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SELECTION AND CORRELATED RESPONSE FOR EGG PRODUCTION TRAITS IN INSHAS AND SILVER MONTAZAH STRAINS OF CHICKENS

By

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Abstract: *Two local strains of chickens selected two generations for increasing egg number up to 40 wks of age (Inshas strain) and egg weight at 40 wks of age (Silver Montazah strain) were used to study the changes in egg number and egg weight after selection and to estimate correlated responses and genetic parameters of some economic traits. The results of selection for egg number at 40 wks of age showed significant differences between selected and control lines as well as among generations. The realized and expected response were 15.2 and 5.33 eggs over two generations. The direct selection for egg weight at 40 wks of age showed also highly significant differences among generations as well as selected and control lines. Moreover, the realized and expected response were 3.70 and 3.19gm over two generations. Heritability estimates for egg number at 40 wks of age in Inshas strain based on sire, dam and sire plus dam components of variance were 0.20, 0.32 and 0.29, respectively, the corresponding estimates of egg weight at 40 wks of age in Silver Montazah strain were 0.52, 0.92 and 0.72, respectively. Negative genetic and phenotypic correlations were observed between egg number at 40 wks of age and age at sexual maturity, duration period of the first ten eggs, egg weight and feed conversion. However, positive correlations between egg weight at 40 wks of age and body weight at sexual maturity, age at sexual maturity, duration period of the first ten eggs and egg mass, while negative correlations with egg number and feed conversion were detected.*

Generally, according to the results of the present experiment, it could be noticed that selection for increasing egg number at 40 wks of age in Inshas strain increased egg number and egg mass as well as improved feed conversion and reduced age at sexual maturity and duration period of the first ten eggs. However, selection for high egg weight at 40 wks in Silver Montazah strain increased egg weight, egg mass, age at sexual maturity and *duration period of the first ten eggs, and improved body weight and feed conversion. Finally, selection program is suggested to be put to improve the egg productive performance of Inshas strain (as a new local strain) and crossed it with Silver Montazah strain to produce a commercial hybrid used in rural production.*

INTRODUCTION

In developing countries, emply different strategies to develop their commercial poultry sector and their poultry genetic resources. Commercial poultry sell various products, most of which are the results of mating three or four lines. These lines must be continuously developed at the pedigree level and reserve lines also kept desipte the constant economic pressure to dispose of surplus lines. During the last four decades some efforts have been done for developing local strains of chickens to be used as a base for future breedimg program. From these strains rose Silver Montazah and Inshas with expected possibility of producing medium type laying hybrid. In the primary phase, within strain selection must be carried out with the aim exploiting some of the additive varaince and icreasing the performance level of the two strains. Beside the breeding program, also disease control, feeding, management and high attention.

Selection program to improve the ability of egg production to an economic rate was tried by several investigatores in Sinai fowl (Soltan, 1991), Norfa strain (El-Wardany *et al*., 1992), Fayoumi breed (El-Full *et al*., 2000), Silver Montazah strain (Younis and Abd El-Ghany, 2004).

Egg production is the yeild of overall performance of a bird concerning many variables such as egg number, egg weight, age at sexual maturity and other characteristices (Eitan and Soller, 1993). These variables are correlated with egg production and with other in positive and negative trends (El-Gendy *et al*., 1997 and Younis and Abd El-Ghany, 2004). Moreover, genetic and phenotypic correlations between either egg number or egg weight with egg production traits were estimated by Enab (1982), El-Wardany *et al*. (1992), El-Full *et al*. (2000), Younis and Abd El-Ghany (2004).

The present study aimed to improve egg number trait up to 40 wks of age in Inshas strain and to improve egg weight trait at 40 wks of age in Silver Montazah strain through selection. Genetic parameters as well as correlated response also were estimated.

MATERIALS AND METHODS

The present study was carried out during three successive generations (2002/2003, 2003/2004 and 2004/2005) at Sakha Research Station, Kafr El-Sheikh, Animal Production Research Institute, Ministry of Agriculture.

The base generation was established from the population of the station which was 1840 unsexed one-day-old chicks of Inshas (840 chicks) and Silver Montazah (1000 chicks) strains. All chicks were pedigreed, wing banded, weighed and reared under the same conditions. Feed and water were supplied *ad libitum* throughout the experiment. The diet used contained 19.3, 15.2 and 17.2 % crude protein and 2868, 2690 and 2710 Kcal ME/kg the starting (0-8 wk), developing (9-20 wk) and laying (>20 wks) periods, respectively.

At 18 weeks of age 50 females and 10 males from each strain were randomly taken to initiate the control lines, while the rest were housed in single cages and tested for egg production traits up to 48 wks of age. The selection criterion in Inshas strain was egg number up to 40 wks of age while that in Silver Montazah strain was egg weight at 40 wks of age.

In each strain the breeding values (Â) of females were estimated according to an index of own performance (Xo) and half-sibs performance (Xs) while the breeding values of males estimated according to mother performance (X_m), which allowed saling the culled males earlier and save costs.

