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DIRECT RESPONSE DUE TO SELECTION FOR BODY WEIGHT AT EIGHT WEEKS OF AGE IN DANDARAWI CHICKEN: BODY WEIGHT AND CONFORMATION.

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ABSTRACT: This study was carried out at the Poultry Farm of Poultry Production Department, Faculty of Agriculture, Assiut University, through two successive generations to study the effect of selection for high body weight at eight weeks of age on body weight and body conformation measurements (shank length and keel length) in Dandarawi chicken. The study involved 2932 pedigreed chicks obtained by mating 96 sires with 935 dams through two successive generations. The chicks in each generation divided into two lines, line (S) selected for high body weight and line (C) is the control line. Chickens were weighed from 0 to 20 weeks of age, shank length from 4 to 20 weeks of age and keel length from 8 to 20 weeks of age was measured for the two lines over generations.

The results showed that body weightsat zero,4, 8 and 20 weeks of agewere significantly different ($P \leq 0.01$) between the two generationsthat improved by the individual selection. Also, there were highly significant differences between linesin body weight from zero to 20 weeks of age ($P \leq 0.01$) and the selected line had higher body weight than the control line over generations.There were highly significant differences between sexesin body weight from 4 to 20 weeks of age ($P \leq 0.01$) which male body weights from 4 to 20 weeks of age were higher than that of females in the two lines over generations. Sexual dimorphism was gradually increased from 4 to 20 weeks of age.There were highly significant differences ($P \leq 0.01$) between generations, lines and sex in shank lengthand keel length at all agesin the present study. It found some significant interactions between the main effects considering the different studied traits which mean that the effect did not due to the main effects, but it may refer to other factors than the main effects. Also, there were insignificant interactions between the main effects which mean that the variations between the studied traits were due to the main effects.

It concluded that by using selection at 8 weeks of ageled to improve body weight and body conformation in Dandarawi chicken.

Keywords: Selection- body weight- body conformation-Dandarawi chicken.

INTRODUCTION

More problems, especially concerning nutrition, quality of meat and eggs, management, price and resistance to disease are encountered in Egypt when attempts were made to employ foreign strains in the field. At the Department of Poultry Production, Faculty of Agriculture, Assiut University, efforts had been directed towards improving the productivity of an old Egyptian strain named Dandarawi which originated in Upper.The Egyptian native breeds demonstrate better general disease resistance than imported breeds because they have evolved through natural selection for a long period in the prevailing environment and can survive under harsh nutritional and environmental conditions.

Body weight is usually consideringa fair indicator for subsequent growth rate (Chambers, 1990). As reported before in different selection programs, there were significant differences between lines selected for high and low body weight at 8 weeks of age (Maloney et al. 1967; Marks, 1983; Liu et al. 1995; Abdellatif, 1999; EL-Dlebshany, 2004; Abd El-Karim and Ashour, 2014; Ashour et al. 2015and Abou El-Ghar and Abd El-Karim, 2016). As for the effect of sex on body weight(Maloney et al. 1967; Jaap, 1971; Soltan and EL-Nadi, 1986 and Abdellatif, 1989) reported that the males body weight at 8 weeks of age was superior that of females with significant differences.The individual selection is effective for certain traits that exhibited high heritability estimates such as body weight (Rishell, 1997).Many of body conformation measurements such as shank and keel lengths may be used as good indicators for skeletal size, where Chambers(1990) stated that there were genetic relationship between growth and skeletal dimensions.Normally the sexual dimorphism occurs in the majority of the domesticated avian species, especially in the chickens where the males were found to be heavier than females by about 10-20% as Merritt (1966) and Buvanendran (1969). Abdellatif and EL-Hammady (1992) indicated the genetics of sexual dimorphism in Dandarawi chickens, where males body weight were heavier than females within the same age and at different ages.The direct response or the genetic gain in a selected trait could be determined by the difference between the mean of selected group and population means(Falconer, 1981). The direct response due to selection for high body weight over generations was reported by Abdellatif (1999) and Abou El-Ghar and Abd El-Karim (2016). The main objectives of the present study were to determine the direct effect due to selection for high body weight at eight weeks of age on body weight and body conformation measurementsover two generations at different ages in Dandarawi chicken.

MATERIALS AND METHODS

The present study was carried out at the Poultry Research Farm, Poultry Production Department, Faculty of Agriculture, Assiut University, through two successive generations. This study was conducted during the period from 2016 up to 2018.

Experimental Birds:

The study included a total of 2932 pedigreed chicks of Dandarawi chickens obtained from the mating between 96 sires with 935 dams through two successive generations.The number of sires and dams and day old offspring chicks for each generation and lines are presented in Table (1). The chicks in each generation were divided into two lines, line (S) selected for high body weight at 8 weeks of age and line (C) is the control linethat kept estimating the direct response due to selection for high body weight over generations as Abdellatif (1999) mentioned**.** In the first and second generation, chicks were selected according to body weight as equal as or more than the mean ofthe selected line at 8 weeks of age.

