J.Animal and Poultry Prod., Mansoura Univ., Vol.6 (12): 781- 796,2015

EFFECT OF SELECTION FOR BODY WEIGHT ON EGG PRODUCTION, EGG QUALITY, FERTILITY AND HATCHABILITY TRAITS in EL-SALAM CHICKEN STRAIN IN EGYPT

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ABSTRACT

This work was carried out at Sakha Poultry Production Research Station, Animal Production Research Institute, Ministry of Agriculture, during two successive generations in order to estimate the correlated response in egg production, egg quality and hatch traits to selection for body weight at 12 weeks of age in El-Salam chicken strains. Traits under taken were body weight, egg number, egg weight, egg mass, egg quality, fertility. Heritability, genetic and phenotypic correlations among studied traits were estimated.

The means of body weight at 12 week of age in El-Salam chicken strain in the base, first and second generations for males were 868.3, 903.6 and 942.9 g and for females were 838.6, 868.3 and 881.3g for selected line, respectively. Moreover, males and females in the selected line were heavier than corresponding birds in the control one for all generations.

After two generations selected for body weight, selected line was significantly higher body weight than control line by 85.4 and 33.6g in average means 9.8% and 4.0% superiority for male and female respectively.

Selection to the weight of the body lead to the delayed age at sexual maturity, as well as increased body weight at sexual maturity and the period until the first ten eggs.

Means of egg number and feed conversion were significantly reduced by generations. Moreover, egg weight and egg mass for selected line were significantly heavier than those of the control one.

As generational succession caused significant improvements on Haugh units, it decreased egg shape index, shell thickens, albumen and yolk percentages. Furthermore, egg shape index and shell percentage were significantly ($P<0.05$) affected by lines. Also, data showed no significant interactions between generations and lines on all of tested egg quality traits.

Reproductive performance as fertility and hatchability percentages were significantly ($P\leq0.05$) reduced by -2.9 vs. -0.6% after progress two generation of selection, but not affected by lines separately or as combination with generations.

Heritability estimated for body weight at 12 week of age were 0.67 based on sire variance component (h^2s).

Negative genetic and phenotypic correlations were found between body weight at 12 week of age with egg number, egg mass, fertility, hatchability, egg shape index, yolk%, shell% and shell thickens, while the positive effect were found for body weight at sexual maturity, age at sexual maturity, the period until the first 10 eggs, egg weight, feed conversion, albumen % and Hough unit.

Keywords: Chickens, selection, body weight, egg production, egg quality, fertility, hatchability, heritability.

INTRODUCTION

The present study is a part of the breeding program of the Animal Production Research Institute (APRI), for improving the productivity of the local Egyptian strains of chickens through selection.

Selection for body weight is the most important traits of genetic improvement program because that body weight is easily measured and correlated with several other traits (Abd El-Ghany 2005, Kosba et al., 2002, and 2006, Ghanem, et al., 2007, Saleh, et al., 2008, Abd El-karim and Ashour 2014, and Ramadan, et al., 2014).

Egg production depends of many characters and is the yield of overall performance of a bird concerning many variables such as body weight, egg weight, egg number, age at sexual maturity, egg quality, these variables are correlated with body weight and with each other in the positive or negative trends (Saleh, et al., 2006 and 2008, Younis et al., 2014 and Amin, 2015).

Egg quality traits are careful important economic in egg production, however, the external and internal egg quality characteristics of the breeds affected performance differed among generation, so, the selected pullets had better egg quality characteristics (thicker shell, higher shell and yolk percentages and Haugh Units), (Islam et al., 2001, Taha and Abd El-Ghany, 2013 and Younis et al., 2014).

Parameters of the genetic trend in weekly hatchability (mean and persistency) were significantly correlated with egg quality traits, suggesting that in a bulk mating in which individual recording of hatchability is not possible, these quality traits could provide some indication on the trend in flock hatchability (Ghanem and Afifi, 2013 and Rayan et al., 2015).

The main aim of this study was calculate the effect of the individual selection for body weight at 12 weeks of age in El-Salam chicken strain on egg production, egg quality and hatch traits and estimate the genetic phenotypic parameters for the different studied traits.

