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PHYSIOLOGICAL EFFECTS OF AGE AND STRAIN ON SOME LOCAL STRAINS OF CHICKENS

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ABSTRACT : The objective of this experiment was to study the effects of age and strain on egg production rate, egg weight , egg shell thickness , blood components (total protein, calcium and alkaline phosphatase), ovarian weight, oviduct weight, oviduct length, uterine weights(absolute (g.) and proportional to oviduct weight %) as well as uterine diameters (outer and inner) and uterine folds (number , height and width). A total number of 8000 pullets of three Egyptian developed strains; Golden Montazah (GM), Mandarah (MN) and Gimmizah (GZ) were used in this study. The study started when birds reached 18 weeks of age. All different strain chickens were reared from one day old under the same conditions in floor poultry houses. The chickens were fed a ration contains 16 % crude protein and 2784 kcal ME /kg. Results indicated that GM strain was superior on MN and GZ strains in egg production, egg weights and egg shell thickness. Blood serum constituents, results indicated that GM strain gave the highest values as compared with the other two strains at 18, 22, 30 and 36 weeks of age. Also, GM was the highest in records for all anatomical parameters such as (ovarian , oviduct and uterine weights and oviduct length). Similar trend was also observed in respect of uterine outer and inner diameter, uterine folds number and uterine folds height and width.

Key Words: Local strains, comparison, reproductive state, egg quality.

INTRODUCTION

Hen productive performances are influenced by many factors of which the physiological one. The level of several blood constituents as physiological state indicator is quite different when various reproductive states is under the control of circulating estrogen (Bacon *et al.*, 1980). The factors that responsible for the variations in egg components and interior egg quality include environmental conditions, age and/or reproductive state and clutch size. Shell quality is an important concerns to both the producer and consumer. According to Stadelman (1977), cracked and leaking eggs are a major economic loss to the egg industry. Strain differences in egg shell quality have been reported and reviewed by Amer (1972), Washburn and Potts (1975), Choi *et al.* (1981), and Maan *et al.* (1984). Age of bird significantly affected shell quality parameters. While shell weight increased with increasing age of bird, percentage of shell was decreased (Izat *et al.*, 1985). The present experiment was conducted to study the influence of age and strain on egg production rate, egg weight and egg shell thickness , blood components as well as ovary, oviduct and uterus measurements for Golden Montazah, Mondarah and Gimmizah as a local strains chickens.

MATERIALS AND METHODS

This study was carried out at El-Takamoly poultry project of El-Fayoum Governorate. A total number of 8000 pullets of three local strains were used in this study, Golden Montazah, Mandarah and Gimmizah, before sexual maturity at 18 weeks and after sexual maturity at 22, 26, 30 and 36 weeks of age.

Chicks were kept in brooders with raised wire floods and exposed to 16 ½ hours of light / day. Water offered adlibitum during the experimental period. Diets were formulated to contain 16% CP and 2784 kcal ME/kg .

Egg production was recorded daily. A total number of 480 eggs were randomly collected from three local strains of chickens (160 eggs from each at different ages, 40 x 4). Egg production rate , egg weight and egg shell thickness were estimated during the experimental period.

Individual blood samples were taken after slaughtering of 10 female birds within each

strains at 18, 22, 26 ,30 and 36 weeks of age. Serum was separated for determination of total protein, calcium and alkaline phosphatase , which were colorimetrically determined using commercial kits, following the same steps as described by manufactures.

A total number of seventy five birds (five of each strain at every age) were slaughtered for obtaining reproductive system samples at five ages of different reproductive states. The following measurements were obtained, weights of ovary, oviduct and length of oviduct, absolute weight of uterus and it's proportional weight to oviduct weight. A total number of 75 uterine samples were examined, outer and inner diameters of each uterine were measured. Number, height and width of uterine folds were also counted.

The data were subjected to a factorial design (3 S x 5 A) , statistical analysis using General Linear Model of SAS® software (SAS Institute , 1990). Significant means were separated by Duncan's Multiple Rang Test (Duncan, 1955).

RESULTS AND DISCUSSION

Egg production rate, egg weight and egg shell thickness:

Egg production rate, egg weight and egg shell thickness data (Table 1) revealed that GM strain had higher egg production rate than the other two strains at all studied ages, while GZ strain had the lowest value. In this respect, Bray *et al.* (1960) stated that egg production was strongly influenced by age of maturity, while Kamar (1964) found that egg number was significantly and negatively correlated with age at sexual maturity. The GM strain showed significantly ($P<0.05$) heaviest egg weight during the period of study up to 30 weeks of age than the other two strains, while GZ showed the lightest egg weight. At 36 weeks of age, GM strain exhibited the lowest egg weight as compared with MN and GZ ones.

