexual maturity, 32, 42, 52 and 62 weeks of age, respectively. The present findings supported those reported by Pandey *et al.* (1989) who noticed that albumen weight increased with advancement of layer age. Also, Hussein *et al.* (1993) found that albumen weight was associated positively with egg weight, it increased with advancing age for Arbor Acres layers and Hy – line strains from 32 to 40 weeks of age. Similarly, Rossi and Pompei (1995) reported that average albumen weight increased with advancing hen age. Concerning the strain effect (Talbe 5), means of albumen weight were significantly higher in foreign strains (L.S.L and L.B) than in local strains (Sinai and Norfa) wihch being 21.87 vs. 24.38, 22.77 vs. 22.94, 31.00 vs. 30.19 and 31.66 vs. 32.89 g. at sexual maturity for Sinai, Norfa, L.S.L and L.B strain in the first and second years, respectively. The present results were in agreement with those reported by El-Sharkawy (1991) who found that Hisex eggs contain significantly higher albumen weight followed by L.S.L eggs than the eggs of Fayoumi and Matrouh (41.42, 38.96, 31.88 and 26.64 g., respectively). Moreover, Goher *et al.* (1995) reported that albumen weight of foreign breeds found to be higher than those of local breeds which being 37.4 and 33.1 g. for White Leghorn and Rhode Island Red vs. 30.3 and 27.5 g. for Silver Montazah and Matrouh, respectively. The differences among ages of layer (A), strains of chickens (S) and between years of laying (Y) were highly ($P \leq 0.01$) significant. The interactions between (A x S), (A x Y) and (S x Y) were highly significant. While insignificant difference was found with respect to the interaction (A x S x Y).

2.2. Albumen percentage (Al. %) :

Concerning the effect of layer age (Table 6), albumen percentage was decreased with advancement of layer age, which being 63.16 vs. 63.69, 62.91 vs. 62.83, 61.88 vs. 62.10, 60.97 vs. 61.25 and 60.62 vs. 60.97 % in the first and second years of laying at sexual maturity, 32, 42, 52 and 62 weeks of age, respectively. The present results supported those reported by Marion *et al.* (1966) and Pandey *et al.* (1989). They noticed that albumen percentage decreased with advancement of layer age.

With respect to the strain effect (Table 6). The present results cleared that the albumen percentage was significantly higher in commercial standard strains than in local strains of chickens, which being 60.39 vs. 61.27, 60.15 vs. 60.27, 65.19 vs. 66.42 and 66.89 vs. 66.80 % in the first and second year of laying, at sexual maturity, for Sinai, Norfa, L.S.L and L.B, respectively. The

Table (5) : Effect of layer age, strain and year of laying on albumen weight trait (means ± S.E)

Age (WK)	Strain	No. of eggs	Means ± S.E (g)*	
			1st year	2nd year
S.M.				
	Sinai	20	21.87 ± 0.71 b	24.38 ± 0.71 c
	Norfa	20	22.77 ± 0.71 b	22.94 ± 0.71 c
	L.S.L	20	31.00 ± 0.71 a	30.19 ± 0.71 b
	L.B	20	31.66 ± 0.71 a	32.89 ± 0.71 a
Total average		80	26.82 ± 0.36 C	27.60 ± 0.36 D
32 WK				
	Sinai	20	24.24 ± 0.71 c	25.53 ± 0.71 c
	Norfa	20	24.12 ± 0.71 c	24.05 ± 0.71 c
	L.S.L	20	33.93 ± 0.71 b	32.64 ± 0.71 b
	L.B	20	34.09 ± 0.71 a	35.59 ± 0.71 a
Total average		80	29.10 ± 0.36 B	29.45 ± 0.36 C
42 WK				
	Sinai	20	27.28 ± 0.71 c	26.91 ± 0.71 c
	Norfa	20	28.27 ± 0.71 c	27.82 ± 0.71 c
	L.S.L	20	36.66 ± 0.71 b	33.47± 0.71 b
	L.B	20	41.98 ± 0.71 a	39.06 ± 0.71 a
Total average		80	33.55 ± 0.36 A	31.81 ± 0.36 AB
52 WK				
	Sinai	20	27.94 ± 0.71 c	25.95 ± 0.71 c
	Norfa	20	28.19 ± 0.71 c	26.81 ± 0.71 c
	L.S.L	20	36.25 ± 0.71 b	36.38 ± 0.71 b
	L.B	20	43.47 ± 0.71 a	39.41 ± 0.71 a
Total average		80	33.96 ± 0.36 A	32.14 ± 0.36 B
62 WK				
	Sinai	20	27.79 ± 0.71 c	26.67 ± 0.71 c
	Norfa	20	29.99 ± 0.71 c	27.51 ± 0.71 c
	L.S.L	20	38.51 ± 0.71 b	35.99 ± 0.71 b
	L.B	20	42.79 ± 0.71 a	39.26 ± 0.71 a
Total average		80	34.77 ± 0.36 A	32.36 ± 0.36 A

