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EFFECTS OF EGGSHELL COLOR ON PRODUCTIVE PERFORMANCE, BODY MEASUREMENTS, AND SOME PLASMA CONSTITUENTS IN GOLDEN MONATZAH CHICKENS

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ABSTRACT: This experiment was conducted to study the association between eggshell color and: productive performance, body measurements and some plasma constituents in Golden Montazah chickens. A total number of 300 Golden Montazah hens, 30 weeks old, were housed individually. Hens were divided into three groups according to their eggshell color (Light Brown, Creamy or White). Blood samples were taken to measure the sex hormones, phosphors and albumin contents and to determine the immune response against Newcastle and H5N1 diseases. Results showed that no significant differences in body weight, comb length, and shank length between females that produced different eggshell color. Wattle length was significantly larger in females produced creamy and light brown shell than females produced white eggshell color. Keel length was significantly longer in females that produced light brown eggs than those that produced Creamy or White eggshell colors. No significant differences in keel length was found between females that produced Creamy or White eggshell colors. No significant differences in egg production were observed between hens that produced different eggshell colors. Egg weight was significantly higher in creamy and white eggshell color than the light brown color group. Also, egg mass was significantly higher in the creamy shell group than the white shell egg group. Shell thickness was significantly higher in Light brown eggs than Creamy or White eggs. Blood Phosphors percentage and albumin percentage, at 42 weeks of age, were significantly higher in females that produced creamy and white eggs than light brown shell color. Antibody titer against H5N1 was significantly higher in hens that produced white eggshell color than hens that produced creamy shell color eggs. No significant differences were observed against Newcastle disease between females produced different eggshell color eggs. Also, no significant differences were observed in estradiol and progesterone hormones in Golden Montazah females produced different eggshell color eggs.

Key words: Golden Montazah, eggshell color, productive performance, body measurements.

INTRODUCTION

The intensity of eggshell pigments varies substantially (Romanoff and Romanoff, 1949, and Shafey *et al*., 2001). The three chief color pigments in the eggshells are biliverdin-IX, zinc biliverdin chelate and protoporphyrin-IX (Kennedy and Vevers, 1976). Brown-shelled eggs contain relatively large amounts of protoporphyrin-IX and relatively small amounts of biliverdin-IX (Kennedy and Vevers, 1976; Schwartz *et al*., 1980; and Wang *et al*., 2009).

Yang *et al*., (2009) reported that there are significant correlations between eggshell color, shell thickness and shell weight. However, they stated that there was no distinct correlation between shell color, egg weight, albumen weight and yolk weight of the Yangzhou chickens. In addition, they demonstrated that some egg quality traits such as shell thickness and shell weight could be assessed through shell color. However, others have provided contradicting results (Joseph *et al.*, 1999 and Richards and deeming, 2001), thus shell color cannot be applied as a quality assessment tool.

MATERIAL AND METHODS

This experiment was carried out at El_Fayioum Poultry Breeding Station, Animal Production Research Institute, Agricultural Research Center.

Experimental Design

A total number of 300, 30 weeks old, Golden Montazah hens, were housed individually in laying cages. They were divided into three groups according to their eggshell color; hens produced light brown color eggs, creamy color eggs or White color eggs.

Management and feeding

At 30 weeks of age, laying hens were wing banded and weighed individually to the nearest gram by using digital weigh scale. Shank length and keel length were obtained according to their egg color and measured to the nearest millimeter by using Vernier Calipers (Das *et al.*, 2014). Shank length was measured from the foot to the middle hock joint (Kang *et al.*, 2012). Keel length was taken as the length of the sternum. Comb length and wattle length were measured to the nearest millimeter using tape ruler.

Laying hens were fed on a layer ration (16 % CP and 2750 KCL). Egg number and egg weight were recorded daily from 32 to 42 weeks of age. At 42 weeks of age, 30 eggs from each group were broken to determine egg quality traits.

Blood Sex Hormones

At 42 weeks of age, five blood samples were collected from each group of hens that produced different eggshell color. Plasma constituents, Progesterone and Estradiol hormones levels were measured, in plasma, using RIA commercial kit (Beekman Coulter Company France). Primary immune response against Newcastle and H5N1 disease were also recorded.

