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THE RELATIONSHIP BETWEEN AGE AT SEXUAL MATURITY AND SOME PRODUCTIVE TRAITS IN LOCAL CHICKENS STRAIN

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ABSTRACT: *A total of 250 females of Alexandria chickens from egg line which selected for age of sexual maturity were divided into three groups according to their age at sexual maturity trait (X ± one unit of S.D.), as early sexual maturity (ESM) averaged (128.5 d), medium sexual maturity (MSM) averaged (152.8 d) and late sexual maturity (LSM) averaged (166.6 d). The objectives of this study were to determinate the relationship between age at sexual maturity and each of growth and egg production traits and to estimate genetic and phenotypic correlation coefficients between age at sexual maturity and studied traits.*

Results showed that, there were significant differences of body weight at 4 wks (202.2, 187.4 and 177.5 gm.) and at 8 wks (560.6, 502.8 and 479.0 gm.) for ESM, MSM and LSM, respectively. However, there were no significant differences of body weight at hatch day (BW0) and at sexual maturity (BWM) among these groups. These results showed that the early age at sexual maturity group had the heaviest weight till 8 weeks of age, which was not found at sexual maturity.

Early age at sexual maturity group gave the highest egg number during the first 90 days after sexual maturity (42.6 eggs) compared with MSM and LSM groups (28.2 and 30.6 eggs, respectively). Also, egg mass during the first 90 days after sexual maturity was the highest value (1405.8 gm.) for early maturity group; in the meanwhile the average of egg weight was the lowest value (33.0 gm.).

The genetic and phenotypic correlations of age at sexual maturity were negatively with all of body weight at 4-wk, 8-wk of age, egg number and egg mass, while they were positive with egg weight.

Therefore, breeding programs aiming to reduced age at sexual maturity to obtain a high number and mass of eggs, must consider high body weight till 8-wk of age, after that restrict the body weight till sexual

maturity. This may be helps breeder to select layers early by using high body weight at eight weeks of age.

INTRODUCTION

Age at sexual maturity (ASM) has long been considered an important fecundity and heredity trait. The primary studies for this trait decided that, the ASM is one of the easiest characters to establish in a flock through selective breeding especially if attention is given to the selection of maturity used of males from early maturity dams pullets started to lay at an earlier age were smaller than those of late sexual maturity, Hutt (1949). Also, after selection for ASM, it has correlated response on egg production traits. Concerning the effect of breed on age at sexual maturity, Kiling et al., (1985) reported that early matured pullets laid their first egg before 136 days, while late pullets matured when they were 152 days of age.

Egg production traits such as egg number, egg weight, egg mass and body weight at sexual maturity are affected by age at sexual maturity in chickens and quails (Abd-El-Gawad, 1975; Morris, 1990; Aly, 1992; Shebl, 1991; El-Bodgady et al., 1993; Ghanem, 1995; Camci et al., 2002 and Meky, 2007). Within-line correlations between age and body weight at sexual maturity were not different from zero (0.09 and 0.12 for two lines of Single comb White Leghorn chickens), as found by (Dunnington and Siegel, 1984). Also, they reported that chickens must reach a minimum age and body weight before they can commence egg production. On the contrary, Kinney (1969), Abdou and Kolastad (1986), Zatter (1994) and Nawar (1995) found that age at sexual maturity was negatively correlated with body weight at sexual maturity. Also, Ghanem (1995) found negatively phenotypic correlated (-0.04) between age and body weight at sexual maturity.

Kosba (1978), Shebl (1991) and Ghanem (1995) showed estimated phenotypic correlation values were -0.32, -0.49 and -0.34 between age at sexual maturity and egg number during 90 days, respectively. Genetic and phenotypic correlation coefficients were estimated for egg line of Alexandria chickens by El-Tahawy (2000), since he found that age at sexual maturity were negative for both kinds of correlation with body weight at eight weeks of age (-0.2 and -0.19 respectively) and egg number during 90 days (-0.67 and -0.38, respectively).

Mean egg weight is strongly influenced by the age at which a flock of hens reaches sexual maturity (Morris, 1985). Also, mean egg weight was highly correlated with age at sexual maturity, irrespective of breed; egg weight increased by 1.6 g for a 10-d delay in maturity (Lewis et al., 1994).

Selection for growth traits was caused correlated response on age at sexual maturity. Maloney et al., (1967) found that during selection for high and low eight weeks body weight, age at sexual maturity was reduced in the high line of female parents at the rate of 0.33 days per generation. Shebl (1980) concluded that divergent selection for eight weeks body weight had an effect on age at sexual maturity in Alexandria chickens, the high line matured earlier than the low line. Also, Abd El-Halim (1999) found negatively genetic correlated (-0.48) between age at sexual maturity and body weight at eight weeks.

