

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

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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 estimating 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 Inshas strain based on sire, dam and sire plus dam components of variance were 0.2, 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 crossing it with Silver Montazah strain to produce a commercial hybrid used in rural production.

INTRODUCTION

In developing countries, employ 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 despite 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 breeding program. From these strains, rose Silver Montazah and Inshas

were established 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 variance and increasing the performance level of the two strains. Besides the breeding program, also disease control, feeding, management and high attention should be considered.

Selection program to improve the ability of egg production to an economic rate was tried by several investigators 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 yield of overall performance of a bird concerning many variables such as egg number, egg weight, age at sexual maturity and other characteristics (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 (2002-2005) at Sakha Research Station, Kafr El-Sheikh, Animal production Research Institute, Ministry of Agriculture.

The base generation was established from available birds at the station which 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 in 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 (\hat{A}) of females were estimated according to an index of own performance (X_o) and half-sibs performance (X_s) while the breeding values of males estimated according to mother performance (X_m), which allowed selling the culled males earlier and save costs.

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

$$\begin{aligned} \hat{A}_2 &= 0.22 X_o + 0.51 X_s & \text{and } r_{A,\hat{A}} &= 0.59 \\ \hat{A}_\sigma &= 0.12 X_m & \text{and } r_{A,\hat{A}} &= 0.25 \end{aligned}$$

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

$$\begin{aligned} \hat{A}_2 &= 0.45 X_o + 0.44 X_s & \text{and } r_{A,\hat{A}} &= 0.74 \\ \hat{A}_\sigma &= 0.25 X_m & \text{and } r_{A,\hat{A}} &= 0.35 \end{aligned}$$

The coefficients in the equations were taken from the tables described by Fock *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.

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

Strain	Generation	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

Body weight at sexual maturity and at 40 wks of age (mature body weight) were 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 certion trait and the average of their population mean (Falconer, 1983).

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

$$V = \text{Number of selected parent} / \text{Number of all population.}$$

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

$$R = (\text{Progeny selected } \bar{X} - \text{Parent selected } \bar{X}) - (\text{Progeny Control } \bar{X} - \text{Parent Control}).$$

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

$$ER = \text{Selection differential (S)} \times \text{heritability (h}^2\text{)}.$$

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

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

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:

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

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

* Mixed model :

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

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

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 increasing 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.

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 inaccurate estimation of heritability of egg number because of big role of non-additive effects or because of relatively small population.

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

Strain	Gen.	Selected line	Control line	S		R	ER
		X± S.E	X±S.E	Males	Females		
Inshas	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
Silver Montazah	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= Second generation

* GR = Cumulative selection response.

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 little 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 decreased in selected line compared to control line. Soitan (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 490.7 gm over two generations of selection. Similar 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 at 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 in harmony 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 -3.51 days 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.

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	Line (L)	Generations (G)			Significances		
		G0	G1	G2	G	L	GxL
Body weight at sexual maturity, g	S	1392.9±6.29	1382.7±6.36	1376.9±6.63	NS	NS	NS
	C	1385.0±10.25	1388.8±13.02	1390.5±11.95			
Mature body weight, g	S	1838.1±17.6	1865.5±15.2	1798.8±14.85	NS	NS	NS
	C	1822.5±45.7	1813.0±31.87	1797.6±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	2366.2±19.9	2748.7±17.4	2956.3±18.2	***	***	***
	C	2305.1±35.7	2440.0±36.3	2451.9±29.8			
Egg mass at 48 wks, g	S	3871.9±28.2	4164.4±24.7	4503.5±28.8	***	***	***
	C	3719.2±50.6	3898.6±51.5	3926.4±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			

Line, 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	Line (L)	Generations (G)			Significances		
		G0	G1	G2	G	L	GxL
Body weight at sexual maturity, g	S	1410.5±6.94	1646.8±6.98	1798.1±6.82	***	***	***
	C	1400.1±11.0	1415.1±12.81	1424.1±14.03			
Mature body weight, g	S	1819.9±14.2	2154.7±13.94	2257.4±12.88	*	***	NS
	C	1825.3±36.3	1935.2±22.10	1792.2±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	1862.3±24.1	2022.4±21.1	2130.6±20.5	*	***	**
	C	1762.5±41.5	1828.8±37.3	1836.8±33.7			
Egg mass at 48 wks, g	S	3140.1±28.9	3314.9±45.5	3470.0±20.5	**	***	***
	C	2859.9±49.7	3014.4±24.6	2987.8±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			

Line, 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.