Statistical Analysis:

Data were analyzed by one-way analysis of variance using (SAS, 2001). Significant differences were detected by Duncan Multiple range test (Duncan, 1955). Significance level was set at 5%. The following model was used:

$Y_{ij}=\mu + S_i + e_{ij}$

Where, Y_{ij} = observation for each dependent variable

μ = Overall Mean

S_i= Effect of shell color

e_{ij}=Error associated with each measurement.

RESULTS AND DISCUSSION

Body measurements:

Data presented in Table (1) showed that the differences between the three groups

of Golden Montazah hens, that produced different eggshell color, had significantly ($P < 0.05$) different in wattle length and keel length. Wattle length (cm) were significantly longer in hens produced light brown color eggs and creamy color eggs than hens that produced white shell color eggs. However, there were no significant differences between hens that produced light brown eggshell and creamy eggshell color in their wattle length. Hens produced light brown eggs had longer keel length (10.02cm) than hens produced Creamy (9.38cm) and White eggshell (9.46cm) color. There were no significance differences in keel length between hens produced creamy and white shell color eggs. Hassan (2002) reported that hens with long keel length at 6 weeks of age had significantly higher ($P < 0.05$) egg mass during the first 90 day of production compared to short and medium keel length in Inshash chicken strain.

No significant differences in body weight, comb length, and shank length traits in Golden Montazah hens that produced different types of eggshell colors at 32 weeks of age.

Egg production traits:

Data presented in Table (2) showed no significant differences in egg number or rate of lay between hens produced different eggshell color groups. Egg weight was significantly ($P < 0.05$) heavier in creamy egg color (51.25gm) and white color (50.80gm) eggs than light brown color (49.05gm) eggs. No significant differences in egg weights were found between hens producing creamy or white color eggs.

Egg mass was significantly heavier in creamy (2917gm) than white eggshell color (2715gm) eggs. However, no significant difference in egg mass was observed between creamy and light brown eggshells color eggs. Also, no significance differences in egg mass between white color and light brown eggshell color eggs.

Egg Quality:

Data presented in Table (3) showed that light brown eggshell color had significantly higher ($P < 0.05$) shell thickness (0.417mm) than creamy (0.373mm) and white shell color (0.373mm) at 42 weeks of age. These results agreed with Drabik *et al*., (2021). They found that brown color eggs had significantly higher shell thickness compared with white color eggs at 36 weeks of age. Also, Sekeroglu and Duman (2011) reported higher shell thickness for brown colored eggs. Also, no significant differences between creamy (0.373) and white (0.373) shell color in shell thickness was observed.

No significant differences were observed in eggshell weight of Golden Montazah hens at 42 weeks of age. This result agreed with Drabik *et al*., (2021). They found that there was no significant difference ($P > 0.05$) in shell weight percentages between light brown eggs color and white color eggs produced by Leghorn hens at 36 weeks of age.

No significant differences were found between different eggshell color groups in their internal egg quality traits at 42 weeks of age Table (4). This result agreed with Yang *et al*., (2009). They found that internal egg quality traits have no correlation with different eggshell color produced by Yangzhou chickens.

Some plasma constituents:

Data presented in Table (5) showed that hens produced creamy and white eggshell color had significantly ($P < 0.05$) higher plasma phosphors and albumin at 42 weeks of age compared with hens that

produced light brown color eggs. However, no significant differences were observed between others plasma constituents' traits (Calcium, total protein, Globulin and Hemoglobin) in hens produced different eggshell color.

Plasma sex hormones and immunity:

Data presented in Table (6) showed that there was no significant difference in plasma estradiol and progesterone hormones in Golden Montazah hens at 42 weeks of age that produced different color eggs. It is clear from the results that hens produced creamy and light brown eggs had higher level of plasma estradiol and progesterone hormones at 42 weeks as compared with the hens that produced white eggs, however, the differences were not significant ($P > 0.05$).

Data presented in Table (7) showed that no significant differences in Primary immune response against Newcastle disease between Golden Montazah hens produced different eggshell color groups were observed. Hens produced creamy eggshell colors tends to have high immune response than hens that produced light brown and white shell colors but the difference was not statistically significant ($P > 0.05$). However, hens produced white eggshell color had significantly higher primary immune response against H5N1 disease than hens produced creamy eggshell color. No significant differences were observed in their primary immune response between hens produced white and light brown color eggs against H5N1 disease. Also, no significant differences against H5N1 disease in primary immune response between hens produced creamy and light brown eggshell color.

