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DIRECT AND CORRELATED RESPONSE OF SELECTION FOR IMPROVING BODY WEIGHT IN EL-SALAM CHICKENS

By

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Abstract: *The present selection experiment was carried out over four successive generations with two linens (selected and control), which had been developed of El-Salam strain of chickens. The first line was selected for improving 12-week body weight using individual selection and the second line was the control line.*

The results indicated that the mean of the body weight at 12 weeks of age after three generations of the selection to this trait to the selected line and control were 965.4 and 864g for males and *888.7 and 847.4g for females. It is found high significant different between the generations and the lines. Selection differentials of male 12-week body weight were 57.4g, 44.6g and 18.6g in the base, first and second selected generations. The corresponding values for females were 56.7g , 14.5g and 6.8g. The realized and expected responses, were 105.3g and 37.4g for males, and were 75.6g and 24.2 g for females over three generations, respectively. Growth rate from 8-12 week of age for selected and control were 46.2g and 33.6g for males and were 43.7g and 46.3g for females respectively. The selected line surpassed the control line by 12.5%, 12.3%, and 7.3% for shank length, keel length, and breast circumference, respectively. Also, the males had significantly longer body measurements than females.*

The body weight increased at 8, 16, and 40 weeks of age as well as at sexual maturity. Moreover, the selected line pullets matured later than those of the control line by 2.9 days. The egg weight increased by 0.3g, egg mass by 97.4g , feed conversion for egg production till 40 week of age by 1.2 kg feed/kg eggs and the duration period of the first ten egg by 1.9 days, while decreased egg number trait by 5.6 eggs.

The realized heritability estimated for body weight at 12 weeks of age based on sire plus dam component of variance in three generations was 0.22. Positive genetic and phenotypic correlations were observed between body *weight at 12 week of age and body weight at different age, egg weight and egg mass till 40 week of age. While negative correlations were observed between body weight at 12 week of age and age at sexual maturity, duration of the first 10 eggs, egg number and feed conversion for egg production.*

In general, according to the results of the present selection experiment it is clear that selection program should be applied to improve the performance of El-Salam strain of chickens through selecting for increase body weight at 12 weeks of age. The selected strain could be crossed in the future to provide small holder families with improved local hybrid chicks.

INTRODUCTION

Development of broiler strains in Egypt is still facing a great deal of difficulty due to the lack of genetic information about the local strains of chickens which should be available before embarking on such a program. Also, poultry industry in Egypt, and particularly chickens, depends mainly on some foreign hybrids while local breeds are neglected, although our local strains i.e., Mandarah, El-Salam, Gimmizah, Bandara, Inshas, Dokki-4, ...etc. are more adapted for the Egyptian environmental conditions and widely distributed in rural sector which contributes with more than 30% of the national poultry production.

By means of selection procedures and breeding programs, many breeders (Abd El-Gawad *et al.,* 1983; Mahmoud, 1982; El-Hossari and Ragab, 1970; and Bakir *et al*., 2002) have succeeded in developing strains of standard breeds like Cornish and Plymouth Rock chickens as heavy breeds for meat production and also, like Rhode Island Red and Leghorn chickens as medium and light breeds for egg production.

However, local breeds are characterised by lower growth traits (body weight and growth rate). Therefore, it is very important to develop such breeding programs to improve the productivity of specific local strains through which the national poultry production would be increased. Furthermore, the improved local strains and/or their hybrids could find a hopeful place in the African poultry market.

The present study is a part of the breeding program of the Animal Production Research Institute (APRI), that aimed at improving the productivity of the local Egyptian strains of chickens through selection. The purpose of the study is to select for body weight at 12 weeks of age in El-Salam strain of chickens and measure the direct response from individual selection for improved 12-week body weight. Moreover, the estimation of some genetic parameters such as hertability coefficients, genetic and phenotypic correlations coefficients.

MATERIALS AND METHODS

The experimental work was conducted in Sakha Research Station, Kafr El- Sheikh, Animal Production Research Institute, Ministry of Agriculture, Egypt. The study started in December 2002 and was terminated in June 2006.

Management Selection:

A total of 1000 day old El-Salam chicks were randomly selected at hatch from the flock of the station. All chicks were wing-banded to keep their pedigree and weighed to the nearest gram at hatch and until 20 weeks of age. On weighing days, the birds were fasted until weighting. The birds were vaccinated at hatch against Mark's disease and reared under conventional open-sided houses until they reached 20 weeks of age. The pullets were transferred to individual laying cages while, cockerels were moved to individual cages in cock's house until 40 weeks of age. During the first 6 weeks of age the birds received a starter ration containing 19.3 % protein and 2868 kcal/kg M.E. From 6 to 20 weeks of age, the birds received a grower ration containing 15.2 % protein and 2690 kcal/kg M.E. From 20-40 weeks of age, the birds received a layer ration containing 17.2 % protein and 2710 kcal/kg M.E. All the other nutritional requirements were covered for each age according to the NRC (1995). The number of tested as well as selected sires and dams for each line during various generations are shown in Table (1).

Semen quality for each cockerel was conducted two weeks before starting the experiment. Random mating was applied in the control lines. Artificial Insemination was used according to Lake and Steuart (1978) during the production season by assigning about five to six females to each male.

Eggs were collected for incubation during ten days, kept in the storage room before setting in the incubator. Diets and water were supplied *ad libitum* during the study period, all birds were kept and reared under the same environmental conditions.

