EFFECT OF AGE AND OVIPOSITION TIME ON EGG QUALITY AND THEIR RELATIONSHIP WITH STRESS, CHANGES IN BLOOD CELL COMPONENTS AND PRE-LAYING BEHAVIOR IN LAYING HENS
1- EGG QUALITY

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Summary

The study is conducted at Meissan Company for table eggs production. The aim was to investigate the effect of age and oviposition time on egg quality

About 17000 ISA-Brown pullet at the age of 22 weeks are used in the study. Eggs sampling is done during the morning and afternoon at different ages (22-38) weeks.

The results revealed the following:

1- Age showes highly significant ($p<0.01$) effect on egg shape, egg weight and its components, percent components, shell thickness, total calcium, magnesium and phosphorus in the shell, and cholesterol content in the egg. On the other hand, age showes no significant effect on total shell ash, quantities of calcium, magnesium and phosphorus per a gram shell, and blood as well as meat spots in eggs.

2- Oviposition time showes highly significant ($p<0.01$) effect all of the egg quality traits mentioned above except the quantity of calcium per a gram shell.

Key words: chicken, oviposition time, Egg quality

***Based on ph.D. disserttion by the third author.**

INTRODUCTION

The tremendous increase in the world population has created a huge demand for food quality and quantity wise. The sector of poultry industry can contribute to this global aim through the production of meat and eggs. characteristics are affected by factors such as age of the laying hens and oviposition time (1). Recently, quality needs shown by consumers, manufactures and producers, allow some egg criteria to be essential in assessing the quality of the egg. The quality of the hens egg is of primary concern to commercial producers mainly from an economic point of view. Sound egg quality means high revenue because it is attractive to domestic consumers and when intended for hatching gives satisfactory results (2).Egg shape is an important factor for egg selection and accounts for 15-30% of the variability of crushing strength remaining after shell thickness (3). Egg weight differs according to breeds (4) and is found to be more closely associated with albumen weight rather than yolk or shell weight (5).Time of oviposition is found to influence egg weight . (6) proved that eggs laid in the morning were heavier than those laid in the afternoon. Also time of oviposition is shown to influence yolk weight. Morning egg tendes to have heavier yolk weights than afternoon eggs (7). Albumen weight was reported to increase with age (8.9). Moreover, time of oviposition was shown to be related to lbumen weight (1). The report of the latter authors also revealed that gradual declines in the percent albumen were different times in the day. The cholesterol content of the egg is one of the most important of the criteria. Since the proposal of interrelationship between the cholesterol content of the diet and heart disease, consumers become more interested in eggs with low cholesterol content. At this point (10) claimes that such eggs are healthy and may have significant commercial advantage. Although, shell quality was intensively studied, (11) emphasizes that, the subject will continue to receive attention despite advances in research, quality control and applied technology.

MATERIALS AND METHODS

The study is conducted in Meissan Company for table eggs production . About 17000 ISA Brown laying hens were accommodated in the house. All the hens received the routine vaccinations and arefree from any disease during the study. Moreover, the hens were laying regularly during the period. The age of the laying hens and their average body weight during the study were recorded to range from 22–38 weeks as well as 1550–2058 grams respectively.The hens were accommodated in layer battery cages (47×37 ×44cm) that equipped with feed troughs and nipple drinkers. The system was provided with 16 hour light /8 hours darkness. The temperature was generally maintained between 20–23 C° and the relative humidity did not exceed 60 %.Feed and water were provided adlibtium. Layer diet of the same ingredients and percentages was given to the hens during the whole period of the study as indicated in table (1).

Table (1):Ingredients and percentages as well as the determined chemical composition of the layer diet.

Ingredients	**%**	**Chemical composition**	**%**
Sorghum	35.00	Dry matter	96.00
Wheat	23.00	Crude protein	17.00
Barely	10.00	Ether extract	04.45
Soya bean	15.50	Crude filer	03.80
Plant protein	10.00	Ash	13.50
Limestone	06.00	Calcium	03.42
Oil	01.00	Magnesium	01.76
Salt	00.25	Phosphorus	00.33
Vit. Min. premix	00.25		
Total	**100.00**		

Age of the laying hens as well as two different times in the day are considered as experimental treatments. Age is considered from 22 weeks and continued thereafter at a week interval up to 38 weeks. On the other hand, the first time in the day considered was from 7 – 9 a. m. (Early), while the second time was from 1 – 3 p. m. (Late). Sampling of eggs is done nine times at equal intervals. At each time of collection 360 egg laid in the morning (7 – 9 a. m.) as well as the same number laid in the afternoon (1 – 3 p. m.) were collected randomly. 36 of the eggs from each time were used for the determination of cholesterol while the rest of the eggs used for the study of other egg quality characteristics. (Egg shape, shell deformity and shell abnormality, Egg weight and its component and percentags of egg component, Blood and meat spots shell thickness, Shell minerals, cholesterol content). The raw data were fed into in the computer and subjected to analysis of variance found in (12) program. Means were compared by Least Significant Difference.