MATERIALS AND METHODS

Data:

This study was carried out on the flock of El-Salam chicken strain in Sakha Animal Production Research Station, located in the northwest of the Nile Delta, Kafr El-Sheikh governorate, Animal Production Research Institute, Ministry of Agriculture and Land Reclamation, Egypt.

Data included a total number of 789 pedigreed birds obtained from 697 dam mated by 92 sires through three successive generations at 12 weeks of age. The number of males and females of selected and control population through generations are presented in Table 1.

Table (1): The number of males and females of selected and control population on the flock El-Salam strain.

Generation	Selected			control		
	Sire	Dam	Progeny	Sire	Dam	Progeny
Base Gen.			800			180
First Gen.	49	379	925	11	82	187
Second Gen.	43	318	817	8	79	133
Total	92	697	2606	19	161	453

Chicks were wing-banded and reared under conventional open-sided houses. Artificial Insemination (Lake and Stuart 1978) had been applied by assigning about eight females to each male during the laying period, with avoiding mating between relatives, random mating was applied in the control lines. During the experimental period, feed and water were supplied ad libitum and all birds were kept and reared under similar environmental conditions. Live body weight for all birds were recorded at 12 weeks of age.

Birds in each generation were divided into two lines, first (selected line) was individually selected according to body weights as equal or greater than average of the flock (or generation) at 12 week of age to the nearest gram. The same criterion was used to select birds in each generation to improve body weight. The pullets were transferred to individual laying cages until 90 days of laying, while cockerels were moved to individual cages in cock's house.

Eggs were collected for incubate during eight days, kept in the reservation room before setting in the incubator. Body weight at 12 weeks of age, age and body weight at sexual maturity, egg number, egg weight, fertility and hatchability, were recorded individually. Egg mass was calculated by multiplying the number of eggs per bird times in the mean of egg weight.

Egg mass = egg number during a specific period x average egg weight during a specific period

Feed conversion through the whole period/generation was calculated from maturation to 90 days was determined according to the following equation:

Feed conversion = feed intake /egg mass

Fertility and hatchability were calculated utilizing artificial insemination using semen provided from 5 to 6 cockerels to each male during the incubation period. The eggs were candled on the 18th day to determine fertility percentage. Infertile clear eggs were macroscopically evaluated to determine apparent infertility by necked eyes. All fertile eggs from each strain were transferred single into pedigree hatching baskets in the hatchers for the remainder incubation period.

Hatchability was determined as the percentage of sound chicks to the number of fertile eggs:

Fertility percentage = (fertile eggs/total eggs) x 100.

Hatchability percentage = (hatched chick/fertile eggs) x 100.

During these study, 0.001g sensitive electronic scale was used for weighing the eggs, shell, yolk, albumen and yolk and albumen weight; a compass sensitive to 0.01mm was used for measuring the length and width of the eggs, length, width, yolk diameter; a table with a flat glass on it was used on which the eggs are broken on a table with a glass cover in order to measure the yolk height, yolk diameter, albumen height. The yolk departed from the albumen part was weighed, a 3-legged micrometer sensitive to 0.01mm was used for measuring the height of yolk and albumen.

Haugh units were calculated according to the formula of Haugh (1937) as follow:

Haugh units (HU) = 100*Log (H+7.57- 1.7W0.37)

Where H= Albumin height, W= Egg weight (g).

The shells were washed under slightly flowing water so that the albumen remains are removed. The washed shells were left to dry in the open air for 24 hours. Then, they were balanced together with the shell membrane, a micrometer sensitive to 0.01mm was used for measuring the shell thickness (Tyler, 1961).