Selection was based on 12 week body weight. Every generation the heaviest 20 males at 12 weeks of age from the progeny of the selected line were selected along with the following 20 heaviest males to be kept as reserves. The 20 selected males were mated with no attempted assorted mating, to the heaviest 119 females from the selected line using about five to six females for each male. The only restriction was no full or half sib matings. All the hens were caged. At the same time about 500 eggs from the base flock were set with the eggs of the selected line to use as contemporary controls. The control chicks were reared intermingled with the selected line.

All management practices were the same as far as possible, within and between lines and generations. All the females were kept to study age at sexual maturity, body and egg weights at sexual maturity, number of days required to lay first 10 eggs, egg production, egg weight and feed conversion for egg production until 40 weeks of age. Body weight was recorded individually to the nearest gram for all birds at 8, 12, 16, and 40 weeks of age, growth rates were calculated biweekly at 8-12 and at 12-16 weeks of age for both sexes (Broody, 1945). Body measurements (shank length, keel length, and body circumferences were measured at 8 and 16 weeks of age to the nearest millimeter (mm).

All the previous measurements were obtained from all the hens of the selected and control lines every generation.

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

Intensity of selection (I) was estimated according to Falconer (1983)

I = S / sd (S = is the selection differential & sd = is the standard deviation).

Density of selection (V) was calculated by the following equation:

V= Number of selected parents / Total number of parents population.

The realized direct and correlated responses were 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 X).

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

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

Statistical analysis was done by using Harvey program (1990) and statistical model was used as follows:

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

Where: Y_{ijkl} = an observation; μ = overall mean; G_i = effect of generation; L_j = effect of line; S_k= effect of sex; $(G*L)_{ij}$ = interaction between generation and line; $(L*S)_{jk}$= interaction between line and sex; $(G*S)_{ik}$=

interaction among generation and sex; $(G*L*S)_{ijk}$= interaction among generation, line and sex, e_{ijkl}= random error

The statistical analysis for egg production traits under study was as follows: $Y_{ijk} = \mu + G_i + L_j + (G*L)_{ij} + e_{ijk}$

Where: Y_{ij}= an observations; μ = overall mean; G_i= effect of generation; L_j= effect of line; $(G*L)_{ij}$= interaction between generation and line; e_{ijk}= random error

The heritability, genetic, and phenotypic correlations estimates were performed according to the following Model: (Harvey, 1990).

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

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

RESULTS AND DISCUSSION

Direct Response:

Selection differential (S) and selection intensity (I) are presented in Table 2. Selection differential mean of body weight at 12 weeks of age were 40.27g for males and 26g for females for three generations. The corresponding value means for the selection intensity were 0.81 of males and 0.3 of females for three generations.

Selection density mean were 5.07 for males and 26.93 for females. The corresponding figures of realized responses were 35.1g of males and 38.4g of females for three generation. Moreover, cumulative selection responses of body weight at 12 weeks of age after three generations of selection were 105.3 and 75.6 g for males and females, respectively.

Expected response means to selection were 12.47 for males and 8.07 for females in three generations. Selection differential were estimated by Abd El-Halim (1999) were 35.6g and 27.1g, while the realized responses were 3.9g and 12.2g for males and females, respectively, after two generations of selection for high body weight.

Data in Table 2 show that the mean of body weight males in the four generations were 913.60 g for selected line and 849.18 g for control line. The corresponding figures of females were 863.38 g for selected line and 834.73 g for control line. These results indicated that the selected line showed significantly higher body weight than the control line. Similar results were reported by El-Tahawy (2000), Kosba *et al.*, (2002a), and Abd El-Ghany (2006) who found that body weight for males were heavier than female, as well as selected line was heavier than control line for Inshas strain which selected individually based on body weight at 12 weeks of age.

Selection response for females was lower compared to males, which could be explained through the higher selection differential and intensity of selection for males than females. After five generation of selection for body weight, Shebl (1980) reported that cumulative genetic gain for body weight at 12 weeks of age for males (92.9g) was more effective than females (79.4g). Also, Abd El-Halim (1999) reported that selection response for females was negative after one generation of selection for body weight at 8-weeks of age in Alexandria strain. Significant of selection on body weight for local strains was also found by Saleh *et al.* (2002) who found that genetic improvement equal to 54g in female after two generations of selection for body weight.

Highly significant differences ($p \leq 0.01$) were found among generations. The body weight at third generation was higher compared with the base population. Moreover, selected line had significantly ($p \leq 0.001$) higher body weight than the control line by 7.3, 7.9 and 7.8 % in the first, second and third generations, respectively. Moreover, highly significant differences were observed between males and females as well as the interaction between generation x lines and generation x line. These interactions may be due to that the change in body weight was not equal per generation.

These results showed that selection for increasing body weight at 12 weeks of age in El-Salam strain of chicken confirmed the genetic variability in the body weight and it was possible to increase significantly the body weight after three generations of selection for body weight, the selected line surpassed the control line with 71.1g in average, which means 8.3% superiority.

In general, the results of present selection experiment revealed that selection program continue to improve the performance of El-Salam strain for live body weight and to exploit the additive genetic variation as well as nicking ability in future.