RESULTS AND DISCUSSION

Egg shape:

The results of the influence of age and oviposition time on egg shape index are depicted in table (2).

Table (2): Effect of age and oviposition time on egg shape index (%)

Oviposition (time)		Early	Late	Mean* (age)
Age (weeks)	**22**	77.61± 0.10	79.76 ± 0.07	78.69^{a} ± 1.14
	24	77.45 ± 0.09	79.64 ± 0.05	78.55^{b} ± 1.16
	26	77.27 ± 0.07	79.50 ± 0.07	79.39^{c} ± 1.18
	28	77.07 ± 0.08	79.32 ± 0.05	78.20^{d} ±1.19
	30	76.85 ± 0.08	79.13 ± 0.05	77.99^{e} ± 1.21
	32	76.61 ± 0.06	78.95 ± 0.07	77.78^{f} ± 1.23
	34	76.38 ± 0.08	78.77 ± 0.07	77.58^{g} ± 1.26
	36	76.19 ± 0.05	78.60 ± 0.06	77.39^{h} ± 1.27
	38	76.00 ± 0.06	78.45 ± 0.06	77.23^{i} ± 1.29
Mean* (oviposition)		76.82^{x} ± 0.55	79.13^{y}± 0.45	-

*** : Significant (p<0.01) difference.**
x, y : Means within a. row.
a-i : Means within a column.
Means not sharing common superscripts letters are significantly different at 1% level.

There were significant (p<0.01) treatments effect on egg shape index. It was showed that slow decrease in egg shape index (78.69 ± 1.14 – 77.23 ± 1.29%) occurred with increasing age. Our results agreed with (13) findings who observed decreased egg shape index as the age of the laying hens progressed.Time of oviposition also influenced egg shape index. Egg shape index of the morning eggs (76.82 ± 0.55%) was lower than that of the afternoon eggs (79.13 ± 0.45%). Moreover, differences between all age groups were again found. Our results confirm those published by (14).

Egg weight:

The results indicate that hen's age and oviposition time significantly (p<0.01) affected egg weight (Table 3).

Table (3): Influence of age and oviposition time on egg weight (g)

Oviposition (time)		Early	Late	Mean* (age)
Age (weeks)	22	52.28± 0.34	51.36± 0.19	51.82^{i} ± 0.55
	24	54.83± 0.19	53.08± 0.09	53.96^{h} ± 0.93
	26	56.48± 0.26	54.55± 0.20	55.52^{g} ± 1.04
	28	58.07± 0.16	55.02± 0.05	56.55^{f} ± 1.61
	30	59.42± 0.24	56.63± 0.13	58.03^{e} ± 1.48
	32	61.45± 0.23	57.96±0.10	59.71^{cd} ± 1. 84
	34	62.28± 0.22	58.35± 0.08	60.32^{c} ± 2.08
	36	63.13± 0.15	59.22± 0.13	61.18^{b} ±2.07
	38	63.81± 0.15	60.07± 0.08	61.94^{a} ± 1.98
Mean* (ovipsition)		59.08^{x} ± 3.80	56.25^{y}± 2.81	-

: *Significant (p (0.01<difference .
x, y : Means within a row .
a-i : Means within a column.
Means not sharing common superscripts letters are significantly different at 1% level

Egg weight was found to increase with increasing age of the laying hens (51.82 ± 0.55 - 61.94 ± 1.98 g). This conclusion is supported by the findings of (7) as well as (15).Reading the egg weight data, morning eggs significantly excelled in egg weight (59.08 ± 3.80 g) as compared to that of afternoon eggs (56.25 ± 2.81 g). These findings confirm previous results obtained by (16) as well as (6). Eggs laid in the morning are always the first in the sequences and the heaviest (16).