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.

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 weight 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

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 Estimates:

Values of heritability coefficients 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 heritability 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).

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

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, heritability 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 Coefficients:

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. Similar 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).

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

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.

REFERENCES

- Abd El-Ghany, F. A. (2005). Selection for improving some economic traits in developed Inshas chickens strain. *Journal of productivity and development*, 10. (2); 195-210.
- Abd El-Latif. M. A. (2002). Egg production performance after five generations of selection in the Egyptian Dandarawi chicken. 7th world congress on genetics applied to livestock production, August 19-23 Montpellier, France.
- Abd El-Halim, H. A. (1999). Selection and genetic analysis of some meat and egg production traits in local chickens. M. Sc. Thesis, Fac. of Agric., Alex. Univ., Egypt.
- Abou El-Ghar, R. Sh., (2003). Combining ability and genetic gain of some economic traits in Norfa chickens. Ph. D. Thesis, Fac. of Agric., Minufiya. Univ., Egypt.
- Ali, O. M. (1992). Selection for improving egg mass in Alexandria strain of chickens. M. Sc. Thesis, Fac. of Agric., Alex. Univ., Egypt.
- Eitan, Y. and Soller, M. (1993). Two-way selection for threshold body weight at first egg broiler strain females. 3- Reproductive performance under various levels of feed restriction. *Poult. Sci.*, 72: 1813-1822.
- El-Full, E. A., E. A. El-Gendy and A. A. Ali, (2000). Genetic stability of egg production traits for two Fayoumi chicken strain selected for increased egg production or fast growth. *Egypt Poult. Sci.*, 20: 219-238.
- El-Full, E. A., A. A. Ali and N. E. Goher, (2001). Effect of standardization on path coefficient analysis of egg characteristics in different genetic groups of Fayoumi fowls. *Egypt. Poult. Sci.*, 21 (III): 655-675.
- El-Gendy, E. A.; Arram, G. A. and Abdou, A. M. (1997). Characteristics of egg production populations. 1-Genetic variation in related traits in groups of chickens differing in genetic background. *Egypt. Poult. Sci.*, 17: 193-213.
- El-Neney, B. A. M. (1996). Improvement of some nutritional and productive traits in Sinia fowl. M. Sc. Thesis, Fac. of Agric., Minufiya Univ., Egypt.
- El-Tahawy, W. S. A. (2000). Genotypical improvement of some productive and reproductive traits in local chicken. M. Sc. Thesis, Fac. of Agric., Alex. Univ., Egypt.
- El-Wardany, A. M. and Abdou, F. H. (1993). Genetic analysis of two strains of Norfa chickens under selection for egg number or size. 2- Expected vs realized correlated response. *Minufiya J. Agric. Res.*, Vol., 18 (I): 241-256.