Correlated Response:

Body weight

Data presented in Table 3 showed that the body weight in the selected line surpassed significantly that of the control line at different ages studied in different generations. Moreover, males had heavier body weight than females at all ages. Similar results were reported by Abd El-Ghany (2006) who found that selection for high body weight at 12 weeks of ages resulted in positive changes for males and females after one generation. The selected line improved than control line. In support of these results, Ghanem (1995), Abd Allah (1997), Abdellatif (1999), Dabess (1999), El-Wardany (1999a), El-Tahawy (2000), Kosba *et al.*, (2002a,b) observed similar results.

The realized correlated responses for body weight at 8, 16, 40 and at maturity positive value were 90.9, 104.2, 215.3 and 16.7g, respectively (Table 4). This finding indicates that positive change of body weight at different ages could be expected with the advancement of selection for body weight at 12 weeks of age.

Growth rate

Results presented in Table 3 illustrate growth rate of males and females in both selected and control lines at different ages and in different generations. Significant differences were found among generations, sex and line and their more interaction at 8-12 and 12-16 weeks of age, but there no significant differences were found among lines for the periods 12-16 weeks of age in all generations. During the first and second generations males and females of selected line were growing faster than those in the control line. Similar results were found by Abd El-Halim, (1999) and Rizkall *et al.*, (2002), who reported nearly equal growth rate during 8-12 and 12-16 week of age, and that body gain increased gradually during the growth period. Also, males had significantly higher values than females for Silver Montazah and Mandarah strains of chickens, while of Fayoumi strain females were higher than the males at 12-16 weeks of age.

The realized correlated response for growth rate at 8-12 and 12-16 weeks of age as a result of selection for body weight at 12 weeks of age were 5.0 and 0.8 g after three generations of selection (Table 4). Similar results were reported by Abd El-Halim, (1999), who found that the realized correlated response of growth rate during growing period as a result of selection for 8-week body weight ranged from –0.7 to 3.1%.

Generally, these results indicated that direct selection for increasing body weight at 12-weeks of age in El-Salam strain of chickens had an affecte on growth rate during growing period after three generations of selection.

Body measurements

Data presented in Table (5) indicated that the highly significant were found among generations and between lines within generations at all ages.

Moreover, birds in the selected line had longer body measurements than control one in the three generations at growing period. Through the comparison between the selected and control line after three generations of selection, it could be noticed that the selected line surpassed the control line for shank length, keel length and breast circumference traits. Also, males had significantly longer body measurements than those females at the same period. After five generations of selection for body weight in Dandarawi breed of chicken, Abdellatif (1999) reported that selected line had longer length compared to control line. Averages of body measurements were similar with those finding by El-Wardany *et al.*, (1994), Rizkalla *et al.*, (2002), Saleh *et al.*, (2002) and Abd El-Ghany (2006).

From the results in the present study it could be concluded that the improvement of body weight affected body measurements in a positive direction.

Age at sexual maturity (ASM)

Data found in Table (6) showed that highly significant differences ($p \leq 0.001$) were found among generations whereas the pullets of the third generation were matured later than those of the other generations. Moreover, it could be cleared that the selection for increase body weight at 12 weeks of age tend to selected line pullets matured later than those of the control line. Similar estimates for age at sexual maturity were reported by Zatter (1994), Ghanem (1995), Abd El-Halim, (1999) and El-Tahawy (2000).

The realized response for ASM from generation to another in the selected line was 0.7, 0.5 and 1.7 days for the 1st, 2nd and 3rd generation Table (4). The cumulative response to selection for high body weight in El-Salam strain of chicken for ASM after three generations were 2.9 days. These result in agreement with that finding by Ghanem (1995), Abd El-Halim (1999), El-Tahawy (2000), and Kosba *et al.*, (2002a; 2006), who proved that heavy body weight late maturity in chickens. Logically, selection for improving body weight causes a slow in reproductive system in chickens and might increase ASM.

Duration period of the first 10 eggs (PF 10)

The pullets in the second generation had the longest period (27.1 days) to produce the first ten eggs compared with base, first, and third generations (Table 6). Also, in the third generation hens in the control line laid the first ten eggs in shorter period (21.3 days) than in the selected line (26.1 days). Furthermore, the cumulative response for the duration period as a result of selection for high body weight at 12 weeks of age increased by generations. The realized correlated response were -0.2, 1.2, 0.9 and 1.9 days in the 1st, 2nd, 3rd and cumulative response, respectively (Table 4). These results are in agreement with reported by Zatter (1994), who found that the duration period of the first 10 eggs ranged from 16.9 to 22.7 days for the local strains of chickens.

Egg number

The mean of egg number were 41.9, 42.5, 41.8 and 41.4 egg in the base, first, second and third generations, respectively. Moreover, selection for high body weight at 12 weeks of age in El-Salam strain affected negatively egg number till 40 weeks of age. It was noticed that means of egg number produced by selected line were lower values than control line (Table 6). These results are in agreement with Ghanem (1995), Abd-Alla (1997), Kosba *et al.,* (2002a), Saleh *et al.,* (2006) and Abd Ella (2007), but Abd El-Halim (1999) who found that the first generation had higher egg number than the base generation.

The realized correlated response for egg number till 40 weeks of age were -2.4, -1.1, -2.1 and –5.6 eggs for the first, second, third generations and cumulative response, respectively, Table (4). Scientifically, selection for high body weight decreased egg number in this study.