Yolk weight and percentage:

The results of the effect of age and oviposition time on yolk weight are depicted in table(4). Both of the two experimental treatments significantly ($p<0.01$) affected yolk weight. Approgressive increase in yolk weight was occurred as the age of the hens increased (12.29 ± 0.10 – 15.01 ± 0.30 g). Apparently, our findings are similar (7) and. (8) conclusions. On other hand, the results proved that oviposition time also affected yolk weight. Morning eggs showed significantly heavier yolk weight (14.07 ± 0.98 g) as compared to afternoon eggs (13.63 ± 0.81 g). These experimental results confirm those reported explanation of increased yolk weight of morning eggs could be attributed to the by (7). The heavier weights of morning eggs. With reference to percent yolk data (Table.4),

Table (4): Influence of age and oviposition time on yolk weight (g) and percent yolk (%)

Ovipsition (time)		Early	Late	Mean* (age)	percent yolk (%)		
					Early	Late	Mean* (age)
Age (weeks)	22	12.32 ± 0.09	12.25 ± 0.08	12.29^{i} ± 0.10	23.57 ± 0.03	23.86 ± 0.03	23.71^{i} ± 0.15
	24	12.96 ± 0.06	12.71 ± 0.04	12.84^{h} ± 0.14	23.64 ± 0.03	23.94 ± 0.04	23.79^{h} ± 0.16
	26	13.40 ± 0.09	13.12 ± 0. 05	13.26^{g} ± 0.17	23.73 ±0.07	24.05 ± 0. 03	23.89^{g} ± 0.17
	28	13.82 ± 0.04	13.30 ± 0.04	13.56^{f} ± 0.28	23.80 ± 0.04	24.17 ± 0.05	23.98^{f} ± 0.20
	30	14.17 ± 0.08	13.73 ± 0.03	13.95^{e} ± 0.24	23.85 ± 0.04	24.25 ± 0.01	24.05^{e} ± 0.21
	32	14.68 ± 0.06	14.11 ± 0.04	14.39^{cd} ± 0. 30	23.89 ± 0.02	24.34 ± 0.03	24.12^{d} ± 0. 24
	34	14.89 ± 0.06	14.25 ± 0.02	14.57^{c} ± 0.34	23.91 ± 0.05	24.42 ± 0.01	24.17^{c} ± 0.27
	36	15.12 ± 0.04	14.50 ± 0.04	14.81^{b} ± 0.33	23.95 ± 0.01	24.48 ± 0.04	24.22^{ab} ± 0.28
	38	15.29 ± 0.05	14.73 ± 0.02	15.01^{a} ± 0.30	23.95 ± 0.03	24.52 ± 0.01	24.24^{a} ±0.30
Mean* (ovipsition)		14.07^{x} ± 0.98	13.63^{y} ± 0.81	-	23.81^{x} ± 0.13	24.23^{y}± 0.23	-

∗ : Significant (p<0.01) difference.
x, y: Means within a row.
a-i : Means within a column.

Means not sharing common superscripts letters are significantly different at 1% level.

both age and oviposition time significantly (p<0.01) affected the percent yolk. Increase in percent yolk was occurred as the age increased (23.71 ± 0.15 –24.24 ± 0.3%). The results obtained by (7) consolidate our findings. Furthermore, percent yolk of afternoon eggs (24.23 ± 0.23%) was significantly greater than that of morning eggs (23.81 ± 0.13%). These findings are in agreement with the results reported by (1). The increase in percents yolk with age and for the afternoon eggs is attributed to the greater relative increase in yolk weight (17 ,18).

Albumen weight and percentage:

Table (5) shows the results of the effect of age and oviposition time on albumen weight. Judging the results presented in the table, both experimental treatments significantly (p<0.01) affected albumen weight. As the age of the flock increased, albumen weight was found to increase (33.85 ± 0.61– 40.38 +1.81g). This trend observed is consistent with the results obtained in similar studies (8). Furthermore, albumen weight of morning eggs significantly exceeded (38.93 ± 2.53g) that of afternoon eggs (36.31 ± 1.73g).Concerning percent albumen data (Table5),

Table (5): Albumen weight as affected by age and oviposition time (g) and percent albumen(%)

Ovipsition (time)		Early	Late	Mean* (age)	percent Albumen (%)		
					Early	Late	Mean* (age)
Age (weeks)	22	34.41± 0.21	33.29 ± 0.11	33.85^{i} ± 0.61	65.82 ± 0.03	64.82 ± 0.03	65.32^{a} ± 0.53
	24	36.10 ± 0.13	34.38 ± 0.07	35.24^{h} ± 1.01	65.84 ± 0.04	64.76 ± 0.04	65.30^{ab} ± 0.16
	26	37.19 ± 0.16	35.28 ± 0.14	36.24^{g} ± 1.01	65.85 ± 0.05	64.68 ± 0.03	65.27^{c} ± 0.62
	28	38.25 ± 0.12	35.53 ± 0.02	36.89^{f} ±1.44	65.88 ± 0.04	64.57 ± 0.04	65.22^{d} ± 0.69
	30	39.15± 0.15	36.54 ± 0.09	37.85^{e} ± 1.38	65.89 ± 0.04	64.53 ±0.01	65.21^{de} ± 0.71
	32	40.50 ± 0.16	37.37 ± 0.06	38.94^{d} ± 1.65	65.91 ± 0.01	64.48 ± 0.02	65.20^{def} ± 0.75
	34	41.06 ± 0.16	37.59 ±0.06	39.33^{c} ± 1.83	65.93 ± 0.03	64.42 ± 0.03	65.18^{defg} ± 0.79
	36	41.63 ± 0.11	38.13 ± 0.09	39.88^{b} ± 1.85	65.95 ± 0.03	64.39 ± 0.02	65.17^{efgh} ±0.28
	38	42.10 ± 0.10	38.66 ± 0.06	40.38^{a} ± 1.81	65.97 ± 0.02	64.36 ± 0.03	65.16^{fghi} ±0.30
Mean* (ovipsition)		38.93^{x} ± 2.53	36.31^{y} ±1.73	-	65.89^{x} ±0.06	64.56^{y} ± 0.16	-