Flock Management:

All birds in the experiment over generations were kept and reared under similar environmental conditions. During the experimental period feeding with a commercial ration and water were supplied *ad- libitum.* At hatching time, all chicks were weighed and wing banded according to their pedigree.

Studies Traits:

1-Body weight (BW): was recorded individually to the nearest gram at hatch time (day old), 4, 8, 12, 16 and 20 weeks of age.

2- Sexual dimorphism (%): at 4, 8, 12, 16 and 20 weeks of age by the differences in body weight between males and females. Sexual dimorphisms (%) over generations werecalculated from the following equationas Abdellatif and EL-Hammady (1992):Sexual dimorphism (%) =

$$\frac{\text{Differences in body weight between males and females}}{\text{body weight of females}} \times X100$$

3- Genetic gain of body weight due to selection for body weight: at 0, 4, 8, 12, 16 and 20 weeks of age genetic gains in body weight to the nearest gram were calculated by the difference between selected line (S) mean and control line (C) mean at first, second generation as follow:($\Delta G = S - C$)

4- Shank length (SL):at 4 up to 20 weeks of age, length of shank (distance between hock and tarsal joint) to the nearest centimeter was recorded.

5- Genetic gain inshank length due to selection for body weight:at 4, 8, 12, 16 and 20 weeks of age genetic gains of shank length to the nearest centimeter (cm) were determined as body weight gain.

6- Keel length (KL):at 4 up to 20 weeks of age, length of keel (from the anterior to the posterior of edge of Keel bone) to the nearest centimeter (cm) was recorded.

7- Genetic gain in keel length due to selection for body weight:at 8, 12, 16 and 20 weeks of age genetic gains inkeel length to the nearest centimeter (cm) were determined as body weight gain.

Statistical Analysis:the statistical analyses of the data were carried out by using the international software program SAS 9.2 (SAS institute, 2009).Statistical analysis for Data of body weight, shank length and keel length were analyzed by using the followingGeneral Linear Model (GLM) of SAS software:

$$Y_{ijkm} = \mu + G_I + L_J + S_K + (GL)_{IJ} + (GS)_{IK} + (LS)_{JK} + (GLS)_{IJK} + e_{IJKm}$$

Where, Y_{ijkm}= observation of each bird,μ = population mean,G_I = effect of generation (i= 1, 2),L_J = effect of line (j = 1, 2),S_K = effect of sex (k = 1, 2),$(GL)_{IJ}$ = the interaction (generation ×line),$(GS)_{IK}$ =the interaction (generation ×sex),$(LS)_{JK}$ =the interaction (line ×sex),$(GLS)_{IJK}$ = the interaction (generation ×line ×sex) and e_{IJKm}= the experimental error.

Differences between any two means were calculated by using Duncan's new Multiple Range Test (Duncan, 1955) at 5%.

RESULTS AND DISCUSSION

1- Body weight (BW): Least square means of body weight of males and females in both selected and control lines in different generations at zero, 4, 8, 12, 16 and 20 weeks of age are presented in Table 2. The results showed that body weight had highly significant differences($P \leq 0.01$)between generations at zero,4,8 and 20 weeks of age.This result in harmony with Abdellatif (1999); EL-Dlebshany (2004) and Khalifa **(**2007), but it was insignificant at 12 and 16 weeks of age due to some environmental factors. The results showed that there were highly significant differences ($P \leq 0.01$) between lines and sexes considering body weight at all ages of study except at hatch time. Differences between sexes were insignificant and the selected line had higher body weight than the control line over generations (Table 3). These results are in full agreement with that reported by Jaap and Smith (1959); Maloney et al. (1967); Marks (1983); EL-Gendy (1984); Liu et al. (1995); Abdellatif (1999); El-Wardany (1999); EL-Dlebshany (2004); Khalifa (2007); Saleh et al. (2008); Abd El-Karim and Ashour (2014); Ashour et al. (2015) and Abou El-Ghar and Abd El-Karim (2016).The selected line was superior in body weight compared with control line at zero, 4, 8, 12, 16 and 20 weeks of age and increased gradually in linear manner (Figure 1). Similar results were reported by Abd El-Ghany (2005); Kosba et al. (2006); Saleh et al. (2008); Abd El-karim and Ashour (2014) and Ramadan et al. (2014). It was noticed that males and females in the selected line were heavier than corresponding birds in the control one in all generations (Table 2). Similar result was also found by EL-Gendy (1984); Abdellatif (1999) and Ashour et al. (2015).Regardless of sex, generation x line interaction was highly significant ($P \leq 0.01$) at zero, 8, 12, 16 and 20 weeks of age where it noticed that the selected line had the highest weight over generation and in the same time the control linein the second generationhad the same weight of the selected line in the first generation at zero weeks of age, while at 8, 12, 16 and 20 weeks of age it found that over generationsthe selected line had the highest weight, but in the first generation the control line had the highest weight than in the second one, but at 4 weeks of age,it was insignificant(Table 3). The interaction generation x sex was significant($P \leq 0.01$) considering body weight at zero and 4 weeks of age. It noticed that the body weight of males was higher than females over generations, but at zero weeks of age females had the same weight over generations, while at 4 weeks of age females in the second generation was higher than that at first generation, but at 8, 12, 16 and 20 weeks of age it was insignificant(Table 3). Results presented in (Table 3) indicated that line x sex interaction was significant ($P \leq 0.01$ and $P \leq 0.05$) considering body weight at 4, 12 and 16 weeks of age. It noticed that body weight of males in the selected line had highest weight than that in the control line and females body in the selected line was higher than that in the control line, butat zero, 8 and 20 weeks of age it was insignificant. There were highly significant ($P \leq 0.01$) interaction (generation x line x sex) taking into considerationbody weight at 8, 16 and 20 weeks, but at zero, 4 and 12 weeks of age it was insignificant. From the significant interactions between the main effects, it could be said that there were other factors affecting on the different variables than the main effects, buttheinsignificant interactions showed that the main effects affected directly on the studies traits.