Statistical Analyses:

Data were statistically analyzed by using linear fixed models (SAS, 2000) with fixed effect to estimate the effect of generation, line, sex, and their interactions. The following full fixed model (1) used:

$$Y_{ijkl} = \mu + G_i + L_j + S_k + (G*L)_{ij} + (G*S)_{ik} + (L*S)_{jk} + (G*L*S)_{ijk} + e_{ijkl} \quad .....(1)$$

Where:

Y_{ijkl} = an observation in generation (i), line (j) and sex (k),
μ, = the overall mean,
G_i = the fixed effect of i^{th} generation (i=1, 2 and 3),
L_j = the fixed effect of j^{th} line (j=1 and 2),
S_k = the fixed effect of k^{th} sex (k=1 and 2),
$(G*L)_{ij}$ = interaction between generation i and line j,
$(G*S)_{ik}$ = interaction between generation i and sex k,
$(L*S)_{jk}$ = interaction between line j and sex k,
$(G*L*S)_{ijk}$ = interaction between generation i, line j and sex k, and
e_{ijkl} = the random error term.

Egg production, egg quality, fertility and hatchability traits were analyzed by using fixed model (2) as follows:-

$$Y_{ijk} = \mu + G_i + L_j + (G*L)_{ij} + e_{ijk} \quad ....(2)$$

Where:

Y_{ijk} = an observation in generation (i), line (j) and sex (k).
μ = the overall mean,
G_i = the fixed effect of i^{th} generation (i=1, 2 and 3),
L_j = the fixed effect of j^{th} line (j=1 and 2),
$(G*L)_{ij}$ = interaction between generation i and line j, and
e_{ijkl} = the random error.

Significant differences among means were tested using Duncan's Multiple (Duncan, 1955).

Heritability estimates were calculated according to (Becker, 1985)

$$h^2_S = 4\ var(S) / [var(S) + var(D) + var(E)]$$

Where: h^2_S = the heritability estimates from sire plus dam component of variance, var (S) = the sire variance component, var (D) = the dam variance component and var (E) = the error variance component.

Genetic and phenotypic correlations were calculated as following:

$$\mathbf{r_G = Cov\ S_{xy} / SQRT\ [\sigma^2 S_x]\ [\sigma^2 S_y]}$$

$$\mathbf{r_P = Cov\ S_{xy} + Cov\ e_{xy} / SQRT\ [\sigma^2 S_x + \sigma^2 e_x]\ [\sigma^2 S_y + \sigma^2 e_y]}$$

Where: r_G is the genetic correlation coefficient, r_P is the phenotypic correlation coefficient, Cov S_{xy} is the expected mean of cross products of the two studied traits x and y from sire component, Cov e_{xy} is the error term expected mean of cross products of the two studied traits x and y.

The realized direct and correlated response was estimated according to the following equation (Guill and Washburn 1974):

$$\mathbf{R = (X_n - X_{n-1}) - (C_n - C_{n-1}).}$$

Where: R is response to selection, X_n is average of selected line in generation n, X_{n-1} is average of selected line in generation n-1, C_n is average of control line in generation n, $C_{n-1}$is average of control line in generation n-1

.

RESULTS AND DISCUSSION

Least square means of live body weight of males and females in both selected and control lines over three successive generations are presented in Table 2. Mean of body weight for males were 868.3, 903.6 and 942.9g and for females were 838.6, 868.3 and 881.3g in the base, first and second generations, respectively. All body weights were increased by generations. The selected line had higher body weight than control line, moreover, the males had higher body weight than females. Ramadan et al., (2014) reported that after eight generations of selection for increasing six week live body weight the selected line weighted 35% more than the control line. So, selection for increased body weight in broiler breeders includes maternal effects which have positive association with body weight of its progenies after hatch (Nassare 2013).

Table (2): Least squares means ± standard errors for body weight at 12-week of age for males and females of El-Salam strain as affected by generations, lines and sex.

Generation	Line	Sex		Average
		Males	Females	
Base Gen.	Selected	868.3±15.3	838.6±9.90	853.4±9.11
	Control	873.3±43.5	836.4±22.5	854.8±23.8
First Gen.	Selected	903.6±21.6	868.3±11.8	885.9±12.3
	Control	861.2±33.0	842.5±34.4	851.8±23.8
Second Gen.	Selected	942.9±29.5	881.3±11.6	912.1±15.9
	Control	862.5±59.5	845.5±30.7	854.0±33.5
Significances				
Gen.		***		
Line		***		
Sex		***		
Gen.* Line		*		
Gen.* Sex		*		
Line * Sex		NS		
Gen.* Line * Sex		*		

***=Significant at (P≤0.05), ***=Significant at (P ≤0.001),**
NS = on-significant.

These results showed that selection for increasing body weight at 12 weeks of age confirmed the genetic variability in the body weight and it was possible to increase significantly the body weight after two generations of selection for body weight, the selected line surpassed the control line with 85.4 and 33.6g in average, which means 9.8% and 4.0% superiority for males and females respectively. Similar results were reported by Abd El-Ghany 2005 and 2006, Kosba et al., 2006, Ghanem, et al., 2007, Saleh et al., 2008, Abd El-karim and Ashour 2014 and Ramadan et al., 2014.