∗ : Significant (p<0.01) difference.
x, y : Means within a row.
a-i : Means within a column.
Means not sharing common superscripts letters are significantly different at 1% level.

both age and oviposition time revealed significant (p<0.01) treatments effect on percent albumen. Decrease in percent albumen (65.32 ± 0.53 – 65.16 ± 0.85%) was occurred as the laying hens age increased, a trend opposite to that reported in this study for the percent yolk with increased age. However, the percent albumen for the morning eggs was found to increase with age (65.82 ± 0.03 – 65.97 ± 0.02%) while that of the afternoon egg was found to decrease with age (64.82 ± 0.03 – 64.36 ± 0.03%). The decrease in percent albumen with increasing age reported here disagree with the results published by (8) as well as Rossi and (9). This disagreement may be possibly due to the time of egg collection and therefore most of these differences could be explained by differences in egg weight which would change the proportions of yolk and albumen.

Eggs laid in the morning had significantly greater percent albumen (65.89 ± 0.06%) than those laid in the afternoon (64.56 ± 0.16%). Apparently, these findings consolidate (1) remarks that gradual declines in percent albumen occur latter in the day. Increased percent albumen of the morning eggs can be justified by the heavier weight of these eggs.

Shell weight and percentage:

Table (6) presents the results of the effect of age and oviposition time on shell weight. The results showed that shell weight significantly (p<0.01) affected by age and oviposition time. Shell weight was found to increase with increased age (5.62 ± 0.15 – 6.49 ± 0.13 g). These obtained results confirm previous findings by (4). In the current study where young birds were used, the relatively high positive correlation between egg weight and shell weight during the first cycle of egg production (19, 20, 4) justify the increased shell weigh with increased age.

Afternoon eggs showed significantly heavier shell weigh (6.24 ± 0.27 g) than morning eggs (6.01±0.29 g). Results published by (21) and. (6) provide support to our findings. Although, the reason afternoon eggs have better shell is still unknown, it could be attributed to the amount of minerals deposited. Table (6)

Table (6): Influence of egg and oviposition time on shell weight (g) and percent shell (%)

Ovipsition (time)		Early	Late	Mean* (age)	percent shell (%)		
					Early	Late	Mean* (age)
Age (weeks)	22	5.48± 0.03	5.75± 0.01	5.62^{i} ± 0.15	10.48± 0.01	11.20± 0.01	10.84^{a} ± 0.38
	24	5.70± 0.02	5.93± 0.04	5.82^{h} ± 0.12	10.40± 0.02	11.17± 0.03	10.78^{ab} ± 0.41
	26	5.82± 0.01	6.08± 0.02	5.95^{g} ± 0.14	10.31± 0.04	11.15± 0.01	10.73^{abc} ± 0.44
	28	5.93± 0.01	6.13± 0.03	6.03^{f} ± 0.11	10.21± 0.03	11.14± 0.04	10.67^{bcd} ± 0.49
	30	6.03± 0.03	6.29± 0.01	6.16^{e} ± 0.14	10.15± 0.03	11.11± 0.01	10.63^{cde} ± 0.50
	32	6.20± 0.02	6.41± 0.01	6.30^{d} ± 0.11	10.09± 0.02	11.05± 0.02	10.57^{def} ± 0.51
	34	6.26± 0.01	6.44± 0.01	6.35^{c} ± 0.09	10.05± 0.04	11.03± 0.02	10.54^{efg} ± 0.52
	36	6.31± 0.01	6.52± 0.01	6.42^{b} ± 0.11	10.00± 0.03	11.01± 0.02	10.50^{fgh} ± 0.54
	38	6.36± 0.01	6.61± 0.02	6.49^{a} ± 0.13	9.97± 0.02	11.00± 0.03	10.49^{fghi} ± 0.55
Mean* (ovipsition)		6.01^{x} ± 0.29	6.24^{y} ± 0.27	-	10.18^{x} ± 0.17	11.10^{y} ± 0.07	-