*** a,b,c = Means have the same superscript in each strain are not differ significantly at P ≤ 0.05**

*** A,B,C,D = Means have the same superscript in each layer age are not differ significantly at P ≤ 0.05**

Table (6): Effect of layer age, strain and year of laying on albumen percentage trait (means ± S.E)

Age (WK)	Strain	No. of eggs	Means ± S.E (%)*	
			1st year	2nd year
S.M.				
	Sinai	20	60.39 ± 0.49 b	61.27 ± 0.49 b
	Norfa	20	60.15 ± 0.49 b	60.27 ± 0.49 b
	L.S.L	20	65.19 ± 0.49 a	66.42 ± 0.49 a
	L.B	20	66.89 ± 0.49 a	66.80 ± 0.49 a
Total average		80	63.16 ± 0.25 A	63.69 ± 0.25 A
32 WK				
	Sinai	20	59.69 ± 0.49 b	60.06 ± 0.49 c
	Norfa	20	60.27 ± 0.49 b	59.45 ± 0.49 c
	L.S.L	20	64.55 ± 0.49 a	64.43 ± 0.49 b
	L.B	20	67.12 ± 0.49 a	67.37 ± 0.49 a
Total average		80	62.91 ± 0.25 A	62.83 ± 0.25 B
42 WK				
	Sinai	20	57.83 ± 0.49 c	59.58 ± 0.49 c
	Norfa	20	59.46 ± 0.49 c	59.66 ± 0.49 c
	L.S.L	20	63.36 ± 0.49 b	62.42 ± 0.49 b
	L.B	20	66.90 ± 0.49 a	66.72 ± 0.49 a
Total average		80	61.88 ± 0.25 B	62.10 ± 0.25 B
52 WK				
	Sinai	20	57.53 ± 0.49 c	58.50 ± 0.49 c
	Norfa	20	58.35 ± 0.49 c	58.32 ± 0.49 c
	L.S.L	20	62.46 ± 0.49 b	61.95 ± 0.49 b
	L.B	20	65.55 ± 0.49 a	66.17 ± 0.49 a
Total average		80	60.97 ± 0.25 B	61.25 ± 0.25 C
62 WK				
	Sinai	20	57.89 ± 0.49 c	58.57 ± 0.49 c
	Norfa	20	57. 70 ± 0.49 c	58.21 ± 0.49 c
	L.S.L	20	62.78 ± 0.49 b	61.98 ± 0.49 b
	L.B	20	64.09 ± 0.49 a	65.13 ± 0.49 a
Total average		80	60.62 ± 0.25 B	60.97 ± 0.25 C

*** a,b,c = Means have the same superscript in each strain are not differ significantly at P ≤ 0.05**

*** A,B,C = Means have the same superscript in each layer age are not differ significantly at P ≤ 0.05**

present results are in agreement with those reported by Goher *et al.* (1995) who found that standard breed eggs had higher albumen percentage than local breeds, which being 60.90, 60.30, 57.61 and 57.22 for Rhode Island Red, White Leghorn, Matrouh and Silver Montazah, respectively. In addition, El-Sharkawy (1991) concluded that albumen percentage for local breeds was significantly lower than commercial strains (54.17, 56.77, 61.83 and 62.74 % for Fayoumi, Matrouh, L.S.L and Hisex eggs, respectively.

There were highly significant differences ($P \leq 0.01$) among ages of layers and strains of chickens as well A x S and S x Y interactions. But, the statistical differences between years of laying were not significant.

2.3. Albumen height :

It was found that the albumen height decreased with the layer age increased. The means of albumen height were 9.00 vs. 9.47, 8.79 vs. 9.08, 7.97 vs. 8.91, 7.65 vs. 8.54 and 6.23 vs. 7.65 mm in the first and second years of laying at sexual maturity, 32, 42, 52 and 62 weeks of age, respectively (Table 7). These results are in agreement with the findings reported by Silversides and Scott (2001), who concluded that albumen height decreased as the hen age increased.