The equations used in Inshas strain (egg number strain) were:

$$\hat{A}_{♀} = 0.22\ Xo + 0.51\ Xs \quad \text{and } r_{A,\hat{A}} = 0.59$$
$$\hat{A}_{♂} = 0.12\ Xm \quad \text{and } r_{A,\hat{A}} = 0.25$$

The equations used in Silver Montazah strain (egg weight strain) were:

$$\hat{A}♀ = 0.45\ Xo + 0.44\ Xs \quad \text{and } rA,\hat{A} = 0.74$$
$$\hat{A}♂ = 0.25\ Xm \quad \text{and } rA,\hat{A} = 0.35$$

The coefficients in the equations were taken from the tables described by Flock *et al.* (1971) given that the heritability (h^2) of egg number is 0.25 and that of egg weight is 0.50. The value of $r_{A,\hat{A}}$ represent the correlation coefficient between the actual and the estimated breeding value which expressed the efficiency of the estimation.

Artificial insemination had been applied by assigning five females to each male, with avoiding mating between relatives. Thirty five sire families were constructed for each strain. The number of tested as well as selected birds were illustrated in Table 1.

Body weight of sexual maturity and at 40 wks of age (mature body weight) was recorded. Age at sexual maturity was measured in days from hatching up to the first egg laied and duration period of the first ten eggs was estimated. Egg number and egg weight were recorded daily from sexual maturity up to 48 wks of age, while feed consumption was recorded weekly at the same period for each hen. Egg mass and feed conversion at 40 and 48 wks of age were calculated.

Selection differential was calculated as the difference between average of the selected parent for a certain trait and the average of their population mean (Falconer, 1983).

Selection density (V) was calculated by the following equation:

V= Number of selected parent / Number of all population.

The realized response was estimated according to the numerator of the following equation after Guill and Washburn (1974) for estimating realized heritability.

R = (Progeny selected X^- -Parent selected X^-)-(Progeny Control X^--Parent Control).

The expected response to selection (ER) was calculated according to the general equation (Falconer, 1983).

ER= Selection differential (S) x heritability (h^2).

This equation could be written in other forms to enable the use of available informaton.

$$
\begin{aligned}
ER &= i.\sigma_p .h^2 \\
&= i.\sigma_A .h \\
&= i.\sigma_A .r_{A,\hat{A}} \\
&= i.\sigma_p .h .r_{A,\hat{A}} \\
&= S.h .r_{A,\hat{A}}
\end{aligned}
$$

The last form was used to calculate ER for males and for females.

Statistical analysis were done according to Harvey program (1990) and statistical models were used as follows:

* Fixed model:

$$Y_{ijk} = \mu + G_i + L_j + (GL)_{ij} + e_{ijk}$$

Where: Y_{ijk} = an observations; μ = overall means; G_i = the fixed effect of i^{th} generation; L_j = the fixed effect of j^{th} line; $(GL)_{ij}$ = effet of the interaction between generation and line, and e_{ijk} = random error.

* Mixed model :

$Y_{ijkl} = \mu + G_i + S_{ij} + D_{ijk} + e_{ijkl}$

Where: Y_{ijkl} = an observations; μ= overall means; G_i = the effect of i^{th} generation, S_{ij} =the effect of j^{th} sire within i^{th} generaton; D_{ijk} = the effect of k^{th} dam within j^{th} sire within i^{th} generaton and e_{ijkl} = random error.

RESULTS AND DISCUSSION

Selection for increasing egg production traits:

a- Egg number:

Least squares means and standard errors of egg number at 40 wks of age for the selected and control lines in the base, first and second generations are presented in Table 2. It could be seen that the averages egg number in the base, first and second generations were 54.1, 62.5 and 69.6 eggs for selected line and 53.1, 54.3 and 53.4 eggs for control line, respectively. These results illustrated that the hens of the selected line at the first and second generations produced significantly more eggs than those of the control line by 7.2 and 8.0 eggs, respectively. Similar results were found by Soltan (1991) in Sinai fowl, El-Wardany *et al*. (1992) in Norfa strain and Younis and Abd El-Ghany (2004) in Silver Montazah strains of chickens. Highly significant differences ($p \leq 0.001$) were found between generations and lines.

Selection differential values were 16.65 and 15.87 eggs (males) and 12.47 and 9.89 eggs (females) in base and first generations, also selection density was 0.11 and 0.10 (males) and 0.44 and 0.36 (females) in the base and first generations, respectively. These values were nearly equal to those reported by Soltan (1991) in Sinai fowl and Younis and Abd El-Ghany (2004) in Silver Montozah strain of chicken.