: *Significant (p (0.01<difference . **x, y : Means within a row**. **a-i : Means within a column**.
Means not sharing common superscripts letters are significantly different at 1%leve

shows the results of the influence of age and oviposition time on percent shell. Both experimental treatments significantly (p<0.01) affected percent shell. Age was found to have a significant treatment decrease on percent shell (10.84 ± 0.38 – 10.49 ± 0.55%). Furthermore, again afternoon eggs showed significantly higher percent shell (11.10 ± 0.07%) as compared with that of morning eggs (10.18 ± 0.17%). These results are in agreement with trends observed in similar studies by (22).

Shell thickness:

The results of the influence of age and oviposition time on shell thickness are depicted in table (7).

Table (7): Effect of age and oviposition time on shell thickness (mm)

Oviposition (time)		Early	Late	Mean* (age)
Age (weeks)	22	0.349 ± 0.01	0.354 ± 0.01	0.352^{a} ± 0.02
	24	0.347 ± 0.01	0.351± 0.01	0.349^{b} ± 0.02
	26	0.345 ±0.01	0.349 ± 0.02	0.347^{bc} ± 0.02
	28	0.344 ± 0.02	0.348 ± 0.02	0.346^{cd} ± 0.01
	30	0.343 ± 0.01	0.347 ± 0.01	0.345^{cde} ± 0.01
	32	0.342 ± 0.01	0.347 ± 0.02	0.344^{def} ± 0.01
	34	0.341 ± 0.01	0.346 ± 0.02	0.344^{def} ± 0.02
	36	0.340 ± 0.01	0.345 ± 0.01	0.343^{efg} ± 0.01
	38	0.339 ± 0.01	0.344 ± 0.01	0.342^{fgh} ± 0.01
Mean* (oviposition)		0.343^{x} ± 0.01	0.348^{y} ± 0.02	-

∗ : Significant (p<0.01) difference.
x, y : Means within a row.
a-i : Means within a column.
Means not sharing common superscripts letters are significantly different at 1% level.

Both of the two experimental treatments significantly (p<0.01) affected shell thickness. Shell thickness was found to decrease with increasing age of the hens (0.352 ± 0.02 – 0.342 ± 0.01 mm). Our results are in accord with the findings reported by (22) as well as (4). Moreover, afternoon eggs showed significantly improved shell thickness (0.348 ± 0.02 mm) as compared with that of morning eggs (0.343 ± 0.01 mm). This conclusion is consistent with results obtained in similar studies (23, 6). The increase in egg size with increasing age and for the eggs laid during the morning forced a limited amount of shell to spread over a large surface area resulting in eggs with thinner shell and consequently inferior quality.

Minerals content of the shell:

Table (8)

Table (8): Relationship of oviposition time to total shell minerals at different ages (%)

Oviposition (time)		Early	Late	Mean (age) N.S.
Age (weeks)	24	53.81±0.10	54.99 ± 0.14	54.36 ± 0.62
	28	53.79 ± 0.10	55.01 ± 0.10	54.46 ± 0.64
	32	53.83 ± 0.10	55.00 ± 0.09	54.42 ± 0.62
	36	53.79 ± 0.13	55.02 ± 0.09	54.41 ± 0.65
Mean* (oviposition)		53.81^{x}± 0.11	55.01^{y}± 0.10	-

*** : Significant (p<0.01) difference.**

presents the results of the effect of age and oviposition time on total shell minerals. Age was found to have no significant effect on total shell minerals while oviposition time significantly (p<0.01) affected it. Afternoon eggs showed significantly greater total shell minerals (55.01 ± 0.10%) than did morning eggs (53.81 ± 0.11). Our results confirm that reported by (23). Greater total shell minerals of the afternoon eggs would imply that hens laying in the afternoon are more efficient in absorbing and utilizing available minerals.

The results of the effect of age and oviposition time on shell calcium (mg/g) as well as total shell calcium (mg) are presented in table (9).

Table (9): Effect of age and oviposition time on shell calcium (mg/g) and Total calcium (mg)

Ovipsition (time)		Early	Late	Mean* (age) N.S	Total calcium (mg)		
					Early	Late	Mean* (age)
Age (weeks)	24	423.03 ± 0.17	421.10 ± 0.35	422.14 ± 1.00	2402.80 ± 8.85	2486.59 ± 4.25	2441.47[d] ± 55.60
	28	422.91 ± 0.13	421.08 ± 0.60	421.99 ± 0.96	2500.39 ± 7.51	2578.40 ± 5.11	2542.94[c] ± 41.18
	32	422.83 ± 0.39	421.06 ± 0.48	421.95 ± 0.96	2597.21 ± 6.75	2692.00 ± 5.13	2644.60[b] ± 49.83
	36	422.92 ± 0.42	421.01± 0.33	421.97 ± 1.04	2664.75 ± 6.32	2724.66 ± 7.18	2694.71[a] ± 31.94
Mean* (ovipsition) N.S		422.93 ± 0.28	421.06 ± 0.44	-	2537.22[x] ± 107.83	2620.41[y]± 96.59	-

N.S.: Non significant.