It was found that the local strains, Sinai and Norfa had lower albumen height than the standard commercial strains, L.S.L and L.B. The means of albumen height were 7.51, 7.75, 10.48 and 10.25 in the first year of laying, and 8.44, 8.18, 10.75 and 10.53 in the second year of laying at sexual maturity for Sinai, Norfa, L.S.L and L.B strains, respectively (Table 7). The present results supported those reported by El-Sharkawy (1991) who found that local breeds had lower albumen height than foreign breeds, which being 4.39, 4.69, 5.06 and 5.37 mm for Fayoumi Matrouh, Hisex and L.S.L, respectively. Also, Mahgoub (2002) reported that albumen height for Sinai chickens (control) was 4.57 mm. The statistical differences of albumen height among ages of layer (A), strains of chickens (S) and between years of laying (Y) and their interaction were highly ($P \leq 0.01$) significant.

2.4. Haugh units(H.U.) :

The present results cleared that Haugh unit scores decreased with advancing the layer age (Table 8). The means of Haugh unit scores were 98.66 vs. 100.62, 97.00 vs. 100.23, 90.75 vs. 96.74, 87.72 vs. 95.93 and 79.16 vs. 91.65 in the first and second years of laying at sexual maturity, 32, 42, 52 and 62 weeks of age, respectively. The present results are in agreement with those reported by Essa (2005) who noticed that the Haugh unit decreased with increasing the age of layer in two commercial strains, Lohman Brown and White. In addition, Radwan (2007) obtained similar finding, which Haugh unit dramatically decreased with progressive age of layers.

Table (7): Effect of layer age, strain and year of laying on albumen height trait (means ± S.E)

Age (WK)	Strain	No. of eggs	Means ± S.E (mm)*	
			1st year	2nd year
S.M.				
	Sinai	20	7.51 ± 0.20 [b]	8.44 ± 0.20 [b]
	Norfa	20	7.75 ± 0.20 [b]	8.18 ± 0.20 [b]
	L.S.L	20	10.48 ± 0.20 [a]	10.75 ± 0.20 [a]
	L.B	20	10.25 ± 0.20 [a]	10.53 ± 0.20 [a]
Total average		80	9.00 ± 0.10 [A]	9.47 ± 0.10 [A]
32 WK				
	Sinai	20	7.96 ± 0.20 [b]	7.93 ± 0.20 [b]
	Norfa	20	7.78 ± 0.20 [b]	8.24 ± 0.20 [b]
	L.S.L	20	9.76 ± 0.20 [a]	9.96 ± 0.20 [a]
	L.B	20	9.67 ± 0.20 [a]	10.19 ± 0.20 [a]
Total average		80	8.79 ± 0.10 [A]	9.08 ± 0.10 [A]
42 WK				
	Sinai	20	6.98 ± 0.20 [b]	7.82 ± 0.20 [b]
	Norfa	20	7.07 ± 0.20 [b]	7.79 ± 0.20 [b]
	L.S.L	20	8.99 ± 0.20 [a]	10.07 ± 0.20 [a]
	L.B	20	8.84 ± 0.20 [a]	9.94 ± 0.20 [a]
Total average		80	7.97 ± 0.10 [B]	8.91 ± 0.10 [B]
52 WK				
	Sinai	20	6.58± 0.20 [b]	7.52± 0.20 [b]
	Norfa	20	6.61 ± 0.20 [b]	7.55 ± 0.20 [b]
	L.S.L	20	8.88 ± 0.20 [a]	9.62 ± 0.20 [a]
	L.B	20	8.54 ± 0.20 [a]	9.45 ± 0.20 [a]
Total average		80	7.65 ± 0.10 [C]	8.54 ± 0.10 [B]
62 WK				
	Sinai	20	5.51 ± 0.20 [b]	6.86 ± 0.20 [b]
	Norfa	20	5.63 ± 0.20 [b]	6.84 ± 0.20 [b]
	L.S.L	20	6.82 ± 0.20 [a]	8.53 ± 0.20 [a]
	L.B	20	6.96 ± 0.20 [a]	8.35 ± 0.20 [a]
Total average		80	6.23 ± 0.10 [D]	7.65 ± 0.10 [C]