The objectives of this study were to determinate the relationship between age at sexual maturity and some production traits (growth and egg production) in local chicken strain and to estimate genetic and phenotypic correlation coefficients between age at sexual maturity and studied traits.

MATERIALS AND METHODS

The present experiment was conducted at the Poultry Research Center, Poultry Production Department, Faculty of Agriculture, Alexandria University. The data was obtained during season 2005/2006.

A total of 250 females of Alexandria chickens which selected as egg line (Ghanem, 1995 and El-Dlebshany, 2004) were divided into three groups according to age at sexual maturity trait ($X \pm 1$ S.D.), as early sexual maturity (ESM) averaged (128.5 d), medium sexual maturity (MSM) averaged (152.8 d) and late sexual maturity (LSM) averaged (166.6 d). The numbers, ranges and averages of age at sexual maturity for each group of egg line females, were shown in Table (1).

Studied Traits:

The following traits were studied:

1. Individual body weight were recorded to the nearest 0.1 (gm.) at hatch day (BW0), four weeks (BW4), eight weeks (BW8) of age and at the first egg (BWM).
2. Age at the first egg in days (Age at sexual maturity, ASM).
3. Egg number during the first 90 days after sexual maturity.
4. Average egg weight in grams during the first 90 days after sexual maturity.
5. Average egg mass in grams during the first 90 days after sexual maturity.

Statistical analysis:

The statistical analyses of the data were carried out utilizing statistical analysis system (SAS, 1992) and least squares and maximum likelihood general purpose program-mixed model (Harvey, 1990). Data were analyzed by adapting the following model:

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

Where, Y_{ij}: The observation for the trait,

μ : Overall mean, G_i : The fixed effect of i^{th} group

(i=1,2 and 3) and e_{ij}: Random error.

Genetic correlation:

Genetic correlation coefficient (r_G) between age at sexual maturity (x) and all studied traits (y) were computed by formula (Becker, 1985):

$$r_G = \frac{Cov_s}{\sqrt{[var(S_x)\, var(S_y)]}}$$

where:

Cov_s : is the sire genetic covariance between traits x and y,

$var(S_x)$: is the sire variance component of trait x, and

$var(S_y)$: is the sire variance component of trait y.

Phenotypic correlation:

Phenotypic correlation coefficient (r_p) between age at sexual maturity (x) and all studied traits (y) were obtained by using the following formula (Becker, 1985):

$$r_p = \frac{Cov_s + cov_w}{\sqrt{(varS_x + var\, w_x)(varS_y + var\, w_y)}}$$

Where:

Cov_s : is the covariance between sires,

cov_w : is the remainder of the genetic plus the environmental covariance.

RESULTS AND DISCUSSION

Data presented in Table (1) demonstrated that least squares means of age at sexual maturity for each group (ESM, MSM and LSM) of egg line dams were 128.5, 152.8 and 166.6 days, respectively. There were highly significant differences ($P \leq 0.0001$) among groups in ASM, which indicated that, each group may have different traits correlated to its age at sexual maturity (Shebl, 1991; El-Bodgady et al., 1993; Ghanem, 1995; Camci et al., 2002 and Meky, 2007).

The relationship between age at sexual maturity and growth traits:

Data presented in Table (2) showed that least square means and standard errors for body weight at hatch day (BW0), four weeks (BW4), eight weeks (BW8) of age and at the first egg (BWM) for each group (ESM, MSM and LSM) of egg line. The results showed that there were significant differences of body weight at 4 wks (202.2, 187.4 and 177.5 gm.) and at 8 wks (560.6, 502.8 and 479.0 gm.) for ESM, MSM and LSM groups, respectively. However, there were no significant differences of body weight at hatch day (BW0) and at sexual maturity (BWM) among groups. These results showed that the early age at sexual maturity group had the heaviest weight till 8 weeks of age, which was not found at sexual maturity.

These findings agree with that reported by Kinney (1969); Maloney et al., (1967); Shebl (1980) and Ghanem, (1995). They indicated that high body weights at 8 wks of age (which influence the early completed reproductive system) were reached maturity earlier than low one in the same breed. The same trend was shown for body weight at sexual maturity, 1540.9, 1543.5 and 1457.7 gm. for ESM, MSM and LSM groups, respectively, but with no significant. Dunnington and Siegel, (1984) reported that chickens must reach a minimum age and body weight before they can commence egg production.

The relationship between age at sexual maturity and egg production traits:

Data presented in Table (3) showed the least square means and standard errors for egg number, average egg weight and egg mass during the first 90 days after sexual maturity for each group (ESM, MSM and LSM) of egg line dams. Highly significantly differences ($P \leq 0.0001$) among groups (ESM, MSM and LSM) were observed for egg number, average egg weight and egg mass during the first 90 days after sexual maturity.