Means not sharing common superscripts letters are significantly different at 1% level.

Both experimental treatments were found to have no significant effect on shell calcium (mg/g). On the other hand, total shell calcium (mg) was significantly ($p<0.01$) affected by age and oviposition time. Increase in total shell calcium was observed as the age of the laying hens increased (2441.47 ± 55.60 – 2694.71 ± 31.94 mg) which is justified by increased shell weight with age. Moreover, the total shell calcium of afternoon eggs was greater (2620.41 ± 96.59 mg) as compared to that of morning eggs (2537.22 ± 107.83 mg). This is also justified by the heavier shell weight of afternoon eggs. These results are in agreement with those published by Patricia (1986). The results of the influence of age and oviposition time on shell magnesium (mg/g) as well as total shell magnesium (mg) are shown in table (10).

Table (10): Influence of age and oviposition time on shell magnesium (mg/g) and Total shell magnesium (mg)

Oviposition (time)		Early	Late	Mean* (age) N.S	Total magnesium (mg)		
					Early	Late	Mean* (age)
Age (weeks)	24	4.29 ± 0.05	4.53 ± 0.05	4.40 ± 0.13	24.36 ± 0.63	26.73 ± 0.34	25.45[d] ± 1.33
	28	4.26 ± 0.05	4.50 ± 0.06	4.39 ± 0.13	25.21 ± 0.33	27.55 ± 0.43	26.48[c] ± 1.27
	32	4.27 ± 0.05	4.51 ± 0.06	4.39 ± 0.13	26.24 ± 0.31	28.81 ± 0.36	27.53[b] ±1.38
	36	4.28 ± 0.05	4.53 ± 0.05	4.41 ± 0.14	26.98 ± 0.36	29.34 ± 0.30	28.16[a] ± 1.27
Mean* (ovipsition) N.S		4.28[x] ± 0.05	4.52[y] ± 0.06	-	25.66[x] ± 1.13	28.11[y] ± 1.10	-

*** : Significant ($p<0.01$) difference.**

Means not sharing common superscripts letters are significantly different at 1% level.

Age showe no significant effect on shell magnesium (mg/g) but it significantly ($p<0.01$) affected total shell magnesium (mg). Increase in total shell magnesium was reported to occur with increased age (25.45 ± 1.33 – 28.16 ± 1.27 mg) which is justified by increased shell weight with age. On the other hand, oviposition time significantly ($p<0.01$) affected both shell magnesium (mg/g) as well as total shell magnesium (mg). Shell magnesium of afternoon eggs was significantly greater (4.52 ± 0.06 mg/g) than that of morning eggs (4.28 ± 0.05 mg/g). Also afternoon eggs showed significantly greater total shell magnesium (28.11±1.10 mg) than did morning eggs (25.66 ± 1.13 mg). Greater shell magnesium of afternoon eggs would imply difference in magnesium deposition rates during shell calcification while increased total shell magnesium of afternoon eggs could be attributed to the heavier shell weight of these eggs. The results obtained here are consistent with those reported in similar study by (23).

The results of the effect of age and oviposition time on shell phosphorus (mg/g) and total shell phosphorus (mg) are set out in table (11).

Table (11): Effected of age oviposition time on shell phosphorus (mg/g) and Total shell phosphorus (mg)

Ovipsition (time)		**Early**	**Late**	**Mean* (age) N.S**	**Total shell phosphorus (mg)**		
					Early	**Late**	**Mean* (age)**
Age (weeks)	**24**	0.89 ± 0.02	1.04 ± 0.01	0.96 ± 0.08	5.10 ± 0.10	6.13 ± 0.06	5.61^{d} ± 0.55
	28	0.89 ± 0.01	1.03 ± 0.02	0.97 ± 0.08	5.25 ± 0.06	6.32 ± 0.06	5.83^{c} ± 0.56
	32	0.90 ± 0.01	1.02 ± 0.02	0.96 ± 0.07	5.53 ± 0.06	6.53 ± 0.10	6.03^{b} ±0.53
	36	0.89 ± 0.01	1.03 ± 0.01	0.96 ± 0.07	5.62 ± 0.05	6.64 ± 0.08	6.13^{a} ± 0.54
Mean* (ovipsition)		0.89^{x} ± 0.01	1.03^{y} ± 0.01	-	5.38^{x} ± 0.24	6.40^{y} ± 0.22	-

Means not sharing common superscripts letters are significantly different at 1% level.