* a,b = Means have the same superscript in each strain are not differ significantly at $P \leq 0.05$

* A,B,C,D = Means have the same superscript in each layer age are not differ significantly at $P \leq 0.05$

Table (8): Effect of layer age, strain and year of laying on Haugh units trait (means ± S.E)

Age (WK)	Strain	No. of eggs	Means ± S.E 1st year	Means ± S.E 2nd year
S.M.				
	Sinai	20	93.45 ± 1.09 b	97.11 ± 1.09 b
	Norfa	20	94.39 ± 1.09 b	96.25 ± 1.09 b
	L.S.L	20	103.92 ± 1.09 a	105.45 ± 1.09 a
	L.B	20	102.90 ± 1.09 a	103.64 ± 1.09 a
Total average		80	98.66 ± 0.54 A	100.62 ± 0.54 A
32 WK				
	Sinai	20	94.74 ± 1.09 b	96.19 ± 1.09 b
	Norfa	20	93.67 ± 1.09 b	95.87 ± 1.09 b
	L.S.L	20	100.82 ± 1.09 a	105.05 ± 1.09 a
	L.B	20	98.77 ± 1.09 a	103.82 ± 1.09 a
Total average		80	97.00 ± 0.54 A	100.23 ± 0.54 A
42 WK				
	Sinai	20	87.11 ± 1.09 b	92.37 ± 1.09 b
	Norfa	20	87.07 ± 1.09 b	91.84 ± 1.09 b
	L.S.L	20	95.02 ± 1.09 a	101.64 ± 1.09 a
	L.B	20	93.18 ± 1.09 a	101.13 ± 1.09 a
Total average		80	90.75 ± 0.54 B	96.74 ± 0.54 B
52 WK				
	Sinai	20	84.31 ± 1.09 c	91.15 ± 1.09 b
	Norfa	20	84.47 ± 1.09 c	92.84 ± 1.09 b
	L.S.L	20	94.42 ± 1.09 a	99.73 ± 1.09 a
	L.B	20	87.66 ± 1.09 b	100.02 ± 1.09 a
Total average		80	87.72 ± 0.54 C	95.93 ± 0.54 B
62 WK				
	Sinai	20	80.26 ± 1.09 a	87.09 ± 1.09 b
	Norfa	20	81.20 ± 1.09 a	86.04 ± 1.09 b
	L.S.L	20	81.41 ± 1.09 a	97.34 ± 1.09 a
	L.B	20	73.76 ± 1.09 b	96.12 ± 1.09 a
Total average		80	79.16 ± 1.09 D	91.65 ± 0.54 C

* a,b,c = Means have the same superscript in each strain are not differ significantly at P ≤ 0.05

* A,B,C,D = Means have the same superscript in each layer age are not differ significantly at P ≤ 0.05

With respect to the strains of chicken effect (Table 8), the present results cleared that the standard commercial strains, L.S.L and L.B, had significantly higher scores of Haugh unit than local strains (Sinai and Norfa) at all ages of layers. The means of Haugh unit scores were 93.45 vs. 97.11, 94.39 vs. 96.25, 103.92 vs. 105.46 and 102.90 vs. 103.64 in the first and second years of laying at sexual maturity for Sinai, Norfa, L.S.L and L.B strains, respectively.

The present results supported those reported by Goher *et al.* (1996) who found that L.S.L eggs had significantly higher Haugh unit scores (76.7) than other local breeds (Fayoumi, Bandara, Golden Montazah, Gimmizah, Dokki-4 and Dandarawi which being 71.9, 71.9, 70.5, 68.2 66.9 and 66.7, respectively). Also, Zaky (2006) reported that Fayoumi breed had lower Haugh unit (92.90) compared to White Leghorn eggs (94.20). The statistical differences of Haugh unit scores among ages of layers (A), strains of chickens (S) and between years of laying (Y) as well as their interactions.

2.5. Yolk to albumen ratio (Y : Al %) :

The present results cleared that yolk to albumen ratio was increased with advancement age of layer. The means of yolk to albumen ratio were 41.70 vs. 42.31, 43.53 vs. 44.09, 45.59 vs. 45.66, 48.08 vs. 46.49 and 48.79 vs. 48.01 % in the first and second years of laying at sexual maturity, 32, 42, 52, and 62 weeks of age, respectively (Table 9). The present results are in agreement with those reported by Hussein *et al.* (1993) who found that a significant increase in Y : Al ratio was evident in older layers. Similarly, Ahn *et al.* (1997) reported that the yolk to albumen ratio of eggs from 28 weeks old hens was the lowest, where the highest percentage was observed at 55 and 78 weeks old hens.