CONCLUSION

From this study, it should be taking into consideration the correlation between eggshell color, productive performance, the immune response against Newcastle and H5N1 diseases in selection program for egg production in local chicken strains.

Table (1): Effects of eggshell color on body measurements of Golden Montazah hens at 32 weeks of age.

Eggshell color	Body measurements				
	Body weight (gm)	Comb length (cm)	Wattle length (cm)	Shank length (cm)	Keel length (cm)
Light brown	1715± 37	6.60± 0.14	2.79^{a*} ± 0.08	9.41± 0.08	10.02^{a}±0.17
Creamy	1699± 37	6.61± 0.14	2.91^{a}± 0.08	9.49± 0.08	9.38^{b}± 0.17
White	1694± 37	6.35± 0.14	2.50^{b}± 0.08	9.49± 0.08	9.46^{b}± 0.17

*a, b. Means within trait, with different superscripts, are significantly different ($P < 0.05$).

Table (2): Egg production traits of Golden Montazah hens from 32 - 42 weeks of age that produced different types of eggshell color.

Eggshell color	Egg Production Traits			
	Egg number	Eggweight (gm)	Rate of lay (%)	Egg mass (gm)
Light brown	56.34± 1.36	49.05^{b*} ± 0.50	62.60± 1.51	2762^{ab}± 68
Creamy	57.1 ± 1.17	51.25^{a}± 0.43	63.43± 1.31	2917^{a}± 59
White	53.65± 1.42	50.80^{a}± 0.52	59.61± 1.58	2715^{b}± 71

*a, b. Means within trait, with different superscripts, are significantly different (P < 0.05).

Table (3): Effects of eggshell color on external egg quality traits of Golden Montazah hens at 42 weeks of age.

Eggshell color	External egg quality traits		
	Egg weight (gm)	Shell weight (gm)	Shell thickness (mm)
Light brown	49.05^{b*} ± 0.05	5.32± 0.11	0.417^{a}± 0.01
Creamy	51.25^{a}± 0.43	5.31± 0.11	0.373^{b}± 0.01
White	50.80^{a}± 0.52	5.35± 0.11	0.373^{b}± 0.01

*a, b. Means within trait, with different superscripts, are significantly different (P < 0.05).

Table (4): Effects of eggshell color on internal egg quality traits of Golden Montazah hens at 42 weeks of age.

Eggshell color	Internal egg quality traits				
	Albumin weight (gm)	Albumin (%)	Yolk weight (gm)	Yolk (%)	Yolk index (%)
Light brown	29.41*±0.49	59.12± 0.40	14.98± 0.25	30.15± 0.38	43.76± 1.14
Creamy	29.69± 0.49	59.45± 0.40	14.93± 0.25	29.91± 0.38	42.08± 1.14
White	29.88± 0.49	59.38± 0.40	15.04± 0.25	29.98± 0.38	43.74± 1.14

*No significant differences were observed between different eggshell colors groups (P > 0.05).

Table (5): Effects of eggshell color on blood plasma constituents of Golden Montazah hens at 42 weeks of age.

Eggshell color	Plasma constituents					
	Calcium (mg/dl)	Phosphors (mg/dl)	Total proteins (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Hemoglobin (g/dl)
Light brown	19.06± 0.58	3.36^{b*} ± 0.35	5.18± 0.31	1.38^{b}± 0.08	3.80± 0.34	19.76± 0.91
Creamy	18.88± 0.58	4.48^{a}± 0.35	5.11± 0.31	1.80^{a}± 0.08	3.32± 0.34	17.72± 0.91
White	18.22± 0.58	5.17^{a}± 0.35	5.40± 0.31	1.90^{a}± 0.08	3.50± 0.34	17.74± 0.91

*a, b. means within traits with different superscripts are significantly different (P < 0.05).

Table (6): Effects of eggshell color on plasma sex hormones in Golden Montazah hens at 42 weeks of age.