The realized and expected selection response were 15.72 and 5.33 eggs over two generations of selection for egg number at 40 wks of age in Inshas strain. Similar results were reported by Soltan (1991) and Younis and Abd El-Ghany (2004). Moreover, the results of the present study cleared that the realized response to improve egg number was higher than the expected genetic gain. This result may be due to inacurate estimation of heritability of egg number because of big role of non-additive effects or because of relayively small population.

b- Egg weight:

As shown in Table 2, the means of egg weight of selected line at 40 wks of age in Silver Montazah strain of chicken were 47.6, 49.9 and 53.4 gm in base, first and second generations, respectively while the corresponding figures of control line were 45.9, 45.7 and 48.0gm, respectively. Furthermore, highly significant differences were found among generations and lines. These results indicates a successful selection program for egg weight in this strain which was significant reflected in inceasing egg weight after two generations. After two years of selection for increasing egg weight in Norfa strain, El-Wardany *et al*. (1992) reported that the means of egg weight increased by 2gm.

Selection differentials were 5.34 and 4.18gm (males) and 4.12 and 3.58 gm (females) for base and first generations, respectively. Moreover, selection density was 0.11 and 0.10 (males) and 0.50 and 0.34 (females) in the same trend. The realized response in egg weight at 40 wks of age were 2.6 and 1.10gm in the first and second generations while the expected selection response was 1.74 and 1.45gm in the same trend. It could be noticed that the difference between expected and realized response for egg weight was less than that showed for egg number strain. Nordskog *et al*. (1973) reported that selection for high egg weight in White Leghorn increased egg weight by 18gm after ten years. As the present study, selection for egg weight at 40 wks of age had improved egg weight by about 1.5 gm per generation which recommend to continuous selection for this trait before using this line for future crossing with other native ones.

Correlated response:

Body weight at sexual maturity and mature body weight was measured, no significant differences were observed between selected and control lines of Inshas strain over two generations of selection (Table 3). The realized response for these traits had a litte negative value (-18.1 and -14.5 gm) after two generations. These results showed that body weight at sexual maturity and mature body weight in Inshas strain which selected for egg number at 40 wks of age were slightly deceased in selected line compared to controle line. Soltan (1991), El-Wardany *et al*., (1992) and Younis and Abd El-Ghany (2004) reported that selection for egg number leads to decrease body weight at late ages in Sinai, Norfa and Silver Montazah chickens. This may be due to negative genetic correlation between the two traits (Table 7).

In case of selection to improve egg weight at 40 wks of age (Silver Montazah), body weight at sexual maturity and mature body weight in the selected line surpassed significantly ($p \leq 0.001$) the control line. The realized response of body weight at sexual maturity and mature body weight were 363.7 and 490.7gm over two generations of selection. Silmilar trend was observed regarding body weight at sexual maturity which increased in line selected for egg weight (El-Wardany and abdou, 1993); El-Neney, 1996; Enab *et al*., 2000 and Abou El-Ghar, 2003). These results clearly showed that selection to increase egg weight in Silver Montazah strain was correlated with increasing body weight a long ages, which agree well with the results in Table 7.

Selection for egg number in Inshas strain showed that pullets in selected line significantly matured earlier than those of control line by -3.59 and -6.90 days in the first and second generations, respectively. Also, the realized response to selection for age at sexual maturity from generation to generation was -2.3 days (1st generation), -2.24 days (2nd generation) and -4.67 days (cumulative response). Moreover, the results indicated that, decreasing age at sexual maturity of selected line reflected the effect of selection for high egg number in Inshas strain. These results are similar with those reported by Poggenpoel *et al.* (1996), Abd El-Latif (2002) and Younis and Abd El-Ghany (2004). However, Selection for high egg weight (Silver Montazah) resulted highly significant differences ($p<0.01$) between generations and lines. It could be noticed that the selected line pullets matured later than those of the control line by 3.86 day in the second generation (Table 4). The cumulative realized response was 1.35 days after two generations in Silver Montazah strain of chickens. That means a negative effect for selection to increase egg weight at 40 wks of age on age at sexual maturity. These results are inharmony with those findings by Enab *et al*. (2000) and Abou El-Ghar (2003).

In Inshas strain, the selected and control pullets produce the first ten eggs during 27.5 and 31.9 days (first generation) and 25.5 and 32.3 days (second generation, respectively. Moreover, the realized response were -2.53, -0.98 and -3.51days in the 1st, 2nd and cumulatively, respectively. In contrary, in Silver Montazah strain, the pullets in the control line laid the first ten eggs earlier or in shorter period compared to the selected line. These results showed evidence for the negative effect of selection for high egg weight on the rate of laying. Furthermore, the cumulative response for this trait was 1.20 days over the two generations. Duration period of the first ten eggs line of Alexandria strain was 12.9 days (Abd El-Halim, 1999).

Selection for increasing egg number at 40 wks in Inshas strain affected egg number at 48 wks of age. It was noticed that means of egg number produced by selected line were higher and highly significant values than control line (Table 3). The realized response for this trait had a high and a positive value (13.04) over the two generations (Table 5). Selection for increasing egg number during the first 90 days of laying in Silver Montazah strain increased egg number at 45 and 65 weeks of age by 13.4 and 33.9 eggs after two generations (Younis and Abd El-Ghany, 2004). However, selection for egg weight at 40 wks of age over two generations had a negative correlated response with egg number at 40 and 48 wks of age, where the realized cumulative response of egg number was -0.34 and -1.08 eggs, respectively. Sheriff (1991) and El-Neney (1996) reported that, selection for high egg weight declines egg number in the first 90 days of laying.