As shown in Table 3, highly and significant differences ($P \leq 0.001$, $P \leq 0.01$) were found among generations and lines for body weight at sexual maturity, age at sexual maturity, weight of the first egg and duration of the first ten eggs.

The pullets of the second generations were significantly higher body weight at sexual maturity ($P \leq 0.001$) and matured later than those in the base generations. Also, highly significant ($P \leq 0.001$) differences were found among lines and generations and their interactions for the weight at the first egg. Moreover, the pullets in the second generation had the longest period to produce the first ten eggs compared with base and first generations. Likewise, hens in control lines laid the first ten eggs in shorter period compared to selected line.

It could be seen that, the realized response for body weight were affected from generation to generation in the selected line for body weight at sexual maturity, age at sexual maturity, weight the first egg and duration of the first ten eggs. In addition, the positive cumulative response were 5.6g, 2.7 days, 0.7g and 1.5 days for body weight at sexual maturity, age at sexual maturity, weight the first egg and duration of the first ten eggs, respectively, as showing in table 7.

In this respect, Saleh, et al., (2008) reported that the selection for increase body weight at 12 weeks of age tend to selected line pullets matured later than those in the control line and the pullets in the second generation had the longest period (27.1 days) to produce the first ten eggs compared with base generations. Similar estimates for age at sexual maturity were reported by El-Tahawy, 2000, Kosba et al., 2002 and 2006, Ghanem et al., 2007, Amin, 2008 and Abd Ella, 2007.

In compare to Younis et al., (2014) found negative estimates for cumulative response for body weight at sexual maturity, age at sexual maturity and duration of the first ten eggs (-6.0g -.5 and -2.48d) in selected Dokki-4 strain for egg production.

Table (3) Least squares means ± standard errors for body weight at sexual maturity, age at sexual maturity, weight the first egg and duration period of the first ten eggs in El-Salam strain as affected by generations and lines.

Gen.	Line	Body weight at sexual maturity	Age at sexual maturity	Weight the first egg	Duration period of the first 10 eggs
Base Gen.	Selected	1430.5±16.9	181.7±1.56	40.8±0.48	24.7±1.76
	Control	1356.1±34.8	182.2±3.21	38.4±0.98	23.5±4.07
	Av.	1393.3±18.0	182.0±1.37	39.1±0.42	23.7±1.67
First Gen.	Selected	1431.1±19.6	184.5±1.81	41.9±0.55	25.4±1.75
	Control	1353.6±17.0	183.1±3.16	38.9±0.96	24.1±3.02
	Av.	1411.9±19.7	183.6±1.34	40.3±0.41	24.9±1.29
Second Gen.	Selected	1444.5±34.2	187.1±1.57	42.3±0.48	26.6±1.36
	Control	1364.5±18.0	184.8±3.16	39.6±0.96	23.9±3.02
	Av.	1430.5±62.8	185.0±1.32	41.7±0.40	25.6±1.46
Significances					
Gen.		***	***	**	***
Line		***	**	***	**
Gen.* Line		**	**	*	*

***=Significant at ($P \leq 0.05$), **=Significant at ($P \leq 0.01$), ***=Significant at ($P \leq 0.001$)**

Least squares means ± standard errors for egg number, egg weight, egg mass and feed conversion are presented in Table 4. Highly significant ($P \leq 0.001$) differences were found among generations and between lines. It was noticed that means of egg number and feed conversion were significantly reduced by generations. Moreover, the egg weight and egg mass for selected line were highly and significantly ($P \leq 0.001$ and $P \leq 0.01$) heavier than those in the control line.