- El-Wardany A. M., Soltan, M. E. and Abdou, F. H. (1992). Correlated selection response to selection for some egg production traits in Norfa chickens. *Minufiya. J. Agric. Res.*, 17 (4): 1833-1863.
- Enab, A. A. (1982). Genetic analysis of some economic traits in chickens. M.Sc. Thesis, Fac of Agric., Minufiya Univ. Egypt.
- Enab, A. A. (2001). Genetic progress achieved in residual feed consumption after generations of selection in Norfa layer chickens. *Egypt. Poult. Sci.*, Vol. 21 (1): 209-220.
- Enab, A. A., N. Kolstad and F. H. Abdou, (2000). Genetic aspects of some egg production traits in Norfa layers under different methods of selection. *Egypt. Poult. Sci.*, 20 : 1017 – 1030.
- Enab, A. A., A. M. El-Wardany and F. H. Abdou, (2001). Genetic and phenotypic parameters of some egg production traits and specific gravity of White Leghom hens. 2nd International conf. on Animal Production & Health in Semi-Arid Areas 4-6 Sept. 557-561.
- Falconer, D. S. (1983). *Introduction to Quantitative Genetic*. Longman Inc., New York, U.S.A.
- Flock, D., Haußmann, H. and Fewson, D. (1971). *Tabellen für die Zuchtwertschätzung bei landwirtschaftlichen Nutztieren*. Heft 54, Mariensee, 1971 Germany.
- Guill, R. A. and Washburn, K. W. (1974). Genetic changes in efficiency of feed utilization of chickens maintaining body weight constant. *Poult. Sci.*, 53:1146-1154.
- Ghanem H. H. (2003). Selection for low egg yolk cholesterol level and correlated response for some economic traits in some native type strains Ph. D. Thesis, Fac. of Agric., Alex. Univ., Egypt.
- Goher, L. M., A. M. El-Wardany and A. A. Enab (1994). Direct and correlated response of egg production performance under selection for egg weight in some local breed of chickens. *Egypt. Poult. Sci.*, 14: 1-22.
- Harvey, W. R. (1990). *Mixed Model Least-Square and Maximum Likelihood Computer Program*. University of Columbus, Ohio, U.S.A.
- Hogsett, M. L. and A. W. Nordskog (1958). Genetic-economic value in selecting for egg production rate, body weight and egg weight. Part 1: Estimation of phenotypic and genetic parameters. Part 2: The genetic consequences of selections using an index for egg size, body weight and egg production rates. M. Sc. Thesis, Univ. of Iowa State, U.S.A.
- Kosba, M. A., Hassan, G. E., Hassan, M. F., Bahie El-Deen, M. and Hanna, Ghanem, H. (1997). Selection and correlated response for age sexual maturity in Alexandria chicken. 2nd Hungarian-Egyptian Conf., Godollo, 16-19 Sept. 1997.
- Leenstra, F. R. and Pit, R. (1988). Fat deposition in a broiler sire strain. 3- Heritability and genetic correlations among body weight, abdominal fat and feed conversion. *Poult. Sci.*, 67: 1-9.
- Leenstra, F. R., Vereijken, F. G. and Pit, R. (1986). Fat deposition in a broiler sire strain. 1- Phenotypic and genetic variation in, and correlation between abdominal fat, body weight and feed conversion. *Poult. Sci.*, 65: 1225-1235.

- Nawar, M. M., F. H. Abdou, A. Abou Ashour and M. El-Nadi, (1995). A comparative performance of six indigenous and seven exotic breeds of chickens under intensive production. 1st Egyptian Hungarian Poultry Conf., 17-19 September, Alex- Egypt. Page 226 – 235.
- Nordskog, A.W., H. S. Tolman, D. W. Casey and C. Y. Lin (1973). Selection in small populations of chickens . Poultry Sci., 52: 1188-1219.
- Poggenpoel, D. G., G. F. Ferreira, J. P. Hayes and J. J. Du Preez, (1996). Response to long-term selection for egg production in laying hens. British Poultry Sci., 37: 743-756.
- Pym, R. A. E. and Nicholls, P. J. (1979). Selection of feed conversion in broilers: Direct and correlated responses to selection for body weight gain, food consumption and food conversion ratio. British Poultry Sci., 20: 73-86.
- Sabri, H. M. and A. Abd El-Warith, (2000). Residual feed consumption as measure of feed efficiency in Fayoumi laying hens. 2-Heritability, genetic and phenotypic correlations. Egypt. Poultry Sci., 20: 927-943.
- Sabri, H. M., H. R. Wilson, R. H. Harms and C. J. Wilcox, (1999). Genetic parameters of egg and related characteristics of White Leghorn hens in a subtropical environment. Genetics and Molecular Biology, 22 (2): 183-186.
- Sharma, P. K., S. K. Varma, S. Brijesh, V. Rachana, B. Singh and R. Varma, (1999). Genetic and phenotypic effects of full-sib mating on growth and production traits in White Leghorn population. Indian J. of Poultry Sci., 34: (1) 80- 82.
- Shebl, M. K. (1998). Estimation of heritability of clutch size using REML Henderson and its relationship with growth and egg production traits in chicken. Egypt. Poultry Sci., 18 (I): 167-182.
- Shebl, M. K., M. Soltan, M. A. Kosba and F. H. Abdou (1991). Environment interactions for growth and reproductive traits in Norfa chickens, Minufiya J. Agric. Res., 16 (2): 1439-1455.
- Sheriff, B. T. B. (1991). Improvement of some economical traits in chickens Ph. D. Thesis, Fac. of Agric., Minufiya Univ., Egypt.
- Soltan, M. E. (1991). Direct response in egg production from selection on early part records and correlated responses in some economic traits as a results of this selection in Sinai (Bedouin) fowl. Minufiya J. Agric. Res., Vol., 16(1): 373-417.
- Younis, H. H. and Abd El-Ghany, A. (2004). Direct and correlated response to selection for egg number in Silver Montazah chickens. Egypt. Poultry Sci., J., 24 (III): 701-718.