Egg weight

Average of egg weight of selected line were 40.8, 41.7, 42.2 and 42.9 g. in the base, first, second and third generations. The corresponding values of the control line were 39.4, 40.4, 40.4 and 41.2 g in the base, first, second and third generations (Table 6). This means that selection for high body weight at 12 weeks of age increased egg weight till 40 wk of age. Shebl, (1980) reported that the line selected for high 8-week body weight had heaviest egg weight in both experimental generations in Alexandria chickens, also, Saleh *et al.,* (2002) reported that the mean of egg weight was 45.6 g for Baheij strain and an improvement of 0.8 g for egg weight was observed as a result of two generations of selection to increase body weight at 8-wks of age.

The realized response for this trait had positive values (3.0 g) after three generations of selection for high body weight at 12 weeks of age in El-Salam strain Table (4). Consequently, selection for high body weight at 12 weeks of age in El-Salam strain had a highly positive correlation with egg weight till 40 weeks of age. This result were similar with those finding by Ghanem (1995) and Saleh *et al.*, (2006).

Egg mass

Highly significantly differences ($p \leq 0.001$) among generations were observed for egg mass of selected line (1828.1, 2004.5, 2191.0 and 1891.1 g) was heavier than those of the control line (1735.7, 2102.2, 1748.5 and 1701.3 g). In contrast Abd El-Halim (1999) and Kosba *et al.*, (2002a) found that the first generation had higher egg mass than the base generation (2978.5 *vs* 2169.8).

The cumulative realized response for these traits had a negative value (97.4 g) till 40 weeks of age after the three generations of selection for high body weight at 12 weeks of age in El-Salam strain, Table (4).

Generally, the calculation of egg mass trait at 40 weeks of age in this study was parallel with change of egg number and egg weight, which was estimated by multiply egg number by egg weight.

Feed conversion for egg production

Highly significantly differences ($p \leq 0.001$) among generations were observed for feed conversion for egg production till 40 weeks of age were 6.20, 4.70, 5.20 and 5.60 kg feed/kg eggs in the base, first, second and third generations, respectively (Table 6). The same results were obtained after two generations of selection in Alexandria strain of chicken (6.8 g/g) by Ghanem (1995). Similar results were agreement with the findings of Saleh *et al.*, (2006) found that feed conversion ranged from 6.54 to 4.16 of Silver Montazah.

Moreover, no differences were found between selected and control line of feed conversion for egg production till 40 weeks of age. Reality, selection for body weight had a negative effect on feed conversion for egg production till 40 weeks of age, which showed that chickens consumed more food to produce that unit of egg. Mathematically, the realized response for this trait had a positive value 1.2, -1.0, 1.0 and 1.2 for the first, second, third generations and cumulative response, respectively as shown in Table (4).

Hertability

Estimates of heritability from sire plus dam components of variance for body weight were 0.20, 0.17, 0.16 and 0.05 (first generation), 0.23, 0.19, 0.08 and 0.15 (second generation) and 0.36, 0.31, 0.14 and 0.18 (third generation), respectively, for body weight at 8, 12, 16 and 40 weeks of age, respectively, (Table 7). Heritability for body weights at different ages were low and moderate values compared to observed for the other studies. However, these results of heritability are agreement with those reported by Ghanem (2003), who reported that heritability values of body weight in local strains of chicken ranged from 0.13 to 0.66. However, higher values were observed in the second generation than those reported by same authors.

Heritability estimates of body weight from sire plus dam component of variance in local strains of chicken were reported by Ghanem (1995), Abd El-Halim (1999) and El-Tahawy (2000).

Heritability estimated of body weight at sexual maturity from sire plus dam components of variance for the selected line Table (7), were 0.16, 0.15 and 0.11 in the first, second and third generations, respectively. These results are harmony with those reported by Abd Alla (1997), Kosba *et al.*, (1997), Abd El-Halim (1999) and Ghanem (2003). In contrast, Abdellatif (1989) and Shebl (1991) found that heritability estimates ranged from 0.78 to 0.89.

Heritability estimated of age at sexual maturity were 0.13, 0.18 and 0.25 based on sire plus dam component of variance for three generations (Table 7). Heritability estimated of age at sexual maturity in this study was in agreement with Ghanem (1995) who selected for age at sexual maturity over two generations. However, these results were lower than reported by Abd Alla (1997), Kosba *et al.*, (2006) and Saleh *et al.*, (2006). Similar results were reported by Kosba *et al.*, (2002a), Ghanem (2003) and Abd Ella (2007).

Heritability estimated of duration period of the first ten eggs were in the first, second and third generations were 0.02, 0.09 and 0.36 respectively (Table 7). These results are in agreement with those finding by Ghanem (2003) who found heritability of the duration period of the first ten eggs ranged from 0.04 to 0.35. While, it lower than observed by Enayat (2006).

Heritability estimated of egg number were 0.15, 0.22 and 0.06 in the first, second and third generations, respectively (Table 7). These results are in agreement with those estimated by Hagger (1994 a, b) and El-Wardany (1999b). While, heritability of egg weight were 0.19, 0.18 and 0.27 in the first, second and third generations based on sire plus dam components of variance, respectively (Table 7). These values are similar to those reported by Sabri and Abd El-Warith (2000), Abdellatif (2001), Kosba *et al.,* (2002a) and Ghanem (2003).