Differences between selected and control lines of egg weight at 40 and 48 wks of age in Inshas strain were insignificant, the realized cumulative response was -1.44 and -1.70 gm for egg weight at 40 and 48 wks of age, respectively. Similar results were reported by Soltan, (1991), Sharma *et al*. (1999) and Younis and Abd El-Ghany (2004). In Silver Montazah strain the average egg weight at 48 wks of age by selected line was significantly heavier than those produced of the control line, the realized cumulative response of egg weight at 48 wks of age was 2.04 gm after the two generations of selection. These results are agreement with those reported by Goher *et al*. (1994) in Gimmizah and Momourh breeds of chickens.

Selection for increasing egg number at 40 wks of age caused an increase in egg mass at 40 and 48 wks of age in Inshas strain where selected line had significantly higher egg mass than that of control line, the realized cumulative responses for these traits were 481.5 and 427.4 gm, respectively over the two generations. Similar results were found by Ali (1992) and Younis and Abd El-Ghany (2004). Moreover, selection for high egg weight at 40 wks of age (Silver Montazah) increase egg mass at 40 and 48 wks of age, where the realized cumulative responses were 193.9 and 892.0 gm over the two generations, respectively. Also, selection for high either egg number or egg weight at 40 wks of age attributed to improve feed conversion at 40 and 48 wks of age (Table 5). Similar results were reported by Younis and Abd El-Ghany (2004).

Heritability:

Values of heritability in the selected lines from sire, dam and sire plus dam components of variance were moderate for body weight at sexual maturity and mature body weight (Table 6). Also, values of heritability for these traits were similar in Inshas and Silver Montazah strains. Similar values were reported by Kosba *et al*. (1997); Abd El-Halim (1999) and

Ghanem (2003). The heritability estimates of age at sexual maturity were 0.32, 0.61 and 0.47 based on $h^2_{S,}$ h^2_D and h^2_{S+D}, respectively over the two generations in Inshas strain. These results reflect the possibility of improving egg production through selection for early sexually matured birds. However, these values of heritabiliy were 0.01, 0.35 and 0.18 in Silver Montazah strain, these estimates of heritability in Inshas strain were higher than those in Silver Montazah strain, which reflect a possible different genetic background of this trait in the two strains. The estimates obtained were similar with that reported by Younis and Abd El-Ghay (2004) and Abd El-Ghany (2005).

The heritability estimates of duration period for the first ten eggs were 0.39, 0.49 and 0.44 (Inshas strain) and 0.76, 0.22 and 0.49 (Silver Montazah) based on $h^2_{S,}$ h^2_D and h^2_{S+D}, respectively. Ghanem (2003) found that heritability from sire component variance ranged from 0.04 to 0.35. The moderate and high heritability estimates for this trait indicate high possibility for duration period of the first ten eggs to be used as a selection criterion for egg production, taking in consideration the results of genetic correlation estimates (Table 7).

The heritability estimates for egg number at 40 and 48 wks of age were 0.26, 0.32 and 0.29 (40 wks), 0.20, 0.31 and 0.26 (48 wks) of Inshas strain based on $h^2_{S,}$ h^2_D and h^2_{S+D}, respectively. The corresponding values of Silver Montazah strain were 0.01, 0.52 and 0.26 (40 wks) and 0.08, 0.70 and 0.39 (48 wks), respectively. For the egg number at 40 and 48 wks of age in the two strains, values of h^2_D appeared in general to be slightly larger than values of h^2_S, which indicates a possible role of maternal or dominance effects for this trait. Similar results were reported by Enab *et al*. (2001) and Abd El-Ghany (2005).

On the other hand, the heritability estimates for egg weight at 40 and 48 wks of age were moderate in Inshas and higher in Silver Montazah strain. Moreover, these values were near equal in their magnitude of other reported by Shebl (1998), Sabri and Abdel-Warith (2000) and Abd El-Ghany (2005). However, heritabilty estimates in the present study were higher than those reported by El-Full *et al*. (2001) and Enab *et al*. (2001). Higher and moderate values of heritability for egg weight indicates that most of its variability is additive genetic and therefore a marked response to selection for it could be expected. Moreover, the estimates of heritability for egg mass at 40 and 48 wks of age in the two strains were within the range of those obtained by El-Full *et al*. (2001), Sabri and Abdel-Warith (2000) and Abd El-Latif (2001). However, these values were lower than those reported by Younis and Abd El-Ghany (2004) and Abd El-Ghany (2005).