الانتخاب والاستجابة المرتبطة لصفات إنتاج البيض في سلاتي دجاج انشاص والمنتره الفضى

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استخدم في هذه الدراسة سلكتين من الدجاج المحلى انتخبت لمدة جيلين بالإضافة الى جيل الأساس لزيادة عدد البيض حتى ٤٠ أسبوع من العمر (سلالة انشاص) ووزن البيض عند ٤٠ أسبوع من العمر (سلالة المنتره الفضى) 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 لصفة عدد البيض كانت ١٥.٢ ، ٥.٣٣ بيضة بعد جيلين من الانتخاب فى سلالة انشاص. الانتخاب المباشر لوزن البيض عند عمر ٤٠ أسبوع من العمر أظهر 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 سلالة المنتره الفضى. تقديرات المكافئ الوراثي لعدد البيض عند عمر ٤٠ أسبوع من العمر فى سلالة انشاص على أساس مكونات تباين الأب ، الأم والأب الأم معا كانت ٠.٢ & ٠.٣٢ & ٠.٢٩ على التوالي بينما التقديرات المقابلة لوزن البيض عند عمر ٤٠ أسبوع فى سلالة المنتره الفضى كانت ٠.٥٢ & ٠.٩٢ & ٠.٧٢ على التوالي. الارتباطات الوراثية والمظهرية كانت سالبة بين عدد البيض عند عمر ٤٠ أسبوع من العمر والعمر عند النضج الجنسي، المدة اللازمة لإنتاج العشر بيضات الأولى ووزن البيض والكفاءة التحويلية. بينما وجد ارتباطات وراثية موجبة بين ووزن البيض عند عمر ٤٠ أسبوع من العمر ووزن الجسم عند النضج الجنسي، العمر عند النضج الجنسي، المدة اللازمة لإنتاج العشر بيضات الأولى ، كتلة البيض بينما كان هناك ارتباطات سالبة بين عدد البيض والكفاءة التحويلية كانت موجودة.

عامّة: وفقا لهذه النتائج المقننة بالتجربة وجد ان الانتخاب لزيادة عدد البيض عند عمر ٤٠ اسبوع من العمر فى سلالة انشاص يزيد عدد البيض، كتلة البيض وكذلك يحسن الكفاءة التحويلية وينقص العمر عند النضج الجنسي والمدة اللازمة لإنتاج العشر بيضات الأولى ويحسن وزن الجسم والكفاءة التحويلية. أخيرا يجب عمل برنامج انتخاب لتحسين أداء إنتاج البيض فى سلالة انشاص (سلالة محلية جديدة) وخطها مع سلالة المنتره الفضى لإنتاج هجين تجارى يستخدم فى الأنتاج الريفى.