Weights of eggs produced by the three different strains were gradually increased up to 30 weeks of age and be constant thereafter. These results indicates that genetic is one of the major factors affecting egg size. This results is in agreement with those of Cook and Briggs (1977) who found from several studies that strain and age of hen

were directly influence the size and composition of egg.

GM strain gave significantly higher egg shell thickness during the period of study up to 30 weeks of age compared with the other strains, while GZ strain record the lowest egg shell thickness. The differences between MN and GZ were significant at 22 weeks only. Shell thickness reached its maximum at 26 weeks then declined with age advancing. The egg weight increased while shell quality and egg production decreases as the hen advance in age, (Peterson, 1965 and Wolford and Tanaka, 1970).

Blood parameters:

The GM strain exhibited an increase in total protein compared to the other two strains at all studied ages except at 18 weeks old (Table 2), while MN strain showed almost the lowest total protein . The differences in serum total protein between MN and GZ were significant ($P<0.05$) at 18, 26, 30 and 36 weeks. Rako *et al.* (1964) showed that total serum protein positively and significantly ($P<0.05$) correlated with egg production. The results of serum calcium level revealed that strain had significant ($P<0.05$) influences on this trait, where GM strain had significantly ($P<0.05$) higher calcium level than the other two strains at all ages studied, while MN showed the lowest ones. The differences between MN and GM strains were not significant at all ages studied. It can be noticed that serum calcium level increased between 22 and 26 weeks of age in association with increasing egg production. These results agreed with those of Winget and Smith (1958) who stated that the fluctuations in blood calcium concentration is accompanied egg formation where shell gland is responsible for these changes. El–Nadi *et al.* (1981) reported that the plasma calcium levels increased after sexual maturity and the increase was higher in active than in inactive hens. Alkaline phosphatase (Table 2) indicated that the highest level was in GM strain as compared to the other two strains along the experimental period from 18 till 36 weeks of age. The differences between MN and GZ strains were not significant at all studied ages. The results obtained indicated that the alkaline phosphatase level declined with advancing in age. This is in agreement with the results

obtained by Choudary *et al.* (1971) and Stutts *et al.* (1957) whom reported that the level of serum alkaline phosphatase was significantly ($P<0.05$) and positively correlated with egg production and other traits such as body weight. Ali and Attia (1980) indicated that alkaline phosphatase could be reliable measure for high egg production.

Anatomical parameters:

Data listed in Table (3) indicated that GM strain possessed significantly heavier ovary weight at all studied ages than the other two strains, while GZ strain showed the lightest ones. The differences between MN and GZ were significant at 22, 30, and 36 weeks only. Ovarian weights sharply increased for all strains at sexual maturity which is noticed when comparing weights of 18 and 22 weeks of age. Oviduct weight and length data (Table 3) showed that, GM strain had highest values than the other two strains at all studied ages, while GZ strain had the lowest ones. The differences between MN and GZ for oviduct weight and length were significant at 26 and 36 weeks only. It can be noticed that oviduct weight and length increased sharply during the age of sexual maturity, between 18 and 22 weeks of age. As shown in Table (3) GM strain had significantly higher uterine weight and proportional to oviduct weights at all studied ages than the other two strains while, GZ showed the lowest ones. The significant ($P<0.05$) differences between MN and GZ strains were at 22 and 36 weeks for both absolute and proportional uterine weight. The sharp increase in uterine weight during the period of sexual maturity, between 18 and 22 weeks of age, indicated the development in secretory glands. Results showed that GM strain was the first to reach sexual maturity early, while GZ strain was the latest one. Both GM and MN strains showed increase in uterine weight compared to GZ strain, which was associated with higher egg production in these two strains (Table 1). This may be due to the development of the secretory gland responsible for egg shell formation. These results are in agreement with those obtained by Habeeb (1994) who demonstrated that Golden Montazah (GM) strain gave the highest records for ovary weight , oviduct length and uterine weights, absolute

and proportional to oviduct weight when compared with the other strains (Mandarah and Gimmizah).

Data in Table (4) showed that GM strain had significantly higher uterine outer and inner diameters than the other two strains at all studied ages, while GZ strain was the lowest. The differences between GM and the other strains were significant ($P<0.05$) at 36 weeks for outer and inner diameters. There were significant ($P<0.05$) increase in outer and Inner diameters between 18 and 22 weeks, which could be a result of reaching sexual maturity during this period. The GM strain had more folds number than the other two strains (Table 4), while GZ strain showed the lowest folds number. The GM strain exhibited significantly ($P<0.05$) higher uterine folds height and width except at 22 weeks of age as compared with the other two strains at all studied ages. These results are similar to the previous findings of Habeeb (1994) who found that Golden Montazah (GM) strain recorded the highest values for uterine outer and inner diameters and uterine folds number , height and width as compared with the other strains (Mandarah and Gimmizah).