Concerning feed conversion the heritability estimates at 40 and 48 wks of age were moderate to high and ranged from 0.36 to 0.77 in the two strains. Comparable heritability estimates of feed conversion based on sire component of variance were reported by Pym and Nicholls, 1979 (0.38); Leenstra *et al*., 1986 (0.39) and Leenstra and Pit, 1988 (0.37) and from sire plus dam component of variance by Younis and Abd El-Ghany, 2004 (0.63). Moreover, most reported heritability estimates of feed conversion are moderate to high, which indicate that this trait is inherited in an additive way and could be improved by selection in local strain of chickens.

Correlations:

In Inshas strain the genetic correlation based on sire plus dam components of variance (Table 7) over two generations between egg number at 40 wks of age and body weight at sexual maturity and mature body weight were -0.55 and -0.34, respectively. The corresponding estimates for phenotypic correlation were small and negative. Similar results were reported by Hogsett and Nordskog (1958) in White Leghorn. In contrary, positive genetic and phenotypic correlations were found by El-Wardany and Abdou (1993) and Younis and Abd El-Ghany (2004). Negative genetic and phenotypic correlations were observed between egg number at 40 wks of age and age at sexual maturity (-0.33 & -0.32) and duration period of the first ten eggs (-0.97 & -0.52). These results mean that pullets of high egg number reached sexual maturity earlier. Simlar results were found by El-Wardany and Abdou (1993) and Younis and Abd El-Ghany (2004). Moreover, negative genetic and phenotypic correlation between egg number at 40 wks of age and egg weight at 40 (-0.51 & -0.44) and 48 wks of age (-0.69 & -0.25) were observed. Several authors reported that the genetic correlation between egg number and egg weight were negative (Shebl *et al*., 1991 and El-Wardany *et al*., 1992). However, positive genetic and phenotypic correlations were found between egg number at 40 wks of age and egg mass at 40 (0.75 & 0.89) and 48 wks of age (0.55 & 0.81). Similar results were reported by Younis and Abd El-Ghany (2004) and Abd El-Ghany (2005). In contrary, negative genetic and phenotypic correlations were observed between egg number at 40 wks of age and feed conversion at 40 (-0.32 & -0.34) and 48 wks of age (-0.15 & -0.18). Younis and Abd El-Ghany (2004) found negative genetic and phenotypic correlations in Silver Montazah strain.

In Silver Montazah strain positive genetic and phenotypic correlations between egg weight at 40 wks of age and body weight at sexual maturity (0.73 & 0.16) and mature body weight (0.55 & 0.12). These results means that selection for high egg weight may increase body weight. Moreover, positive correlations were observed by El-Tahawy (2000) and Enab *et al.* (2001). Also, positive genetic and phenotypic correlations between egg weight at 40 wks and age at sexual maturity (0.84 & 0.04) and duration period of the first ten eggs (0.76 & 0.28) were detected. Higher and positive correlations were found by Nawar *et al*. (1995) and El-Tahawy (2000). Egg number at 40 and 48 wks of age were weekly negatively correlated (Table 7) with egg weight at 40 wks of age. Similar values were reported by El-Full *et al*. (2000) and Enab *et al*. (2001). However, positive genetic and phenotypic correlations between egg weight at 40 wks of age and egg mass at 40 (0.78 & 0.36) and 48 wks of age (0.83 & 0.55) were observed. These results indicated that selection for high egg weight at 40 wks of age in Silver Montazah strain will increase egg weight and egg mass. Positive correlations were found by Sabri *et al*. (1999) and Sabri and Abd El-Warith (2000). However, negative genetic and phenotypic correlations were observed between egg weight at 40 wks of age and feed conversion at 40 (-0.28 & -0.35) and 48 wks of age (-0.13 & -0.25).

Generally, according to the results of the present selection experiment it is clear that selection for egg number at 40 wks of age in Inshas strain increased egg number and egg mass as well as improved feed conversion and reduced age at sexual maturity and duration period of the first ten eggs. However, selection for high egg weight at 40 wks of age in Silver Montazah strain increased egg weight, egg mass, age at sexual maturity and duration period of the first ten eggs, and improved body weight and feed conversion. Finally, selection program should continue to improve the productive performance of Inshas and Silver Montazah strains (as local strains) for several generations before crossing them to produce commercial laying hybrid for rural production.

Table 1: Number of tested and selected birds for each sex and strain along two generations of selection.

Strain	Gen.	Sex	No. of tested birds	No. of selected birds	Selection Density
Inshas	G0	Males	318	35	0.11
		Females	397	175	0.44
	G1	Males	340	34	0.10
		Females	472	170	0.36
Silver Montazah	G0	Males	319	35	0.11
		Females	350	175	0.50
	G1	Males	330	33	0.10
		Females	485	165	0.34

G0 = Base generation & G1 = First generation

Table 2 : L.S.M. ± S.E. for egg number (Inshas strain) and egg weight (Silver Montazah strain) at 40 weeks of age as well as selection differential (S), realized response (R) and expected response (ER).