Early age at sexual maturity group gave the highest egg number during the first 90 days after sexual maturity (42.6 eggs) compared with MSM and LSM groups (28.2 and 30.6 eggs, respectively). Also, egg mass during the first 90 days after sexual maturity was the highest value (1405.8 gm.) for early maturity group. However, the average egg weight during the first 90 days after sexual maturity was the lowest value (33.0 gm.) for early maturity group. Although these decrease in average egg weight (4.9 gm.) with early mature group, but there were increasing in egg mass by 246 gm. in ESM compare with LSM. These results due to the highly increase in egg number produced (12 eggs) by ESM.

These findings agree with that reported by Kosba (1978); Morris, (1985); Shebl (1991); Ghanem (1995); El-Bodgady et al., (1993) and El-Tahawy (2000). They found increasing in egg number and decreasing in egg weight with early age at sexual maturity birds.

Genetic and phenotypic correlations:

The genetic and phenotypic correlations values of age at sexual maturity with studied traits are presented in Table (6). The observed genetic and phenotypic correlations of age at sexual maturity with body weight at 8 wks of age were negative (-0.31 and -0.26 respectively), which indicated that higher body weight at 8 wks mature earlier. Similar results were obtained by Maloney et al., (1967); Shebl (1980); Abd El-Halim (1999) and El-Tahawy (2000).

There was negative and very small genetic correlation (-0.01) of age at sexual maturity with body weight at sexual maturity. These findings agree with that reported by Kinney (1969); Dunnington and Siegel, (1984); Abdou and Kolastad (1986), Zatter (1994) and Nawar (1995); Ghanem (1995) and Abd El-Halim (1999).

Highly and negatively genetic and phenotypic correlations values of age at sexual maturity with egg number during the first 90 days after sexual maturity were -0.59 and -0.52, respectively. The same direction of egg number was found with egg mass but less strong, were -0.37 and -0.31, respectively. These results indicated that early maturity related with high egg number and mass. However, the genetic and phenotypic correlations of age at sexual maturity with average egg weight were positive (0.32 and 0.37 respectively), which indicated that early maturity birds produce smaller egg weight. The findings agree with that reported by Kosba (1978), Morris (1985), Shebl (1991) and Ghanem (1995).

CONCLUSION

Generally, the results of the present study showed that, age at sexual maturity affected many important traits. Early maturity hens produced more number and mass of egg, although they produced smaller egg weight than the late maturity.

Moreover, age at sexual maturity correlated with growth traits, especially with body weight at eight weeks of age. So, the hens which had high body weight at 8-wk of age, matured earlier than the low of them. With notice, that these increased in body weight at 8-wk of age are not required at sexual maturity.

Therefore, breeding programs aiming to reduced age at sexual maturity to obtain a high number and mass of eggs, must consider high body weight till 8-wk of age, after that restrict the body weight till sexual maturity. This may be helps breeder to select layers early by using high body weight at eight weeks of age.

Table (1): The numbers, ranges, least square means, standard errors and probability for each group of age at sexual maturity (days) of egg line dams.

Age at sexual maturity	N	Range		Mean X±S.E
		Low	High	
Early (ESM)	54	121	136	$128.5^{a} \pm 0.54$
Medium (MSM)	166	139	162	$152.8^{b} \pm 0.47$
Late (LSM)	30	164	169	$166.6^{c} \pm 0.29$
Overall mean				149.2 ± 0.81
Probability				0.0001

*Means having different superscript in the same column are significantly different (P≤ 0.05)

Table (2): Least square means, standard errors and probability for growth traits in three groups of age at sexual maturity of egg line dams.

Groups	Growth Traits			
	BW0(gm.) X±S.E	BW4(gm.) X±S.E	BW8(gm.) X±S.E	BWM(gm.) X±S.E
Early(ESM)	32.4 ± 0.41	$202.2^{a} \pm 4.69$	$560.6^{a} \pm 9.73$	1540.9 ± 30.44
Medium(MSM)	33.0 ± 0.30	$187.4^{b} \pm 3.01$	$502.8^{b} \pm 7.85$	1543.5 ± 20.23
Late (LSM)	33.9 ± 0.59	$177.5^{b} \pm 5.16$	$479.0^{b} \pm 15.95$	1457.7 ± 47.60
Overall mean	33.0 ± 0.23	189.4 ±2.36	512.4 ± 6.15	1532.6 ± 16.04
Probability	0.1633	0.0068	0.0001	0.2258

*Means having different superscript in the same column are significantly different (P≤ 0.05)

Table (3): Least square means, standard errors and probability for egg production traits in three groups of age at sexual maturity of egg line dams.