It's worthily said that Golden Montazah (GM) strain gave the highest records for egg production rate, egg weight, egg shell thickness, blood components (total protein, calcium and alkaline phosphatase), ovarian weight, oviduct weight, oviduct length, uterine weights (absolute g.) and proportional to oviduct weight %) as well as uterine diameters (outer and inner) and uterine folds (number , height and width) were compared with the other strains (Mandarah and Gimmizah) at different eggs.

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Table 1. Means ($\bar{X}$) ± standard errors (SE) of egg production, egg weight and egg shell thickness as affected by age and strain for different local strains [Gimmizah (GZ), Mandarah (MN) and Gloden Monatazah (GM)] of chickens.

Traits / Strains	Egg Production (%)	Egg weight (g)	Egg shell thickness (μ)
At 22 weeks :			
GZ	11	35.85±0.69 ^{b}	39.70±1.01 ^{b}
MN	18	37.07±0.64 ^{a}	41.87±1.26 ^{a}
GM	27	37.41±0.96 ^{a}	41.39±0.80 ^{a}
At 26 weeks :			
GZ	32	39.37±0.69 ^{c}	42.25±0.66 ^{b}
MN	45	40.21±0.30 ^{b}	42.78±1.06 ^{b}
GM	62	40.91±0.78 ^{a}	43.75±0.48 ^{a}
At 30 weeks :			
GZ	40	45.62±0.24 ^{a}	41.90±0.64 ^{b}
MN	64	45.63±0.25 ^{a}	41.58±0.93 ^{b}
GM	68	45.73±0.25 ^{a}	43.30±0.75 ^{a}
At 36 weeks :			
GZ	47	45.31±0.26 ^{b}	41.10±1.06 ^{a}
MN	68	45.97±0.25 ^{a}	41.55±0.82 ^{a}
GM	75	45.25±0.24 ^{b}	39.70±0.71 ^{b}

Means bearing different letters within the same classification, differ significantly (P<0.05).

Table 2. Means ($\bar{X}$) ± standard errors (SE) of blood biochemical parameters as affected by age and strain for different local strains [Gimmizah (GZ), Mandarah (MN) and Gloden Monatazah (GM)] of chickens.

Traits / Strains	Serum total protein (mg/100ml)	Serum calcium (mg/100ml)	Serum alkaline Phosphates (unit/100ml)
At 18 weeks :			
GZ	5.51±0.30 ^{a}	19.01±0.40 ^{b}	29.61±2.36
MN	4.48±0.28 ^{b}	20.18±0.49 ^{ab}	30.66±3.06
GM	5.20±0.29 ^{a}	20.72±0.47 ^{a}	33.09±3.44
At 22 weeks :			
GZ	6.14±0.25	19.59±0.66 ^{b}	28.65±2.68 ^{b}
MN	5.61±0.30	19.16±0.70 ^{b}	28.26±2.77 ^{b}
GM	6.36±0.35	21.22±1.24 ^{a}	35.93±2.81 ^{a}
At 26 weeks :			
GZ	6.48±0.32 ^{a}	23.21±1.15 ^{b}	28.86±2.83 ^{b}
MN	6.27±0.28 ^{b}	22.90±1.44 ^{b}	26.67±3.14 ^{b}
GM	7.14±0.29 ^{a}	25.80±1.22 ^{a}	32.86±2.44 ^{a}
At 30 weeks :			
GZ	7.76±0.32 ^{b}	22.88±1.27 ^{b}	27.90±1.69
MN	6.44±0.45 ^{c}	22.82±1.14 ^{b}	28.62±2.01
GM	8.82±0.29 ^{a}	24.96±0.80 ^{a}	30.66±3.09
At 36 weeks :			
GZ	6.64±0.36 ^{b}	24.71±0.64 ^{ab}	24.16±2.04 ^{b}
MN	7.35±0.40 ^{a}	23.91±0.95 ^{b}	25.44±1.14 ^{b}
GM	7.56±0.31 ^{a}	25.88±1.29 ^{a}	29.36±1.86 ^{a}

Means bearing different letters within the same classification, differ significantly (P<0.05).

Table 3. Means ($\bar{X}$) ± standard errors (SE) of ovarian weight, oviduct weight, oviduct length and uterine weights, absolute (g.) and proportional to oviduct weight (%)as affected by age and strain for different local strains [Gimmizah (GZ), Mandarah (MN) and Gloden Monatazah (GM)] of chickens.