Concerning the strain effect on Y : Al ratio (Table 9), it was found that the local strains, Sinai and Norfa, had higher yolk to albumen ratio than in foreign commercial strains (L.S.L and L.B) at all ages. Means were 46.70 vs. 46.88, 47.42 vs. 47.85, 39.04 vs. 37.76 and 35.63 vs. 36.75 % in the first and second years of laying for Sinai, Norfa, L.S.L and L.B. strains at sexual maturity. In this respect, Pandey *et al.* (1989) reported that strains of White Leghorn had a significant effect on the yolk to albumen ratio. Also, Suk and Park (2001) reported that yolk to albumen ratio of eggs from Korian native chickens were significantly larger than the ones of ISA Brown and CEC breeds.

The statistical differences among ages and strains of chickens were highly ($P \leq 0.01$) significant. Insignificant difference between years of laying was observed. The interactions between (A x S), (A x Y) and (S x Y) were highly significant. The interaction for (A x S x Y) was not significant.

Table (9) : Effect of layer age, strain and year of laying on yolk : albumen ratio trait (means ± S.E)

Age (WK)	Strain	No. of eggs	Means ± S.E (%)* 1st year	Means ± S.E (%)* 2nd year
S.M.				
	Sinai	20	46.70 ± 1.04 a	46.88 ± 1.04 a
	Norfa	20	47.42 ± 1.04 a	47.85 ± 1.04 a
	L.S.L	20	39.04 ± 1.04 b	37.76 ± 1.04 b
	L.B	20	35.63 ± 1.04 c	36.75 ± 1.04 b
Total average		80	41.70 ± 0.52 C	42.31 ± 0.52 D
32 WK				
	Sinai	20	49.25 ± 1.04 a	49.48 ± 1.04 a
	Noraf	20	50.19 ± 1.04 a	50.18 ± 1.04 a
	L.S.L	20	37.88 ± 1.04 b	39.06 ± 1.04 b
	L.B	20	36.79 ± 1.04 b	37.63 ± 1.04 c
Total average		80	43.53 ± 0.52 C	44.09 ± 0.52 C
42 WK				
	Sinai	20	52.07 ± 1.04 a	50.03 ± 1.04 a
	Norfa	20	51.12 ± 1.04 a	50.36 ± 1.04 a
	L.S.L	20	42.67 ± 1.04 b	43.25 ± 1.04 b
	L.B	20	36.48 ± 1.04 c	38.99 ± 1.04 c
Total average		80	45.59 ± 0.52 B	45.66 ± 0.52 BC
52 WK				
	Sinai	20	54.13 ± 1.04 a	50.31 ± 1.04 a
	Norfa	20	53.83 ± 1.04 a	52.02 ± 1.04 a
	L.S.L	20	45.28 ± 1.04 b	44.48 ± 1.04 b
	L.B	20	39.06 ± 1.04 c	39.14 ± 1.04 c
Total average		80	48.08 ± 0.52 A	46.49 ± 0.52 AB
62 WK				
	Sinai	20	55.18 ± 1.04 a	53.29 ± 1.04 a
	Norfa	20	54.48 ± 1.04 a	54.02 ± 1.04 a
	L.S.L	20	45.76 ± 1.04 b	45.27 ± 1.04 b
	L.B	20	39.77 ± 1.04 c	39.46 ± 1.04 c
Total average		80	48.79 ± 0.52 A	48.01 ± 0.52 A

*** a,b,c = Means have the same superscript in each strain are not differ significantly at $P \le 0.05$**

*** A,B,C,D = Means have the same superscript in each layer age are not differ significantly at $P \le 0.05$**

REFERENCES

Abdou, F.H. (1996). Improving indigenous chickens breeds : experience from Egypt, Norway and Tanzania. Egypt. J. Anim. Produ. 33 : 567 – 576.

Ahn, D.U., S.M. Kim and H. Shu (1997). Effect of egg size and strain and age of hens on the solids content of chicken eggs. Poultry Science 76 : 914 – 919.

Carter, T.C. (1968). Egg quality a study of the hens egg. Oliver & Boyd Edinburgh. Part 8 : 207 – 251.