Eggshell color	Sex hormones	
	Estradiol (pg/ml)	Progesterone (ng/ml)
Light brown	259.68* ± 35.33	0.34 ± 0.06
Creamy	240.90 ± 35.33	0.46 ± 0.06
White	232.80 ± 35.33	0.28 ± 0.06

*No significant differences were observed between different eggshell colors groups.

Table (7): Effects of eggshell color on primary immune response against Newcastle and H5N1 viruses in Golden Montazah hens at 42 weeks of age.

Egg color	Primary antibody titers	
	Newcastle	H5N1
Light Brown	7.33 ± 0.84	3.50^{ab}* ± 0.43
Creamy	8.16 ± 0.84	2.77^{b} ± 0.43
White	6.66 ± 0.84	7.17^{a} ± 0.43

*a, b. Means within traits with different superscripts are significantly different (P < 0.05).

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الملخص العربى
دراسة تأثير لون القشرة علي ألاداء ألانتاجي والتناسلي والفسيولوجي لدجاج المنتزة الذهبي

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أجريت هذه الدراسة في محطة بحوث الفيوم لدراسة أرتباط لون قشرة البيض بالأداء الأنتاجي وقياسات الجسم ومكونات بلازما الدم من الفوسفور والالبيومن والهرمونات الجنسية ومستوى المناعة ضد مرضى النيوكاسـل وأنفلونزا الطيور فى سلالة المنتزة الذهبى خلال الفترة من ٠٣ الي ٢٤ أسبوع من العمر. تم وزن وتقسيم الدجاج الي ثلاث مجموعات حسب لون القشرة (بنى فاتح - كريمى - أبيض). تم تسجيل البيض ووزنة يوميا. تم سحب عينات دم لتقدير نسبة الفوسفور والالبيومين ومستوى الهرمونات الجنسية وكذلك تقدير مستوى المناعة ضد مرض أنفلونزا الطيور والنيوكاسل وكانت أهم النتائج التى تم الحصول عليها كالتالى:

١ -لا يوجد فروق معنوية في قياسات الجسم المختلفة بأستثناء طول الداليتين حيث كان أعلي معنويا في الاناث المنتجة للبيض البنى الفاتح والكريمى عن الاناث المنتجة للبيض الأبيض. وكذ لك طول الساق كان أعلي معنوياً في الاناث المنتجة للبيض البنى الفاتح عن الاناث المنتجة للبيض الأبيض والكريمى وهكذا كانت الأناث ذات الساق الأطول مرتبطة بأنتاج البيض البنى.

٢ -لايوجد أختلافات معنوية في عدد البيض المنتج ومعدل الانتاج خلال الفترة من ٢٣ الي ٢٤ أسبوع من العمر بين الوان البيض المختلفة بينما سجل البيض الأبيض والكريمى اللون أعلي وزن معنوى عن البيض البنى الفاتح. سجل البيض البنى الفاتح اعلي سمك للقشرة عن البيض الكريمى والابيض وكان الفرق بينهم معنوى بينما لم يوجد فروق معنوية فى سمك القشرة بين البيض الأبيض والكريمى اللون.

٣ - لا يوجد فروق معنوية فى وزن الصفار والبياض بين الوان قشرة البيض المختلفة.

٤ - سجلت الاناث المنتجة للبيض الكريمى والأبيض أعلى نسبة من الفوسفور وألألبيومين في الدم عن الأناث المنتجة للبيض البنى الفاتح.

٥ - لا يوجد فروق معنوية في مستوى الهرمونات الجنسية في الدم سواء الأستروجين أو البروجستيرون بين الأناث المنتجة لألوان البيض المختلفة.

٦ - سجلت الاناث المنتجة للبيض الأبيض مناعة أعلى معنوياً لمرض أنفلونزا الطيورعن الأناث المنتجة للبيض الكريمى بينما لم يوجد فروق معنوية بين الاناث المنتجة لالوان البيض المختلفة في مستوى المناعة ضد مرض النيوكاسل.

وعلي ذلك يمكن ألأخذ في الأعتبار لون قشرة البيض وعلاقتة بلأداء ألانتاجى ومستوى المناعة عند الانتخاب لانتاج البيض في السلالات المحلية.

الكلمات الدالة: المنتزة الذهبى – لون قشرة البيض - الأداء الانتاجى - قياسات الجسم - مكونات بلازما الدم - مستوى المناعة.