Heritability estimated of egg mass were 0.11, 0.16 and 0.25 based on sire plus dame components of variance in the first, second and third generations, respectively (Table 7). This results are similar with those reported by Shebl (1998) and El-Wardany (1999b).

Estimates of h^2_{S+D} of feed conversion for egg production till 40 weeks of age are presented in Table (7). It could be seen that, heritability estimated of feed conversion for egg production from three generations were 0.03, 0.10 and 0.32. The same results were reported by Younis and Abd El-Ghany (2004), Enayat (2006) and Abd Ella (2007).

Correlations

Data in Table (7) shows that Positive value for genetic and phenotypic correlations based on full sibs were found with body weight and body weight at 8, 16 and 40 weeks of age. Highly positive value of genetic and phenotypic correlations between body weight and body weight at sexual maturity. This mean that selection for high body weight may increase body weight at sexual maturity. Moreover, positive genetic and phenotypic correlations were reported by El-Tahawy (2000) and Abd Ella (2007).

Low and negative value of genetic correlation were found between body weight and age at sexual maturity (-0.01). However, lower and positive values of phenotypic correlations (0.004) were observed (Table 7). Moreover, higher positive value of phenotypic correlations was reported by El-Tahawy (2000) while, Abdellatif (2001) showed that correlations between body weight and age at sexual maturity ranged from 0.06 to 0.13 (phenotypic correlation) and from 0.002 to 0.18 (Genetic correlation).

The genetic and phenotypic correlations between body weight and duration period of the first ten eggs had low and moderate values in present study, whereas genetic and phenotypic correlations were -0.31 and -0.02, respectively. These results mean that selection to increase body weight at 12 weeks of age in El-Salam strain could increase duration period of the first ten eggs.

Negative genetic and phenotypic correlations between body weight and egg number were observed it were -0.05 to -0.02, respectively. Similar results were reported by Abdou and Enab, (1994) and El-Wardany, (1999b). However, some authors reported that the genetic and phenotypic correlations between body weight and egg number at different ages were positive

(Hagger, 1994 a,b; Younis and Abdel Ghany, 2004 and Abd El-Ghany, 2005).

Body weights were positively correlated and were highly value genetic correlation (0.59), while low value of phenotypic correlations (0.03) with egg weight till 40 weeks of age, respectively. Similar values were reported by Sabri and Abd El-Warith (2000).

Positive genetic (0.12) and phenotypic (0.03) correlations between body and egg mass till 40 weeks of age and egg mass till 40 weeks of age. These results mean that selection for high body weight at 12 weeks of age will increase egg mass. Positive genetic and phenotypic correlations between body weight and egg mass in different breeds were reported by Sabri and Abd El-Warith (2000).

Genetic and phenotypic correlations between body weight and feed conversion till 40 weeks of age were low and negative value. The genetic correlation was -0.09 and the phenotypic correlation was 0.005. These results in agreement with reported by Sabri and Abd El-Warith (2000), who found that phenotypic correlation between body weight and feed conversion were 0.15 in Fayoumi strain of chickens.

In general, positive genetic and phenotypic correlations were found between body weight at 12 weeks of age with body weight at different ages and at maturity, egg weight and egg mass, while was negative value with age at sexual maturity, duration period to produce the first ten eggs, egg number and feed conversion for egg production.

CONCLUSIONS

It could be concluded from the results of the present study, selection for body weight at 12 weeks of age in El-Salam strain of chickens increases body weight at all ages, improved egg weight, egg mass till 40 weeks of age, age at sexual maturity, duration period of the first 10 eggs and increase feed conversion for egg production as well as reduced the egg number trait.

Table (1): The number of tested selected and control birds of generations in El-Salam chickens.

Generation	Sex	No. of tested birds	Selected	Control
Base	Male	307	19	5
	Female	354	119	28
	Total	*661*	*138*	*33*
First	Male	342	14	6
	Female	400	88	29
	Total	*742*	*102*	*35*
Second	Male	388	19	6
	Female	467	117	29
	Total	*855*	*136*	*35*

Table (2): Least squares means ± standard errors of body weight at 12 weeks of age for the selected and control lines as well as selection differentials (S), selection intensities (I), selection densities (V), realized responses (R) and expected responses (ER) during the three generations of selection.

Gen.	Selected X±S.E	Control X±S.E	S (g)	I	V %	R (g)	ER** (g)
Males							
G0	832.1±38.5	836.0±75.0	57.4	0.64	6.2		
G1	909.0±45.9	831.7±69.9	44.6	0.95	4.1	81.2	17.8
G2	947.9±39.4	865.0±69.9	18.6	0.85	4.9	5.6	13.8
G3	965.4±27.5	864.0±54.3				18.5	5.8
CR*						105.3	37.4
Females							
G0	791.7±15.4	826.4±31.7	56.7	0.39	33.7		
G1	870.5±18.3	822.8±31.9	14.5	0.25	22.0	82.4	17.6
G2	902.6±15.9	841.9±31.9	6.8	0.26	25.1	13.0	4.5
G3	888.7±11.9	847.8±31.4				19.8	2.1
CR*						75.6	24.2

G0=Base generation G1=First generation G2=Second generation G3=Third generation CR*=Cumulative selection response ER**=Expected response = Heritability x selection differential.

Table (3): Least squares means ± standard errors of body weights and growth rates at different ages of El-Salam strain during growing period as affected by generations, lines and sex.