The realized cumulative response for egg number, egg weight, egg mass and feed conversion for egg production till 90 days were -1.6egg, 0.9g, -29.6g and 0.02 kg/kg, respectively, as in table 7. The present results indicated that, although egg mass were improved by generations, it situation that the negative value were found for egg number (-0.3 and -1.3 egg) whereas the positive value were found for egg weight (0.8 and 0.1 g) for the realized response from the 1st and 2nd generations, as a import that, the egg mass attribute were consequently affected by egg number more than egg weight.

Saleh et al., (2008) reported that selection for body weight in El-Salam strain be liable to increased egg weight, egg mass and feed conversion, while decreased egg number trait. The cumulative responses for these traits were 0.3g, 97.4g, 1.2 kg feed/kg egg and –5.6 eggs, respectively, as well as, Sabri and Abd El-Warith (2000), Abd El-Ghany (2005) and Saleh et al., (2002) observed that the mean of egg weight were improved by 0.8g as a result of two generations of selection for body weight for Baheij strain. Also, Kosba et al., (2002) reported that the first generation had higher egg mass and egg number than the base generation. Younis et al., (2014) reported that the hens of the selected line to egg production in the first and second generations produced more eggs than control line by 7.9 and 15.8 eggs in Dokki4 strain.

Table (4) Least squares means ± standard errors for egg production traits and feed conversion in El-Salam strain as affected by generations and lines.

Gen.	Line	Egg number	Egg weight	Egg mass	Feed conversion
Base Gen.	Selected	45.1±1.68	44.9±0.31	1921.9±78.7	7.65±0.37
	Control	46.6±3.99	40.2±0.71	1423.3±182.3	7.92±0.86
	Av.	45.3±1.64	41.9±0.30	1652.5±77.1	7.91±0.37
First Gen.	Selected	44.4±2.14	46.3±0.38	2197.3±98.1	6.93±0.46
	Control	46.2±3.03	44.8±0.53	2201.7±138.7	7.21±0.66
	Av.	45.1±1.41	45.3±0.25	2272.3±64.6	7.17±0.31
Second Gen.	Selected	43.2±1.37	46.9±0.25	2207.7±62.7	7.55±0.30
	Control	44.7±3.41	45.3±0.61	1988.7±156.1	7.80±0.74
	Av.	43.5±1.33	45.5±0.24	2106.6±60.7	7.61±0.29
Significances					
Gen.		*	**	***	*
Line		**	***	*	*
Gen.* Line		*	**	*	*

***=Significant at ($P\leq0.05$), **=Significant at ($P\leq0.01$), ***=Significant at ($P\leq0.001$).**

Highly and significant differences ($P\leq0.01$ and $P\leq0.05$) among generations for egg shape index, yolk percent, shell thickens, high Unit and albumen percent were found as shown in table 5. In contrast, no significant were found for shell percent and among lines and their interaction for every one of traits without egg shape index and shell percent ($P\leq0.05$). In general, egg quality is a slightly affected by selection for high body weight at 12 week of age in El-Salam strain because this traits depend on the different environmental factors. All measures of these traits were fill in the normal range of the most studies reported by El-Sudany 2005, Mertens 2006, Abd Ella 2007, Aly et al., 2010, Rayan et al., 2013 and Younis et al., 2014.

Table (5) Least squares means ± standard errors for egg quality traits in El-Salam strain as affected by generations and lines.