Age showed no significant effect on shell phosphorus (mg/g) but it significantly ($p<0.01$) effected total shell phosphorus (mg). Increase in total shell phosphorus was reported to occur with increased age (5.61 ± 0.55 – 6.16 ± 0.54 mg) which is explained by increased shell weight. Furthermore, both shell phosphorus (mg/g) and total shell phosphorus (mg) were affected significantly ($p<0.01$) by oviposition time. Afternoon eggs showed significantly more shell phosphorus (1.03 ± 0.01 mg/g) than morning eggs (0.89 ± 0.01 mg/g). Also afternoon eggs significantly excelled in total shell phosphorus (6.40 ± 0.22 mg) compared to morning eggs (5.38 ± 0.24 mg). Again the results indicate that there may be difference in phosphorus deposition rates during shell calcification. Moreover, heavier shell weights of afternoon eggs justify why these eggs excelled in total shell phosphorus.

In conclusion, the present investigation indicate that variation in shell quality may be due to difference in magnesium and phosphorus deposition during shell calcification rather than calcium.

Blood and meat spots:

The results of the influence of age and oviposition time on the incidence of blood and meat spots in eggs are depicted in table (12).

Table (12): Effect of age and oviposition time on the incidence of blood and meat spots in eggs

Oviposition (time)		Early	Late	Mean (age) N.S.
Age (weeks)	22	0.1002 ± 0.09	0.1336 ± 0.12	0.1169 ± 0.10
	24	0.1336 ± 0.14	0.0668 ± 0.07	0.1002 ± 0.11
	26	0.2672 ± 0.11	0.2338 ± 0.10	0.2505 ± 0.11
	28	0.2004 ± 0.12	0.1336 ± 0.14	0.1670 ± 0.12
	30	0.2338 ± 0.11	0.2672 ± 0.11	0.2505 ± 0.11
	32	0.2672 ± 0.11	0.1336 ± 0.14	0.2004 ± 0.12
	34	0.1336 ± 0.14	0.1670 ± 0.12	0.1503 ± 0.13
	36	0.1670 ± 0.12	0.1670 ± 0.12	0.1670 ± 0.12
	38	0.1336 ± 0.14	0.1670 ± 0.12	0.1503 ± 0.13
Mean* (oviposition)		0.1818^{x} ± 0.12	0.1633^{y} ± 0.11	-

∗ : Significant (p<0.01) difference.
N.S.: Non significant.
x,y : Means within a row.

The data demonstrate that age showed no significant effect on the incidence of spots in eggs. Our results considered to be similar to the findings of (24) who found that age of the bird have no significant influence on blood and meat spots incidence. However, these results are contrary to those of (25) who shown that bird age have significant effect on blood and meat spots incidence. The explanation for these different results could be attributed to strain differences or management practices.

On the other hand, the present results indicate that oviposition time significantly (p<0.01) affected the incidence of blood and meat spots in eggs. Afternoon eggs showed significantly lower incidence (0.1633 ± 0.11) than did the morning eggs (0.1818 ± 0.12). The reason for the higher incidence of spots in the morning eggs is probably due the effect of stress prevailing during the morning as indicated by the incidence of eggs with abnormal shell laid during the afternoon.

Cholesterol content:

Data of the effect of age and oviposition time on yolk cholesterol concentration (mg/g) and total yolk cholesterol (mg) are presented in table (13).

Table (13): Influence of age and oviposition time on yolk cholesterol concentration (mg/g) and Total yolk cholesterol (mg)