Gen.	Selected line	Control line	S	S	R	ER
	X± S.E	X±S.E	Males	Females		
Egg number line (Inshas strain), egg						
G0	54.1±0.45	53.1±0.81	16.65	12.47	----	----
G1	62.5±0.39	54.3±0.82	15.87	9.89	7.20	2.88
G2	69.6±0.41	53.4±0.67	----	----	8.00	2.45
CR*	----	----	----	----	**15.20**	**5.33**
Egg weight line (Silver Montazah strain), gm						
G0	47.6±0.28	45.9±0.48	5.34	4.12	----	----
G1	50.0±0.24	45.7±0.44	4.18	3.58	2.60	1.74
G2	53.4±0.24	48.0±0.39	----	----	1.10	1.45
CR*	----	----	----	----	**3.70**	**3.19**

G0 = Base generation & G1 = First generation & G2= Secondgeneration
* GR = Cumulative selection response.

Table 3 : L. S. M. ± S. E. for economic traits during base (G0), first (G1) and second (G2) generation of egg number line (Inshas strain).

Traits	L	Generations (G)			Significances		
		G0	G1	G2	G	L	G*L
Body weight at sexual maturity, g	**S**	1392±6.29	1382±6.36	1376±6.63	NS	NS	NS
	C	1385±10.25	1388±13.02	1390±11.95			
Mature body weight, g	**S**	1838±17.6	1865±15.2	1798±14.85	NS	NS	NS
	C	1822±45.7	1813±31.87	1797±53.06			
Age at sexual maturity, day	**S**	171.4±0.74	165.5±0.65	162.7±0.67	***	***	*
	C	172.5±1.32	169.0±1.25	169.6±1.11			
Duration period of first 10 eggs, day	**S**	30.7±0.49	27.1±0.43	26.5±0.45	***	***	***
	C	30.8±0.88	31.9±0.89	32.4±0.73			
Egg Number 48 wks, egg	**S**	83.9±0.60	92.7±0.53	100.2±0.55	***	***	***
	C	81.3±1.08	85.2±1.10	84.5±0.91			
Egg weight at 40 wks, g	**S**	43.8±0.30	43.4±0.26	43.1±0.27	NS	NS	NS
	C	43.4±0.54	44.9±0.55	45.7±0.45			
Egg weight at 48 wks, g	**S**	46.2±0.35	44.2±0.31	45.1±0.32	NS	NS	NS
	C	45.8±0.63	45.7±0.64	46.4±0.53			
Egg mass at 40 wks, g	**S**	2366±19.9	2748±17.4	2956±18.2	***	***	***
	C	2305±35.7	2440±36.3	2451±29.8			
Egg mass at 48 wks, g	**S**	3871±28.2	4164±24.7	4503±28.8	***	***	***
	C	3719±50.6	3898±51.5	3926±42.3			
Feed conversion at 40 wks, g:g	**S**	5.13±0.03	4.06±0.03	3.52±0.03	***	***	***
	C	5.13±0.06	5.15±0.07	4.31±0.05			
Feed conversion at 48 wks, g:g	**S**	4.92±0.02	3.92±0.02	3.47±0.02	***	***	***
	C	4.98±0.05	4.57±0.05	3.90±0.04			

L, S=Selected line and C=Control line.
NS= Non-significant & * Significant at 5% level of probability.
*** Significant at 0.1% level of probability.

Table 4: L. S. M. ± S. E. for economic traits during base (G0), first (G1) and second (G2) generation of egg weight line (Silver Montazah strains).

Traits	L	Generations (G)			Significances		
		G0	G1	G2	G	L	GxL
Body weight at sexual maturity, g	S	1410±6.94	1646±6.98	1798±6.82	***	***	***
	C	1400±11.0	1415±12.81	1424±14.03			
Mature body weight, g	S	1819±14.2	2154±13.94	2257±12.88	*	***	NS
	C	1825±36.3	1935±22.10	1792±62.7			
Age at sexual maturity, day	S	174.0±0.73	175.2±0.63	176.0±0.6	*	**	*
	C	171.5±1.25	175.2±1.14	172.2±1.02			
Duration period of first 10 eggs, day	S	30.1±0.55	32.3±0.65	33.9±1.12	***	***	***
	C	30.1±0.91	30.5±1.12	32.7±0.56			
Egg number 40 wks, egg	S	39.2±0.50	39.8±0.43	39.9±0.42	NS	NS	NS
	C	38.4±0.86	40.0±0.78	38.4±0.70			
Egg number at 48 wks, egg	S	62.5±0.58	62.2±0.51	63.3±0.49	NS	NS	**
	C	61.2±1.00	63.9±0.91	61.0±0.81			
Egg weight at 48 wks, g	S	50.3±0.35	52.9±0.30	54.6±0.29	***	***	**
	C	46.7±0.60	46.2±0.54	49.0±0.48			
Egg mass at 40 wks, g	S	1862±24.1	2022±21.1	2130±20.5	*	***	**
	C	1762±41.5	1828±37.3	1836±33.7			
Egg mass at 48 wks, g	S	3140±28.9	3314±45.5	3470±20.5	**	***	***
	C	2859±49.7	3014±24.6	2987±40.4			
Feed conversion at 40 wks, g:g	S	6.53±0.07	4.99±0.06	4.39±0.06	***	***	NS
	C	6.85±0.13	5.35±0.12	4.88±0.11			
Feed conversion at 48 wks, g:g	S	5.84±0.05	4.74±0.04	4.14±0.04	***	***	NS
	C	6.08±0.08	4.95±0.07	4.64±0.07			

L, S=Selected line and C=Control line.