Gen.	Line	Egg shape index	Albumen %	Yolk %	Shell %	Shell thickens	High Unit
Base Gen.	Selected	78.1±0.02	57.5±0.19	32.4±.002	9.8±0.09	0.35±0.28	87.4
	Control	77.9±0.12	57.3±1.84	31.7±.025	10.4±0.01	0.37±2.66	82.5
	Av.	77.9±0.04	57.5±0.62	32.2±.008	9.9±.001	0.36±0.90	86.2
First Gen.	Selected	77.3±0.03	58.0±0.23	32.0±.003	9.7±.001	0.35±0.34	87.5
	Control	77.0±0.06	57.6±0.38	31.2±.005	10.4±.002	0.35±0.55	85.7
	Av.	77.2±0.03	57.8±0.16	31.9±.002	9.9±.001	0.35±0.24	86.6
Second Gen.	Selected	76.0±0.03	58.6±0.20	31.6±.003	9.6±.001	0.32±0.29	93.7
	Control	76.8±0.09	58.1±0.58	31.7±.008	10.0±.003	0.35±0.84	94.1
	Av.	76.0±0.03	58.4±0.22	31.6±.003	9.8±.001	0.33±0.32	94.5
Significances							
Gen.		**	*	*	NS	**	**
Line		*	NS	NS	*	NS	NS
Gen.* Line		NS	NS	NS	NS	NS	NS

***=Significant at ($P \leq 0.05$), **=Significant at ($P \leq 0.01$), ***=Significant at ($P \leq 0.001$), NS = non-significant.**

Results of hatch traits are presented in Table 6. It was cleared that fertility and hatchability percent were significant lowered by generations ($P \leq 0.05$). Fertility percent were 70.6, 68.8 and 67.5 and hatchability percent were 58.7, 58.1 and 57.8 in the selected line for the 1st, 2nd and 3rd generation, respectively. On the other hand, there were neither significant effects on any of the mentioned hatch traits between lines nor the interaction with generations. The negative value were found for cumulative response for fertility and hatchability percent (-2.9 and -0.6) after two generation of selection for body weight (Table 7). Ghanem and Afifi (2013) reported that for the hatchability traits were decreased in the 1st and 2nd generation and increased in the 3rd generation. Falconer and Mackay (1996) reported that breeding reproduction traits is a difficult task because the heritability of fitness related traits is generally low. The present results are disagreement with that reported by Heier and Jarp 2001, El-Sudany 2005, El-Full et al., 2005 and Amin 2008.

Table (6): Least square means and standard errors for fertility and hatchability percentage in El-Salam strains of chicken.

Gen.	Line	Hatch traits %	
		Fertility	Hatchability
Base Gen.	Selected	70.6±3.38	67.33±4.63
	Control	69.7±3.74	66.92±5.06
	Av.	70.1±8.15	67.23±10.9
First Gen.	Selected	68.8±3.12	66.47±3.11
	Control	69.7±6.40	64.83±4.23
	Av.	69.1±2.55	65.51±12.8
Second Gen.	Selected	67.5±2.57	65.28±2.66
	Control	69.5±4.99	64.15±4.00
	Av.	68.4±2.10	64.82±06.6
Significances			
Gen.		*	*
Line		NS	NS
Gen.* Line		NS	NS

***=Significant at ($P\leq0.05$), NS = non-significant**

Table (7): Realized correlated response for unselected traits in El-Salam chicken strain affected by generations.

Traits	Realized response		Cumulative response
	G1	G2	
Body weight at 12 week of age			
Male	47.4	38.0	85.4
Female	23.6	10.0	33.6
Egg production traits			
Body weight at sexual maturity	3.1	2.5	5.6
Age at sexual maturity	1.9	0.8	2.7
Weight the first egg	0.6	0.1	0.7
Duration period of the first 10 eggs	0.1	1.4	1.5
Egg number	-0.3	-1.3	-1.6
Egg weight	0.8	0.1	0.9
Egg mass	-13.0	-16.6	-29.6
Feed conversion	-0.01	0.03	0.02
Egg quality traits			
Egg shape index	0.1	-1.1	-1.0
Albumen %	0.2	0.1	0.3
Yolk %	0.1	-0.9	-0.8
Shell %	-0.1	-0.1	-0.2
Shell thickens	0.02	-0.03	-0.01
High Unit	-3.1	-2.2	-5.3
Hatch traits			
Fertility %	-1.8	-1.1	-2.9
Hatchability %	-0.4	0.2	-0.6

G1 = First generation, G1 = Second generation

Reviewed estimates in the Egyptian studies indicated that heritabilities of body weight and egg weight for local breeds were higher than those for foreign breeds, although the heritability of egg number, egg quality, fertility and hatchability were low ability (Heier and Jarp, 2001, Amin 2008, Wolc et al., 2010, El-Dlebshany et al., 2013 Ghanem and Afifi, 2013, Mehri, 2013 and Younis, et al., 2014). This is due to that genetic variance component in local breeds were higher than the corresponding estimates in foreign breeds.