Duncan, D.B. (1955). The new multiple range and F test. Biometrics 11 : 1 – 42.

El-Sharkawy, S.I. (1991). Differences in egg characteristics among some native breeds and some commercial strains under Egyptian conditions. Egypt. Poult. Sci., 11 : 397 – 411.

Essa, A.H.A. (2005). Effects of age on some physical and Rheological properties of egg shell quality in chickens. Menufiya Journal of Agricultural Research. Vol. 30 (1) : 51 – 76.

Ezzeldin, Z.A. and A.M. El-Labban (1989). Interior egg quality of purebred and crossbred chickens. 3rd Egypt. Brit. Conf. on Anim., Fish and Poult. Prod., 971 – 982.

FAO (1997). World nutrition report, FAO, Rome.

Fletcher, D.L., W.M. Britton, G.M. Pesti and A.P. Rahn (1983). The relationship of layer flock age and egg weight on egg component yields and solids content. Poultry Science 62 : 1800 – 1805.

Goher, L.M.A., T.H. Mahmoud and S.M. Riad (1995). Strain differences in response to adding antifungal compound. First Egypt. Hung. Poult. Conf., 17 – 19 September.

Goher, L.M.A., T.H. Mahmoud and M.A. Abd-El-Galil (1996). Performance of certain Egyptian breeds of chickens fed a low – protein diet during the laying period. Agric. Res. Rev., 74 (3) : 851 – 868.

Haugh, R.R. (1937). The Haugh unit for measuring egg quality. US Egg Poultry Mag. 43, 522 – 555, 572 – 573.

Hussein, S.M., R.H. Harms and D.M. Janky (1993). Effect of age on the yolk to albumen ratio in chicken eggs. Poultry Science 72 : 594 – 597.

Kaminska, B.Z. and B. Skraba (1991). Analysis of hen types considering albumen : yolk ratio and its changes during the laying cycle. Pages 43 – 49 in : Proceedings of the 4th European Symposium on the quality of poultry products; II. Eggs and egg products. Doorwerth, the Netherlands.

Mahapatra, C.M., B. Panda, D.N. Maitra and N.K. Pandey (1989). Physico – chemical evaluation of egg quality of native and Farm - bred chicken. Indian - Journal - of - Animal - Sciences. 59 : 7, 865 – 870.

Mahgoub, S.M.M. (2002). Study of some environmental factors affecting

performance in chickens. M.Sc. Thesis. Faculty of Agriculture, Minufiya University, Shibin El-Kom, Egypt.

Marion, J.E., J.G. Woodroof and D. Tindell (1966). Physical and chemical properties of eggs as affected by breeding and age of hens. Poultry Science 45 : 1189 – 1195.

Mohan, B., M. Ramakrishnan and V. Mani (1992). Influence of egg weight on egg quality characteristics of commercial chicken egg. Indian – Veterinary – Journal. 69 : 1, 41 – 44.

Monira, K. N., M. Salahuddin and G. Miah (2003). Effect of breed and holding period on egg quality characteristics of chicken. International Journal of Poultry Science 2 (4) : 261 – 263.

Pandey, N.K.; B. Panda, D.N. Maitra and C.M. Mahapatra (1989). Changes in quality characteristics and component yields of White Leghorn eggs due to strain and age of birds and season of the year. Indian Journal of Animal Science 59 (9) : 1139 – 1143.

Premavalli, K. and K. Viswanathan (2004). Influence of age on the egg quality characteristics of commercial White Leghorn chicken. Indian Veterinary Journal. 2004. 81 : 11, 1243 – 1247.

Radwan, L.M.A. (2007). Comparative study on ultrastructural measurements of eggshell quality in some local breeds of chicken using modern techniques. M.Sc. Thesis, Fac. of Agric. Ain Shams Univ., Egypt.

Rossi, M. and C. Pompei (1995). Changes in some egg components and analytical values due to hen age. Poultry Science 74 : 152 – 160.

Scott, T.A. and F.G. Silversides (2000). The effect of storage and strain of hen on egg quality. Poultry Science 2000; 79 : 1725 – 1729.

Shawer, M.F., M.N. Hassanin and A. A. Alsobayel (1991). Some factors influencing some egg quality traits during storage. Egyptian Poultry Science. Volume (11) : 165 – 188.

Silversides, F.G. and T.A. Scott (2001). Effect of storage and layer age on quality of eggs from two lines of hens. Poultry Science. 80 : 1240 – 1245.