Traits / Strains	Ovarian weight (g)	Oviduct weight (g)	Oviduct length (cm)	Urine weights (g)	Uterine weight (%)
At 18 weeks :					
GZ	1.16±0.27	1.75±0.48	11.10±0.66	0.67±0.11	30.03
MN	1.36±0.20	3.31±0.67	12.00±0.68	0.95±0.20	27.74
GM	3.17±0.28	2.20±0.29	15.60±0.93	1.01±0.10	35.40
At 22 weeks :					
GZ	16.80±1.54^{b}	19.62±2.23^{b}	36.70±6.19^{c}	5.35±0.45^{b}	27.77^{a}
MN	26.60±2.62^{a}	20.95±1.98^{ab}	51.40±4.63^{b}	5.56±0.52^{b}	26.64^{b}
GM	28.40±3.19^{a}	23.12±1.08^{a}	58.10±1.65^{a}	6.40±0.38^{a}	26.81^{b}
At 26 weeks :					
GZ	26.41±1.68^{b}	21.83±1.30^{b}	50.60±3.61^{b}	6.59±0.27^{ab}	27.51
MN	28.09±1.96^{b}	26.19±1.77^{a}	60.90±3.47^{a}	6.13±0.69^{b}	26.33
GM	36.20±4.06^{a}	28.56±1.74^{a}	62.80±3.93^{a}	6.96±0.26^{a}	25.63
At 30 weeks :					
GZ	27.78±2.34^{b}	24.95±2.92^{b}	55.00±4.60^{b}	6.69±0.58^{b}	28.13
MN	33.95±3.47^{a}	26.40±2.48^{b}	55.90±4.55^{b}	6.70±0.52^{b}	26.74
GM	36.90±2.64^{a}	29.31±1.87^{a}	61.30±3.83^{a}	7.31±0.69^{a}	28.70
At 36 weeks :					
GZ	30.10±3.23^{b}	24.51±2.95^{c}	54.90±3.58^{b}	6. 48±0.75^{b}	29.29^{a}
MN	36.10±2.65^{a}	28.12±1.64^{b}	61.40±3.42^{a}	7.65±0.45^{a}	26.39^{ab}
GM	38.36±2.51^{a}	31.10±2.78^{a}	60.30±4.10^{a}	7.90±0.80^{a}	32.27^{a}

Means bearing different letters within the same classification, differ significantly (P<0.05).

Table 4. Means ($\bar{X}$) ± standard errors (SE) of uterine diameters (outer and inner) and uterine folds (number , height and width) as affected by age and strain for different local strains [Gimmizah (GZ), Mandarah (MN) and Gloden Monatazah (GM)] of chickens.

Traits / Strains	Uterine diameters		Uterine folds		
	Outer	Inner	Number	Height	Width
At 18 weeks :					
GZ	80.00±11.6	65.65±7.00	58.00±7.85^{b}	9.28±2.76^{c}	3.68±0.27^{c}
MN	84.00±8.89	69.00±8.17	60.60±8.96^{ab}	18.76±3.98^{b}	4.88±0.69^{b}
GM	97.40±13.61	78.60±13.34	64.02±650^{a}	26.00±5.54^{a}	6.70±1.41^{a}
At 22 weeks :					
GZ	135.00±24.90^{b}	118.20±23.16^{c}	66.60±2.93^{a}	32.62±1.42^{c}	4.60±0.26^{b}
MN	228.00±24.58^{a}	189.00±23.89^{b}	62.80±5.20^{ab}	54.10±3.81^{b}	9.22±0.86^{a}
GM	260.00±14.83^{a}	235.40±15.43^{a}	60.60±3.44^{b}	60.20±4.97^{a}	9.44±0.59^{a}
At 26 weeks :					
GZ	270.00±18.43	207.00±19.78^{b}	61.80±4.47^{b}	69.80±4.07^{b}	9.60±0.51^{ab}
MN	279.00±12.49	224.60±11.69^{b}	66.60±4.70^{a}	73.20±2.82^{ab}	10.62±0.54^{a}
GM	298.00±8.60	289.20±8.71^{a}	65.60±3.22^{a}	77.20±1.70^{a}	9.18±0.47^{b}
At 30 weeks :					
GZ	378.00±13.19	322.40±12.98^{b}	70.06±7.61^{b}	69.40±4.94	9.30±1.36^{b}
MN	400.00±50.00	343.00±50.40^{ab}	73.08±3.53^{ab}	71.20±6.08	10.20±1.28^{ab}
GM	404.00±39.37	364.00±53.05^{a}	76.00±2.47^{a}	75.10±2.04	11.20±0.58^{a}
At 36 weeks :					
GZ	408.00±43.19^{c}	350.40±42.04^{c}	69.04±4.46^{c}	74.60±2.54^{b}	10.40±0.51^{b}
MN	521.00±35.44^{b}	461.60±33.33^{b}	86.08±7.07^{b}	75.00±3.42^{b}	10.40±0.93^{b}
GM	557.00±41.46^{a}	517.00±30.32^{a}	94.06±6.01^{a}	79.60±1.69^{a}	13.00±1.48^{a}