NS= Non-significant & * Significant at 5% level of probability.

** Significant at 1% level of probability

*** Significant at 0.1% level of probability.

Table 5: Realized response for unselected traits in selected line by generation in egg number and egg weight lines.

Traits	Realized response		
	G_1	G_2	Cumulative
Egg number line (Inshas strain)			
Body weight at sexual maturity, g	-14.0	-4.1	-18.1
Mature body weight, g	36.9	-51.4	-14.5
Age at sexual maturity, day	-2.42	-2.25	-4.67
Duration period of the first ten eggs, day	-2.53	-0.98	-3.50
Egg number at 48 wks, egg	4.85	8.19	13.04
Egg weight at 40 wks, g	-1.93	0.49	-1.44
Egg weight at 48 wks, g	-1.95	0.25	-1.70
Egg mass at 40 wks, g	243.6	237.9	481.5
Egg mass at 48 wks, g	113.1	314.3	427.4
Feed conversion at 40 wks, g:g	-1.05	0.30	-0.75
Feed conversion at 48 wks, g:g	-0.59	0.22	-0.37
Egg wieght line (Silver Montazah strain)			
Body weight at sexual maturity, g	221.4	142.3	363.7
Mature body weight, g	224.9	265.8	490.7
Age at sexual maturity, day	-2.52	3.87	1.35
Duration period of the first ten eggs, day	1.76	-0.56	1.20
Egg number at 40 wks, egg	-1.94	1.60	-0.34
Egg number at 48 wks, egg	-2.94	4.02	-1.08
Egg weight at 48 wks, g	3.19	-1.15	2.04
Egg mass at 40 wks, g	73.7	120.2	193.9
Egg mass at 48 wks, g	20.4	871.6	892.0
Feed conversion at 40 wks, g:g	-0.04	-0.13	-0.17
Feed conversion at 48 wks, g:g	0.03	-0.29	-0.26

G1= First generation & G2= Second generation

Table 6: Heritability estimates and standard errors for studied traits from sire (h^2_S), dam (h^2_D) and sire plus dam (h^2_{S+D}) components of variance in Inshas and Silver Montazah strains of chickens over two generations.

Traits	h^2_S	h^2_D	h^2_{S+D}
Egg number line (Inshas strain)			
Body weight at sexual maturity	0.17±0.16	0.55±0.36	0.36±0.34
Mature body weight	0.25±0.17	0.61±0.25	0.43±0.32
Age at sexual maturity	0.32±0.19	0.61±0.28	0.47±0.22
Duration period of the first ten eggs	0.39±0.35	0.49±0.36	0.44±0.22
Egg number at 40 wks	0.26±0.17	0.32±0.23	0.29±0.19
Egg number at 48 wks	0.31±0.29	0.20±0.18	0.26±0.12
Egg weight at 40 wks	0.46±0.33	0.56±0.42	0.51±0.39
Egg weight at 48 wks	0.79 ±0.30	0.49±0.29	0.64±0.13
Egg mass at 40 wks	0.33±0.21	0.46±0.33	0.40±0.31
Egg mass at 48 wks	0.39±0.31	0.25±0.18	0.32±0.22
Feed conversion at 40 wks	0.45±0.23	0.77±0.30	0.61±0.31
Feed conversion at 48 wks	0.40±0.25	0.55±0.34	0.48±0.29
Egg weight line (Silver Montazah strain)			
Body weight at sexual maturity	0.16±0.13	0.46±0.21	0.31±0.09
Mature body weight	0.28±0.12	0.55±0.29	0.41±0.21
Age at sexual maturity	0.01±0.01	0.35±0.25	0.18±0.08
Duration period of the first ten eggs	0.76±0.22	0.22±0.21	0.49±0.10
Egg number at 40 wks	0.01±0.11	0.52±0.21	0.26±0.09
Egg number at 48 wks	0.08±0.12	0.70±0.21	0.39±0.10
Egg weight at 40 wks	0.52±0.27	0.93±0.21	0.72±0.08
Egg weight at 48 wks	0.90±0.23	0.94±0.22	0.92±0.09
Egg mass at 40 wks	0.25±0.15	0.49±0.22	0.37±0.10
Egg mass at 48 wks	0.61±0.20	0.80±0.21	0.71±0.10
Feed conversion at 40 wks	0.48±0.31	0.77±0.51	0.36±0.39
Feed conversion at 48 wks	0.51±0.38	0.67±0.59	0.59±0.33

Table 7 : Estimates of genetic (r_G) and phenotypic (r_P) correlations between egg number (Inshas strain) and egg weight (Silver Montazah strain) at 40 wks and correlated traits over two generations from sire plus dam components of variance.