Estimates of heritability from sire components of variance as well as genetic and phenotypic correlations are presented in Table 8. The heritability estimated for body weight at 12 weeks of age and at sexual maturity were 0.67, 0.62, respectively. High values heritability for body weights indicates that, direct selection for increasing body weight at 12-week of age would be effective in improving body weight. However, Saleh et al., (2008) reported that the heritability estimated for body weight at 12 week of age and at sexual maturity in El-Salam chicken strain were 0.31 and 0.11 after three generations of selection for body weight, respectively. From h^2 estimates in table 8, the heritabilities values were different by the trait [(0.91 *vs.* 0.10) for egg production, (0.45 *vs.* 0.07) for egg quality and (0.21 vs. 0.12) for hatch traits]. In addition Abd El-karim and Ashour 2014 showed that heritability estimate for body weight was 0.55 after two selected generations for body weight.

Positive value for genetic and phenotypic correlations (Table 8) are with body weight at 12 week of age and body weight age at sexual maturity, age at sexual maturity, duration period of the first ten eggs, egg weight and feed conversion. Moreover, phenotypic correlation was negative value for egg number, egg mass and for all traits of egg quality and hatch traits.

Low and negative value of genetic correlation were found between body weight and hatchability% (-0.03) in table 8. However, lower and positive values of phenotypic correlations (0.164) were observed for Albumen%. Younis et al., (2014) revealed negative genetic and phenotypic correlation over two generation was found between egg number and body weight at sexual maturity (-0.56).

In other study, Saleh et al., (2008) estimated the genetic correlations between body weight at 12 week of age and body weight at sexual maturity by (0.78), egg weight (0.59) and egg mass (0.12). While the genetic correlation for age at sexual maturity was (-0.01), duration of the first 10 eggs (-0.31) and egg number (-0.05). Moreover, phenotypic correlation was negative for duration of the first 10 eggs (-0.02) and egg number (-0.02), while were positive for age at sexual maturity (0.004), egg weight (0.03) and egg mass (0.03).

In this respect, Abd Ellatif, 2001 showed that phenotypic correlations between body weight and age at sexual maturity ranged from 0.06 to 0.13 and genetic correlation ranged from 0.002 to 0.18. However, some authors reported that the genetic and phenotypic correlations between body weight and egg number were positive (Younis and Abd El-Ghany, 2004, Abd El-Ghany, 2005 and Saleh et al., 2006).

Table (8): Heritability estimates, genetic and phenotypic correlations between body weight at 12-wk of age and egg production, egg quality and hatchability traits in El-Salam strain

Traits	h^2s	r_G	r_P
Body weight age at 12 week of age	0.67		
Egg production traits			
Body weight at sexual maturity	0.62	0.53	0.56
Age at sexual maturity	0.45	0.29	0.56
Duration period of the first ten eggs	0.40	0.35	0.89
Egg number	0.52	-0.79	-0.97
Egg weight	0.38	0.87	0.76
Egg mass	0.91	-0.49	-0.55
Feed conversion	0.59	0.81	0.62
Egg quality traits			
Egg shape index	0.45±0.31	-0.35±0.50	-0.25
Albumen %	0.36±0.22	0.64±0.17	0.16
Yolk %	0.18±0.26	-0.76±0.08	-0.31
Shell %	0.42±0.29	-0.59±0.22	-0.15
Shell thickens	0.07±0.40	-0.65±0.17	-0.53
High Unit	0.15±0.36	0.67±0.34	0.28
Hatch traits			
Fertility %	0.21±0.21	-0.33±0.15	-0.45
Hatchability %	0.12±0.15	-0.03±0.57	-0.72

h^2s =heritability estimates by sire variance component,
r_g = genetic correlations and r_p = phenotypic correlations

Finally, the present study cleared that, the present selection program in this investigation should be applied to improve the performance of El-Salam chickens strain as a local hybrid chicks in Egypt through selecting for increase body weight at 12 weeks of age.