Means bearing different letters within the same classification, differ significantly (P<0.05).

التأثيرات الفسيولوجية للعمر والسلالة على بعض سلالات الدجاج المحلية

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أجريت هذه الدراسة باستخدام ثلاثة سلالات الدجاج المحلية وهى (الجميزة، المندرة والمنتزه الذهبى) تمت تربيتها من اليوم الأول للفقس تحت ظروف غذائية وبيئية موحدة وذلك بهدف دراسة ومعرفة التأثيرات الفسيولوجية للعمر والسلالة على بعض سلالات الدجاج المحلية

وتضمنت هذه الدراسة ما يلى :-

دراسة لمعدل انتاج البيض ومتوسط وزن البيض وسمك القشرة فى الأعمار المختلفة مع دراسة التغيرات فى بعض مكونات الدم (البروتين والكالسيوم ، وانزيم الفوسفاتيز القاعدى)، اضافة الى بعض المقاييس التشريحية.

كانت نتائج البحث كالتالى :-

أوضحت النتائج وجود اختلافات معنوية بين السلالات حيث أظهرت سلالة المنتزه الذهبى أعلى معدل لإنتاج البيض ومتوسط وزن البيض وسمك القشرة بفارق معنوى مقارنة بكل من الجميزة والمندره كما وجدت اختلافات معنوية بين الجميزة والمندره لصفة وزن البيض عند عمر ٢٢ ، ٢٦ ، ٣٦ أسبوع ، ولصفة سمك القشرة عند عمر ٢٢ أسبوع فقط.

كما أشارت النتائج إلى تفوق سلالة المنتزه الذهبى معنويا خلال الأعمار المدروسة لكل من مستوى البروتين الكلى والكالسيوم وإنزيم الفوسفاتيز القاعدى فى السيرم عن كل من سلالتى الجميزة والمندرة بينما كانت سلالة الجميزة الأقل بفارق معنوى بالنسبة لهذه الصفات، بينما كانت الاختلافات بين الجميزة والمندرة معنوية فى مستوى إنزيم الفوسفاتيز القاعدى عند عمر ٢٢ أسبوع فقط.

كما بينت النتائج وجود اختلافات بين السلالات الثلاثة فى وزن المبيض وطول ووزن القناة التناسلية حيث أظهرت سلالة المنتزه الذهبى طوال فترة الدراسة أعلى قياسات بفروق معنوية عن كل من سلالتى الجميزة والمندرة بينما سجلت سلالة الجميزة أقل معنوية مع وجود اختلافات معنوية بين الجميزة والمندرة لكل من وزن المبيض عند عمر ٢٢ ، ٣٠ ، ٣٦ أسبوع فقط ولوزن قناة المبيض عند عمر ٢٦ ، ٣٦ أسبوع فقط وأيضاً وجدت اختلافات معنوية بينهم فى طول قناة المبيض عند عمر ١٨ ، ٢٦ ، ٣٦ أسبوع.

كما بينت الدراسة أن سلالة المنتزه الذهبى طوال الفترة التجريبية سجلت أعلى قيمة لمتوسط وزن الرحم المطلق مقارنة بسلالتى الجميزة والمندرة.

كما أشارت النتائج إلى وجود اختلافات غير معنوية بين السلالات الثلاثة بالنسبة لمقياس وزن الرحم منسوبا لوزن قناة المبيض.

أظهرت سلالة المنتزه الذهبى طوال فترة الدراسة أعلى قيم لمتوسط القطر الداخلى والخارجى للرحم مقارنة بكل من الجميزة والمندرة بينما أظهرت سلالة الجميزة أقلهما مع وجود اختلافات معنوية بين الجميزة والمندرة عند عمر ٢٢ ، ٣٦ أسبوع فقط.

وفيما يتعلق بعدد الثنايا الرحمية وارتفاعها وعرضها فقد كانت مطابقة لنفس اتجاه القطر الداخلى والخارجى للرحم فيما يتعلق بالاختلافات بين السلالات والأعمار.