Ovipsition (time)		Early	Late	Mean* (age)	percent shell (%)		
					Early	Late	Mean* (age)
Age (weeks)	22	12.59 ± 0.03	16.29 ± 0.03	14.44^{a} ± 1.93	155.72 ± 1.09	200.37 ± 0.52	178.04^{i} ± 23.33
	24	12.57 ± 0.03	16.27 ± 0.02	14.42^{b} ± 1.93	162.43 ± 0.63	206.49 ± 0.41	184.46^{h} ± 23.01
	26	12.56 ± 0.03	16.26 ± 0.02	14.41^{bc} ± 1.93	168.10 ± 0.39	213.24 ± 0.58	190.67^{g} ± 23.58
	28	12.54 ± 0.03	16.26 ± 0.01	14.40^{cd} ± 1.94	173.89 ± 0.57	215.77 ± 0.85	194.83^{f} ± 21.88
	30	12.54 ± 0.02	16.24 ± 0.01	14.39^{de} ± 1.93	178.02 ± 1.21	222.57 ± 0.63	200.29^{e} ± 23.28
	32	12.53 ± 0.02	16.22 ± 0.02	14.38^{ef} ± 1.92	183.88 ± 1.04	228.32 ± 0.52	206.10^{d} ± 23.22
	34	12.51 ± 0.02	16.20 ± 0.02	14.36^{g} ± 1.92	186.46 ± 0.30	230.69 ± 0.55	208.57^{c} ± 23.10
	36	12.49 ± 0.01	16.19 ± 0.01	14.34^{h} ± 1.93	189.85 ± 0.63	234.62 ± 0.43	212.24^{b} ± 23.39
	38	12.48 ± 0.02	16.17 ± 0.02	14.32^{i} ± 1.92	191.32 ± 0.22	238.19 ± 0.63	214.75^{a} ± 24.48
Mean* (ovipsition)		12.53^{x} ± 0.04	16.23^{y} ± 0.04	-	176.63^{x} ± 11.97	221.14^{y} ± 12.39	-

∗ : Significant (p<0.01) difference.
x, y : Means within a row.
a-i : Means within a column.
Means not sharing common superscripts letters are significantly different at 1% level.

Judging the data, both of the two experimental treatments significantly (p<0.01) affected the two cholesterol values. As the age of the laying hens progressed, yolk cholesterol concentration was decreased (14.44 ± 1.93 – 14.32 ± 1.92 mg/g) where as total yolk cholesterol was increased (178.04±23.33 – 214.75 ± 24.48 mg). Our findings are consistent with the results obtained in similar studies by (26) as well as (7). The increase in total yolk cholesterol with increasing age despite the decrease in yolk cholesterol concentration indicates that the increase in yolk weight was greater than the reduction in yolk cholesterol concentration, therefore the determinative factor of egg cholesterol content was the weight of the yolk. The data distinctly showed significantly lower yolk cholesterol concentration of morning eggs (12.53 ± 0.04 mg/g) compared with that of afternoon eggs (16.23 ± 0.04 mg/g). Furthermore, the data revealed that morning eggs had significantly lower total yolk cholesterol (176.63 ± 11.97 m8g) than afternoon eggs (221.14 ± 12.39 mg). Increased plasma levels of cholesterol and corticosterone documented during stress-related research in chicken (27) may provide strong support that the higher cholesterol contents of afternoon eggs may be related to the stress prevail during the morning time as indicated by the incidence of eggs with abnormal shell. Possible hypothesis could be offered for the explanation can base on the fact that morning stress elevate plasma cholesterol resulted in hypercholestermia that the hens will prevent it by the disposal of the excess plasma cholesterol in the yolk (28, 29) of the afternoon eggs as they still developing during the morning time. Finally, these interesting results suggest that eggs laid in the morning cholesterol significantly less cholesterol than the eggs laid in the afternoon. Afternoon eggs are the expected to meet the consumer demands as healthier food as well as the interests of the producers.

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تأثير العمر ووقت وضع البيض على الصفات النوعية للبيضة وعلاقتها بالتوتر والتغيرات في المكون الخلوي للدم والسلوكية في مرحلة ما قبل وضع البيض في الدجاج البياض

1- الصفات النوعية للبيضة

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الخلاصة

أجريت الدراسة الحالية في الحقل التابع لشركة ميسان لانتاج بيض المائدة بهدف تقييم تأثير العمر ووقت وضع البيض على الصفات النوعية للبيضة . استخدمت 17000 دجاجة من سلالة ايزا براون بعمر 22 أسبوع . جمعت من القطيع عينات من البيض صباحاً وبعد الظهر بأعمار مختلفة (22 – 38) أسبوع .

أشارت نتائج الدراسة الى ما يلي :

1- كان للعمر تاثير عالي المعنوية (P<0.01) على شكل البيضة ، ووزن البيضة ومكوناتها والنسب المئوية للمكونات ، سمك القشرة ، كميات الكالسيوم والمغنسيوم والفسفور بالقشرة ، فضلاً عن محتوى البيضة من الكولسترول . ومن جهة أخرى لم يظهر للعمر تأثير معنوي في النسب المئوية للأملاح بالقشرة ، كميات الكالسيوم والمغنيسيوم والفسفور بكل غرام من القشرة ، والبقع الدموية واللحمية .

2- كان لوقت وضع البيض تاثير عالي المعنوية (P<0.01) على كل الصفات النوعية للبيضة المذكورة أعلاه ما عدا كمية الكالسيوم بالغرام الواحد من القشرة .

- مستل من أطروحة دكتوراه للباحث الثالث