Gen.	Line	Sex	Body weight at			Growth rate	
			8-week	16-week	40-week	8-12	12-16
G0		Male	544.5±38.2	1188.4±44.9	1794.7±62.7	37.8±5.51	35.5±4.39
		Female	485.3±15.8	1102.3±18.8	1604.6±25.8	42.3±2.30	32.6±1.84
		Av.	515.7±17.6	1145.3±24.4	1699.7±33.9	40.0±2.98	34.1±2.38
G1	S	Male	606.4±34.6	1190.7±47.8	2111.5±62.6	41.2±5.86	28.2±4.67
		Female	526.3±13.8	1167.7±19.1	1638.5±25.4	50.3±2.34	29.9±1.86
		Av.	566.4±18.6	1179.2±25.7	1875.0±33.7	45.8±3.15	29.1±2.52
	C	Male	594.8±52.8	1141.7±72.9	1850.0±92.2	33.2±8.94	31.1±7.14
		Female	490.0±24.0	1102.9±33.2	1648.6±42.7	51.6±4.07	29.5±3.25
		Av.	542.4±29.0	1122.3±40.1	1749.3±50.8	42.4±4.91	30.3±3.92
G2	S	Male	623.2±29.7	1265.8±41.0	2055.6±56.7	41.3±5.03	28.9±4.01
		Female	577.0±12.0	1140.6±16.5	1771.5±21.0	45.1±2.03	23.7±1.62
		Av.	600.1±16.0	1203.2±22.1	1913.5±30.2	43.2±2.71	26.3±2.16
	C	Male	678.3±52.8	1183.3±72.9	1935.0±92.6	35.3±8.94	29.5±7.14
		Female	508.9±24.0	1108.3±33.2	1694.6±42.9	42.9±4.07	27.9±3.25
		Av.	593.6±29.0	1145.8±40.1	1814.8±51.0	37.7±4.91	28.7±3.92
G3	S	Male	665.3±20.4	1379.7±28.6	2187.9±42.1	46.2±3.51	34.9±2.80
		Female	597.1±8.92	1146.0±12.3	1863.6±15.8	43.7±1.51	25.9±1.21
		Av.	631.2±11.2	1262.9±15.6	2025.8±22.5	44.9±1.91	30.4±1.52
	C	Male	552.0±40.9	1205.0±56.5	1890.0±71.7	33.6±6.93	31.7±5.53
		Female	528.5±23.6	1112.3±32.6	1731.0±42.1	46.3±4.00	27.4±3.19
		Av.	540.3±23.6	1158.7±32.6	1810.5±41.6	39.9±4.00	29.6±3.19
Significances							
Gene (G)			**	*	***	*	**
Line (L)			*	**	***	*	NS
Sex (S)			***	***	***	**	*
G x L			NS	*	NS	*	*
G x S			*	NS	*	*	NS
L x S			NS	*	**	NS	NS
G x Lx S			NS	NS	*	NS	NS

G0=Base generation G1=First generation G2=Second generation G3=Third generation S=Selected line C=Control line *=Significant at 5% level of probability **=Significant at 1% level of probability ***=Significant at 0.1% level of probability NS=No significant

Table (4): Realized correlated response for other traits in the selected line by generation.

Traits	Generations			Total
	First	Second	Third	
Body weight at 8-wks	24.0	-17.5	84.4	90.9
Body weight at 16-wks	56.9	0.5	46.8	104.2
Body weight at 40-wks	125.7	-27.0	116.6	215.3
Growth rate 8-12 wk	3.4	2.1	-0.5	5.0
Growth rate12-16 wk	-1.2	-1.2	3.2	0.8
Body weight at sexual maturity	-36.5	41.4	11.8	16.7
Age at sexual maturity	0.7	0.5	1.7	2.9
Duration of the first 10 eggs	-0.2	1.2	0.9	1.9
Egg number for 40 wks of age	-2.4	-1.1	-2.1	-5.6
Egg weight for 40 wks of age	-0.1	0.5	-0.1	0.3
Egg mass for 40 wks of age	-190.1	540.2	-252.7	97.4
Feed conversion for egg production	1.2	-1.0	1.0	1.2

Table (5): Least squares means ± standard errors of body measurements at different ages of El-Salam strain during growing period as affected by generation, line and sex.