Groups	Egg Production Traits		
	EN90(eggs) X±S.E	EW90(gm.) X±S.E	EM90(gm.) X±S.E
Early (ESM)	$42.6^{a} \pm 1.33$	$33.0^{c} \pm 0.41$	$1405.8^{a} \pm 3.45$
Medium(MSM)	$28.2^{b} \pm 0.73$	$35.3^{b} \pm 0.28$	$995.5^{b} \pm 2.38$
Late (LSM)	$30.6^{b} \pm 1.52$	$37.9^{a} \pm 0.70$	$1159.8^{b} \pm 3.19$
Overall mean	31.6 ± 0.70	35.1 ± 0.24	1109.2 ± 1.04
Probability	0.0001	0.0001	0.0001

*Means having different superscript in the same column are significantly different ($P \leq 0.05$)

Table (4): The genetic (r_g), phenotypic correlations and standard errors between age at sexual maturity and studied traits.

Traits	$r_g \pm$ S.E	r_p
BW0	0.06 ± 0.14	0.06
BW4	- 0.26 ± 0.13	- 0.15
BW8	- 0.31 ± 0.13	- 0.26
BWM	- 0.01 ± 0.14	0.02
EN90	- 0.59 ± 0.13	- 0.52
EW90	0.32 ± 0.12	0.37
EM90	-0.37± 0.13	-0.31

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الملخص العربي

العلاقة بين عمر البلوغ الجنسى و بعض الصفات الإنتاجية فى الدجاج المحلى

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أجريت هذه التجربة بأستخدام ٢٥٠ دجاجة من سلالة الإسكندرانى خط إنتاج البيض المنتخب لعمر البلوغ الجنسى وتم تقسيمهم إلى ثلاث مجاميع على أساس صفة عمر البلوغ الجنسى (المتوسط ± وحدة إنحراف قياسى) كما يلى:

مبكرة البلوغ الجنسى (ESM) بمتوسط ١٢٨.٥ يوم ، و متوسطة البلوغ الجنسى (MSM) بمتوسط ١٥٢.٨ يوم و متأخرة البلوغ الجنسى (LSM) بمتوسط ١٦٦.٦ يوم. وكان الغرض من الدراسة تقدير العلاقة بين عمر البلوغ الجنسى و كلا من صفات النمو وبعض صفات إنتاج البيض مع تقدير التلازم الوراثى و الظاهرى بين صفة عمر البلوغ الجنسى و الصفات الإنتاجية المدروسة.

أظهرت النتائج إن هناك أختلافات معنوية فى صفتى وزن الجسم عند عمر ٤ أسابيع بمتوسطات (٢٠٢.٢ و ١٨٧.٤ و ١٧٧.٥ جرام) و عند عمر ٨ أسابيع بمتوسطات (٥٦٠.٦ و ٥٠٢.٨ و ٤٧٩.٠ جرام) لمجاميع ESM , MSM , LSMعلى الترتيب. بينما لم تكن هناك أختلافات معنوية فى وزن الجسم عند عمر يوم و عمر البلوغ الجنسى بين المجاميع. أى أن الدجاجات المبكرة فى عمر البلوغ الجنسى كانت أثقل فى الوزن حتى عمر ٨ أسابيع و لم تكون هذة الزيادة فى الوزن موجودة عند عمريوم وعمر البلوغ الجنسى.

مجموعة الدجاجات المبكرة البلوغ الجنسى ESM أعطت أعلى عدد من البيض (٤٢.٦ بيضة) فى ال٩٠ يوم الأولى بعد البلوغ الجنسى بالمقارنة بمجاميع LSM, MSM (٢٨.٢ و ٣٠.٦ بيضة) على الترتيب. كتلة البيض فى ال٩٠ يوم الأولى بعد البلوغ الجنسى أيضا كانت أعلى قيمة (١٤٠٥.٨ جرام) لمجموعة الدجاجات مبكرة البلوغ. بينما متوسط وزن البيضة فى ال٩٠ يوم الأولى بعد البلوغ الجنسى كان أقل قيمة (٣٣.٠ جرام) لمجموعة الدجاجات مبكرة البلوغ بالمقارنة بالمجموعتان المتوسطة و المتأخرة البلوغ.

الأرتباط الوراثى و الظاهرى لعمر البلوغ الجنسى كان سالبا مع كل من وزن الجسم عند عمر ٤ أسابيع و وزن الجسم عند عمر ٨ أسابيع و عدد البيض و كتلتة فى ال٩٠ يوم الأولى بعد البلوغ الجنسى.

نتائج هذا البحث تساعد فى برامج التربية التى تهدف إلى خفض عمر البلوغ الجنسى مع زيادة فى عدد وكتلة البيض أنه يجب الأخذ فى الأعتبار وزن الجسم المرتفع عند عمر ٨ أسابيع. وهذا يساعد المربيين على الأنتخاب المبكر للدجاجات البياضة عن طريق وزن الجسم المرتفع عند عمر ٨ أسابيع.