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تـأثير الانتخـاب لـوزن الجسم علـى صفات إنتـاج البيض، جودة البيض، الخصوبه والفقس فى سلالة دجاج السلام فى مصر

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أجريت هذه الدراسة بمحطة بحوث الإنتاج الحيوانى بسخا - معهد بحوث الإنتاج الحيوان - وزارة الزراعة خلال جليين منتخبين لدراسة الإستجابه المرتبطه لصفات إنتاج وجودة البيض والفقس عند الإنتخاب لزيادة وزن الجسم عند عمر ١٢ اسبوع في سلالة السلام. كانت الصفات التى تم تقديرها، وزن الجسم ، عدد ووزن وكتلة البيض، جودة البيض ، الخصوبة. قدر المكافىء الوراثى لكل من الارتباط الوراثى والمظهري للصفات المدروسة.

- سجل متوسط وزن الجسم عند عمر ١٢ اسبوع لسلاله دجاج السلام فى القطيع الأساسي والجيل الأول والثانى للذكور ٨٦٨.٣ ,٩٠٣.٦ ,٩٤٢.٩ جم وبالنسبه للإناث ٨٣٨.٦ ,٨٦٨.٣ ,٨٨١.٣ جم على التوالى. وعلاوه على ذلك كانت الذكور والإناث في الخط المنتخب أثقل من الطيور المقابلة في خط الكنترول لجميع الأجيال.
- حدث تفوقاً بعد جليين من الإنتخاب لوزن الجسم معنوياً فى الخط المنتخب مقارنة بالكنترول بمقدار ٨٥.٤ جم و٣٣.٦ جم وكان متوسط نسبة الزياده ٩.٨% و٤.٠% للذكور والإناث على التوالى.
- الإنتخاب لزيادة وزن الجسم أدى الى تأخر العمر عند النضج الجنسى بالرغم من زيادة وزن الجسم عند النضج الجنسى والفتره اللازمه لإنتاج العشرة بيضات الأولى.
- بينما انخفض عدد البيض والكفاءه التحويليه إنخفاضا معنوياً خلال الأجيال. علاوه على ذلك كان وزن البيضة وكتلة البيض فى الخط المنتخب أكثر معنويه من خط الكنترول.
- من خلال تعاقب الأجيال حدث تحسن معنوى على وحدات هوف، بينما إنخفض معامل شكل البيض، سمك القشره، ونسب الزلال وصفار البيض. وعلاوة على ذلك، كان معامل شكل البيض ونسبة القشره تأثيره معنويا (P≤0.05) بين الخطوط. كما أظهرت النتائج عدم وجود معنويه بين الأجيال والخطوط على كل صفات جودة البيض.
- انخفض الآداء التناسلي لنسب الخصوبة والفقس معنويا (P≤0.05) بنسبة -٢.٩ مقابل -٠.٦٪ بعد جيلين من الإنتخاب، ولم يحدث تأثير بين الخطوط سواء منفصله أو تداخلها مع الأجيال.
- سجلت قيم المكافئ الوراثي لوزن الجسم (٠.٧٦) عند عمر ١٢ اسبوع كان ذلك على أساس تباينات الأب.
- سجل الإرتباط الوراثي و المظهرى قيماً سلبيه بين وزن الجسم عند عمر ١٢ اسبوع وعدد البيض، وكتلة البيض ونسبة الخصوبة والفقس، ومعامل شكل البيضة، ٪ صفار، ٪ القشره وسمك القشره، في حين كان للإرتباط الوراثى والمظهرى أثر إيجابي على وزن الجسم عند النضج الجنسى والعمر عند النضج الجنسي، وفترة إنتاج ١٠ بيضات الأولى، وزن البيضة، والكفاءه التحويليه ، ٪ نسبة الزلال وحدة هوف (Haugh unit).

* وفقا لنتائج التجربة الحالية من الواضح أن اختيار برنامج التحسين الوراثى الحالى أدى إلى تحسين آداء سلالة دجاج السلام باعتباره من الهجن المحلية من خلال إختياره لزيادة وزن الجسم عند عمر ١٢ أسبوع.