Gen.	Line	Sex	8 wks of age			16 wks of age		
			SL	**KL**	**BC**	**SL**	**KL**	**BC**
G0		1	5.3±0.08	6.9±0.07	17.8±0.17	7.8±0.17	9.3±0.21	27.3±0.40
		2	4.8±0.14	6.7±0.14	17.6±0.15	7.6±0.09	8.0±0.10	25.3±0.21
		Av.	5.1±0.08	6.8±0.08	18.5±0.18	8.2±0.10	9.1±0.11	26.4±0.23
G1	S	1	5.4±0.09	7.1±0.08	18.6±0.19	8.8±0.11	9.9±0.11	26.9±0.24
		2	4.7±0.09	6.8±0.08	17.8±0.20	7.6±0.11	8.8±0.11	24.4±0.25
		Av.	5.1±0.06	6.9±0.21	17.9±0.50	8.2±0.08	9.4±0.08	26.2±0.21
	C	1	5.7±0.18	6.7±0.17	18.0±0.91	7.4±0.22	9.4±0.23	25.8±0.50
		2	4.8±0.41	6.0±0.39	16.8±0.40	7.2±0.50	9.0±0.13	24.0±0.41
		Av.	4.9±0.08	6.4±0.21	17.4±0.50	7.3±0.28	9.1±0.10	25.6±0.17
G2	S	1	6.2±0.16	7.2±0.15	19.0±0.19	9.1±0.20	10.3±0.20	27.8±0.45
		2	5.0±0.08	6.9±0.07	17.9±0.37	8.0±0.09	9.0±0.36	25.8±0.45
		Av.	6.1±0.09	7.0±0.06	18.7±0.14	9.0±0.11	10.2±0.11	28.1±0.25
	C	1	5.8±0.29	6.0±0.28	18.5±0.64	7.5±0.36	9.3±0.21	26.3±0.23
		2	4.8±0.12	5.7±0.14	17.4±0.34	7.2±0.19	8.9±0.27	24.9±0.24
		Av.	5.6±0.11	5.9±0.07	17.4±0.50	7.6±0.14	9.6±0.14	25.8±0.46
G3	S	1	6.3±0.16	4.7±0.15	19.4±0.36	9.3±0.20	10.5±0.20	29.2±0.76
		2	5.6±0.21	7.5±0.20	18.1±0.47	8.2±0.28	9.2±0.27	26.4±0.16
		Av.	6.3±0.11	7.3±0.11	19.2±0.20	8.5±0.19	11.2±0.32	29.0±0.31
	C	1	6.1±0.27	6.9±0.26	18.6±0.61	7.5±0.36	9.0±0.07	27.8±0.44
		2	5.2±0.15	6.1±0.14	17.6±0.33	7.3±0.19	8.8±0.11	25.8±0.42
		Av.	5.6±0.16	6.5±0.11	17.9±0.36	7.3±0.20	9.5±0.10	27.6±0.43
Significance								
Generation (G)			***	***	[illegible]	***	***	***
Line (L)			***	***	**	*	***	NS
Sex (S)			*	NS	**	***	***	*
G x L			***	***	***	***	***	*
G x S			*	NS	*	***	***	***
L x S			***	***	**	NS	***	NS
G x L x S			*	**	***	***	***	**

G0=Base generation G1=First generation G2=Second generation G3=Third generation *=Significant at 5% level of probability **=Significant at 1% level of probability
***=Significant at 0.1% level of probability S=Selected line C=Control line Sex (1=males and 2=females)
NS=No Significant SL=Shank length. KL=Keel length BC=Breast circumference

Table (6): Least squares means ± standard errors of body weight at sexual maturity (WSM), age at sexual maturity (ASM) and duration of the first 10 eggs (PF10), egg number (EN), egg weight (EW), egg mass and feed conversion for 40 week of age in El-Salam selected and control lines over 4 generations.

Gen.	Line	No.	WSM	ASM	PF 10	EN 40	EW 40	Egg mass	Feed cov.
G0	Selected	119	1444.5±16.5	183.8±1.37	24.7±1.47	42.4±1.50	40.8±0.74	1828.1±66.0	5.70±0.25
	Control	28	1375.7±34.0	182.8±2.82	21.8±3.12	39.6±3.29	39.4±1.60	1735.7±146.2	6.70±0.56
G1	Selected	88	1433.0±19.2	185.0±1.59	25.3±1.53	42.6±1.55	41.7±0.86	2004.5±68.9	4.80±0.26
	Control	29	1400.7±33.4	183.3±2.77	22.6±2.66	42.2±2.75	40.4±1.49	2102.2±121.9	4.60±0.45
G2	Selected	117	1457.5±16.6	186.2±1.38	27.1±1.32	41.7±1.24	42.2±0.74	2191.0±55.0	4.80±0.20
	Control	29	1383.8±33.4	184.0±2.77	23.2±2.66	42.4±3.20	40.4±1.49	1748.5±141.8	5.60±0.53
G3	Selected	92	1469.8±18.0	187.2±1.49	26.1±1.43	40.7±1.36	42.9±0.80	1891.1±60.3	5.70±0.22
	Control	30	1384.3±32.8	183.3±2.72	21.3±2.61	43.5±3.02	41.2±1.46	1701.3±134.1	5.50±0.50
Significances									
Generation (G)			***	***	*	*	*	***	***
Line (L)			*	***	*	**	*	*	NS
G x L			*	*	*	*	*	*	*

G0=Base generation G1=First generation G2=Second generation G3=Third generation *=Significant at 5% level of probability **=Significant at 1% level of probability ***=Significant at 0.1% level of probability NS=No Significant

Table (7): Estimates of heritability from sir plus dam (h2S+D) for body weight at different ages and egg production traits, and genetic ± standard error (rG±SE) and phenotypic correlations (rP) between body weight at 12 week of age and the other traits for three generations in El-Salam selected population.