Traits	Correlations	
	r_P	r_G
Egg number at 40 wks (Inshas strain)		
Body weight at sexual maturity	-0.09	-0.55±0.41
Mature body weight	-0.08	-0.34±0.32
Age at sexual maturity	-0.32	-0.33±0.22
Duration period of the first ten eggs	-0.52	-0.97±0.66
Egg number at 48 wks	0.51	0.56±0.26
Egg weight at 40 wks	-0.44	-0.51±0.31
Egg weight at 48 wks	-0.25	-0.69±0.34
Egg mass at 40 wks	0.89	0.75±0.11
Egg mass at 48 wks	0.81	0.55±0.31
Feed conversion at 40 wks	-0.34	-0.32±0.08
Feed conversion at 48 wks	-0.18	-0.15±0.08
Egg weight at 40 wks (Silver Montazah strain)		
Body weight at sexual maturity	0.16	0.73±0.16
Mature body weight	0.12	0.55±0.32
Age at sexual maturity	0.04	0.84±0.10
Duration period of the first ten eggs	0.28	0.76±0.09
Egg number at 40 wks	-0.01	-0.01±0.16
Egg number at 48 wks	-0.05	-0.11±0.13
Egg weight at 48 wks	0.59	0.83±0.04
Egg mass at 40 wks	0.36	0.78±0.11
Egg mass at 48 wks	0.55	0.83±0.15
Feed conversion at 40 wks	-0.35	-0.28±0.19
Feed conversion at 48 wks	-0.25	-0.13±0.98

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الملخص العربى

الانتخاب والاستجابة المرتبطة لصفات إنتاج البيض في سلالتي دجاج انشاص والمنتزه الفضي

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استخدم فى هذه الدراسة سلالتين من الدجاج المحلى انتخبت لمدة جيلين بالأضافة الى جيل الأساس لزيادة عدد البيض حتى ٤٠ أسبوع من العمر (سلالة انشاص) ووزن البيض عند ٤٠ أسبوع من العمر (سلالة المنتزه الفضي) وذلك لدراسة التغيرات في عدد البيض ووزن البيض بعد الانتخاب ولحساب التغيرات المصاحبة والمعالم الوراثية لبعض الصفات الاقتصادية.

أظهرت نتائج الانتخاب لعدد البيض حتى ٤٠ أسبوع من العمر وجود اختلافات معنوية بين الخط المنتخب والغير منتخب وكذلك بين الأجيال. الاستجابة المحققة والمتوقعة لصفه عدد البيض كانت ١٥,٢ ، ٥,٣٣ بيضة بعد جيلين من الانتخاب فى سلاله أنشاص. الانتخاب المباشر لوزن البيض عند عمر ٤٠ أسبوع من العمر اظهر أيضا اختلافات عالية المعنوية بين الأجيال وبين الخط المنتخب والغير منتخب. علاوة على ذلك وجد أن الاستجابة المحققة والمتوقعة لصفة وزن البيض كانت ٣,٧ ، ٣,١٩ جم بعد جيلين من الانتخاب فى سلاله المنتزة الفضى. تقديرات المكافئ الوراثي لعدد البيض عند عمر ٤٠ أسبوع من العمر في سلالة انشاص على أساس مكونات تباين الأب ، الأم والأب والأم معا كانت ٠,٢٠ & ٠,٣٢ & ٠,٢٩ على التوالي بينما التقديرات المقابلة لوزن البيض عند عمر ٤٠ أسبوع في سلالة المنتزة الفضى كانت ٠,٥٢ & ٠,٩٢ & ٠,٧٢ على التوالي.

الأرتباطات الوراثية والمظهرية كانت سالبة بين عدد البيض عند ٤٠ أسبوع من العمر والعمر عند النضج الجنسى، المدة اللازمة لانتاج العشر بيضات الأولى وون البيض والكفاءة التحويلية. بينما وجد ارتباطات وراثية موجبة بين ووزن البيض عند ٤٠ أسبوع من العمر ووزن الجسم عند النضج الجنسى، العمر عند النضج الجنسي ، المدة اللازمة لانتاج العشر بيضات الأولي ، كتلة البيض بينما كان هناك ارتباطات سالبة بين عدد البيض والكفاءة التحويلية.

عامة: وفقا لهذه النتائج وجد ان الانتخاب لزيادة عدد البيض عند عمر ٤٠ اسبوع من العمر فى سلالة انشاص يزيد عدد البيض، كتلة البيض وكذلك يحسن الكفاءة التحويلية ويقلل العمر عند النضج الجنسى والمدة اللازمة لانتاج العشر بيضات الاولى ويحسن وزن الجسم والكفاءة التحويلية. لذلك يجب عمل برنامج انتخاب لتحسين آداء أنتاج البيض فى سلالة أنشاص (سلالة محلية جديدة) وخلطها مع سلالة المنتزة الفضى لأنتاج هجين تجارى يستخدم فى الأنتاج الريفى.