Snedecor, G.W. and Cochran (1977). Statistical methods. Iowa State University Ames., Iowa, USA.

Soltan, M.E. (1992). Performance of selected Sinai fowl in comparison with Fayoumi and Baladi fowls standard Egyptian local breeds. II. Egg quality. Menofiya Journal of Agriculture research. Vol. 17 (2) : 513 – 526.

Soltan, M.E., M.M. El-Nady, B.M. Ahmed and A.M. Abou-Ashour (1985). Studies on the productive pervormance of Sinai Bedouin fowl. Menofiya Journal Agriculture Research. Vol. 10 (4) : 2147 – 2168.

SPSS, P.C. Programe (1997). By SPSS Inc., North Michigan U.S.A.

Stino, F.K.R., N.E. Goher, G.A.R. Kamar and N.A. Hanash (1982). The effect of breed and housing system on the egg quality of White Baladi and

Fayoumi hens in the subtropic. Egypt. J. Anim. Prod., 22 (2) : 191 – 198

Suk, Y.O. and C. Park (2001). Effect of breed and age of hens on the yolk to albumen ratio in two different genetic stocks. Poultry Science 80 : 7, 855 – 858.

Well, R.J. (1968). The measurement of certain egg quality. A study of the hens. Ed. By T.C. Carter Pub. Oliver and Boy Edinbrugh PP. 220 – 226 and 235 – 236.

Zaky, H.I. (2006). The effect of heterosis between Fayoumi and White Leghorn chickens on egg quality traits under desert conditions. Egypt. Poult. Sci. 26 : 39 – 52.

تأثير التداخل بين عمر الدجاج البياض ، سلالة الدجاج البياض ، وسنة الوضع علي صفات جودة البيضة الداخلية

جودة محمد جبريل[١] ، محمد السيد سلطان[١] ، فاروق حسن عبده[١] ، محمد فكري عامر[٢]، أيمن حافظ عامر عيسي[١]، سامية محمد محفوظ محجوب[١]

[١] كلية الزراعة بشبين الكوم – جامعة المنوفية

[٢] جامعة عين شمس

الملخص العربي

أجريت هذه الدراسة لمقارنة صفات جودة البيضة الداخلية في سلالتين من الدجاج المحلي المحسن (سيناء ونورفا) مع سلالتين من الدجاج التجاري الأجنبي (لوهمان المنتخب الأبيض ، ولوهمان البني) عند عمر النضج الجنسي ٣٢ ، ٤٢ ، ٥٢ ، ٦٢ أسبوع من العمر لمدة سنتين متتاليتين . ويمكن تلخيص النتائج المتحصل عليها كما يلي :

١ – مقارنة السلالات المحلية مع الأجنبية : وجد أن السلالات الأجنبية (لوهمان الأبيض ولوهمان البني) حققت قيم معنوية عالية في وزن الصفار ، دليل الصفار ، وزن البياض ، النسبة المئوية للبياض ، ارتفاع البياض ووحدات هاو وانخفاض النسبة المئوية للصفار ، تقييم لون الصفار والنسبة المئوية للصفار : البياض بمقارنتها بالسلالات المحلية (سيناء ونورفا) .

٢ – تأثير عمر الدجاج البياض :

٢ – ١ – وجد أن كل من وزن الصفار ، النسبة المئوية للصفار ، وزن البياض ، النسبة بين الصفار والبياض تزداد وكل من دليل الصفار ، لون الصفار ، النسبة المئوية للبياض ، ارتفاع البياض ووحدات هاو تقل قيمتها بزيادة عمر الدجاج البياض .

٣ – تأثير التداخل : كانت تأثيرات التداخل بين العمر والسلالة ، العمر وسنة الوضع ، السلالة وسنة الوضع أو بين العمر والسلالة وسنة الوضع معنوية ($P \leq 0.05$) أو عالية المعنوية ($P \leq 0.01$) في معظم صفات جودة البيضة الداخلية التي درست .

٤ – الخلاصة : حيث أن وزن كل من الصفار والبياض يكون أكبر في الدجاج كبير العمر ، لذلك يكون أكثر استفادة للمنتجين والمصانع إستخدام الدجاج الصغير السن (٣٢ – ٤٢ أسبوع) في إنتاج بيض المائدة والطيور الأكبر في العمر (٥٢ أسبوع أو أكثر) في إنتاج البيض السائل .