Traits	Heritability			Correlations	
	First generation	Second generation	Third generation	rG	rP
BW 8	0.20±0.22	0.23±0.14	0.36±0.10	0.32±0.44	0.23
BW 12	0.17±0.08	0.19±0.10	0.31±0.09	-	-
BW 16	0.16±0.13	0.08±0.09	0.14±0.07	0.43±0.53	0.20
BW 40	0.05±0.18	0.15±0.02	0.18±0.09	0.24±0.50	0.06
WSM	0.16±0.013	0.15±0.20	0.11±0.07	0.78±0.66	0.12
ASM	0.13±0.14	0.18±0.12	0.25±0.14	-0.01±0.29	0.004
PF10	0.02±0.13	0.09±0.22	0.36±0.08	-0.31±0.41	-0.02
EN	0.15±0.12	0.22±0.08	0.06±0.10	-0.05±0.81	-0.02
EW	0.19±0.05	0.18±0.15	0.27±0.12	0.59±0.73	0.03
EM	0.11±0.11	0.16±0.07	0.25±0.22	0.12±0.85	0.03
FC	0.03±0.21	0.10±0.29	0.32±0.08	-0.09±0.53	-0.005

BW8=Body weight at 8 wks of age BW12=Body weight at 12 wks of age BW16=Body weight at 16 wks of age WSM=Body weight at sexual maturity BW40=Body weight at 40 wks of age ASM=Age at sexual maturity PF10=Duration of the first 10 eggs
EN=Egg number EW=Egg weight EM=Egg mass FC=Feed conversion for egg production
rG = Genetic correlations rP = Phenotypic correlations

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Selection, correlated response, body weight, egg, heritability, El-Salam.

الملخص العربي

الاستجابة المباشرة والمرتبطة بالانتخاب لتحسين وزن الجسم فى دجاج السلام

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اجريت هذه الدراسة بمحطة بحوث الانتاج الحيوانى بسخا-وزارة الزراعه خلال اربعه اجيال متعاقبه (٢٠٠٢/٢٠٠٦) لدراسة الاستجابه المباشره للانتخاب لزيادة وزن الجسم عند ١٢ اسبوع في سلالة السلام والاستجابة المرتبطه لصفات وزن الجسم ، معدل النمو ، مقاييس الجسم ، عمر النضج الجنسى ، المده اللازمة لانتاج الـ١٠ بيضات الاولى ، عدد ووزن البيض ، كتلة البيض ، الكفاءة التحويلية لانتاج البيض حتى ٤٠ اسبوع من العمر وتم أيضا تقدير المكافئ الوراثي للصفات المختلفة والارتباط الوراثي والمظهري للصفات المدروسه .

نمت الدراسة عن طريق تكوين سلالتين سلالة منتخبة لزيادة وزن الجسم عند عمر ١٢ اسبوع لمدة ثلاثة اجيال وفيها يتم انتخاب اقل عشرون اب واقل مائتان ام ليكونوا اباء الجيل الأول وسلالة الكنترول عشوائية لم يتم فيها اى انتخاب.

اظهرت النتائج ان متوسط وزن الجسم عند ١٢ أسبوع من العمر بعد ثلاثة أجيال من الانتخاب لهذه الصفة للخط المنتخب والكنترول ٩٦٥.٤ و ٨٦٤.٠ جرام للذكور، ٨٨٨.٧ و٨٤٧.٤ جرام للاناث. وكان الفارق الانتخابي ٥٧.٤ ، ٤٤.٦، ١٨.٦ جرام بالنسبة للذكور بينما كانت القيم المناظره في الاناث ٥٦.٧ ، ١٤.٥، ٦.٨ جرام فى الجيل الأول والثانى و الثالث على التوالى ، بينما كانت الاستجابه المحققة و المتوقعه ١٠٥.٣، ٣٧.٤ جرام للذكور و ٧٥.٦، ٢٤.٢ جرام للاناث.

حقق الانتخاب لزيادة وزن الجسم عند ١٢ اسبوع زياده عالية المعنوية فى وزن الجسم عند أعمار ٨، ١٢، ١٦، ٤٠ وعند النضج الجنسي كما ادى الى التأخير في عمر النضج الجنسى بـ ٢.٩ يوم . ايضا ادى الانتخاب الى زيادة وزن البيض وكتلة البيض و الكفاءة التحويليه لانتاج البيض حتى ٤٠ اسبوع من العمر و الفتره اللازمه لانتاج العشرة بيضات الاولى، بـ ٠.٣ جم و ٩٧.٤ جم و١.٢ كجم/ كجم و ١.٩ يوم . بينما نقص عدد البيض بـ - ٥.٦ بيضة بعد ثلاثة أجيال من الانتخاب.

المكافئ الوراثي لصفة وزن الجسم عند ١٢ اسبوع من العمر فى الجيل الأول والثانى والثالث كان ٠.١٧ و ٠.١٩ و ٠.٣١ على اساس مكونات كل من الاب والام معا على التوالى. اما الارتباط الوراثي من مكونات الاخوة الأشقه بين الصفة المنتخبه مع وزن الجسم عند مختلف الاعمارو كذلك وزن البيض كان موجبا. بينما كان الارتباط الوراثي سالبا مع صفات انتاج البيض (العمر عند النضج الجنسي و عدد البيض وكتلة البيض و الكفاءة التحويليه لانتاج البيض).

من الواضح و من خلال هذه النتائج هو حدوث تحسين فى صفة وزن الجسم لسلالة السلام عند ١٢ اسبوع من العمر عند استخدام الانتخاب الفردى وبطريق غير مباشر أدى الى زيادة وزن البيض وكتلة البيض والكفاءة التحويلية لانتاج البيض حتى ٤٠ اسبوع من العمر وايضا الفترة اللازمة لانتاج العشرة بيضات الأولى مما يوصي بالاستمرار في برنامج الانتخاب لتحسين الصفات الإنتاجية في السلالات المحلية مستقبلا.