2- Sexual dimorphism (%):

Means of body weight (g) for males, females, difference between males and females and their sexual dimorphism (%) for both control and selected line over generations at 4, 8, 12, 16 and 20 weeks of age are presented in (Table 4). Differences between the two sexes (sexualdimorphism) were gradually increased from 4 to 20 weeks of age and the sexual dimorphism in selected line ranged from 16.1% to 38.83%, while in control line it ranged from 12.59% to 36.82% from 4 to 16 weeks of age. This resultagreed with that reported by Merritt (1966); Buvanendran (1969)and Abdellatif and EL-Hammady (1992).

3- Genetic gain in body weight due to selection for body weight at 8-wks of age:

Results of genetic gain due to selection for body weight at 8 weeks of age are presented in (Table 5). It was noticed inconsistent increments in the genetic gain of body weight where it was 1. 19, 19.74, 17.66, 74.42, 79.43 and 125.87 g in first generation, while in second generation it was 2.05, 15.35, 70.52, 162.86, 170.28 and 170.13 g at zero, 4, 8, 12, 16 and 20 weeks of age, respectively. Fluctuations in genetic gains over generations may be due to the fact that the selected number of males and females in each generation were differed. This result agreed with that reported byAbdellatif (1999) and Abou El-Ghar and Abd El-Karim (2016).

4- Shank length (SL): Least square meansof shank length (cm) of males and females for both selected and control lines in the two generations at 4, 8, 12, 16 and 20 weeks of age are presented inTable(6). The results showed that there were highly significant differences between generations, lines and sexes ($P \leq 0.01$) at 4,8, 12, 16 and 20 weeks of age (Table 7).This result in harmony with Abdellatif (1999); Khalifa (2007); Abd El-Karim and Ashour (2014) and Abou El-Ghar and Abd El-Karim (2016). The selected line had longer shank length than the control line over generations (Table 6). Also, it was noticed that the selected line had superior shank length compared with control line at 4, 8, 12, 16 and 20 weeks of age and it increased gradually in linear manner (Figure 2). These results are in full agreement with Abdellatif (1999); El-Wardany (1999); Abd El-Ghany (2006); Khalifa (2007); Abd El-Karim and Ashour (2014) and Ramadan et al. (2014).

Regardless of sex, generation x line interaction was highly significant ($P \leq 0.01$) at 4, 12, 16 and 20 weeks of age. It noticed that the selected line and control line in the second generation showed longer shank than that corresponded in the first generation, but at 8weeks of age was insignificant (Table 7). There were significant interaction($P \leq 0.01$) generation x sex considering shank length at 12 and 20weeks of age. It noticed that shank length of males and females in the second generation was longer than the corresponding in the first generation, respectively, but at 4, 8 and 16 weeks of age it were insignificant (Table 7). Results presented in (Table 7) indicated that line x sex interaction was insignificant consideringshank length at 4 and 12 weeks of age, while at 8, 16 and 20 weeks of age it was highly significant.We noticed that the shank length of males and females in the selected line was longer than that corresponded in the control line, respectively. The interactions generation x line x sex were not significant when considering shank length at all ages of the study. This result agreed with Abdellatif (1999); Abd El-Karim and Ashour (2014). From the significant interactions between the main effects, it could be said that there were other factors affecting on the different variables than the main effects, where theinsignificant interactions showed that the main effects affected directly on the studies traits.

5- Genetic gain inshank length due to selection for body weight:

The genetic gain due to selection in shank length is presented in (Table 8). It was noticed inconsistent increments in shank length where it was 0.22, 0.32, 0.30, 0.31 and 0.21 (cm) in first generation, while in second generation it was 0.08, 0.31, 0.51, 0.52 and 0.54 (cm) at 4, 8, 12, 16 and 20 weeks of age, respectively. Fluctuations in genetic gains in shank length over generations due to the fact that the selected number of males and females in each generation were different. This result agreed with that reported by Abdellatif (1999) and Abou El-Ghar and Abd El-Karim(2016).

6- Keel length (KL):

Least square meansof keel length (cm) of males and females for both selected and control lines in the two generations at 8, 12, 16 and 20 weeks of age are presented in Table (9). The results showed that there were highly significant differences between generations, lines and sexes (P≤0.01) at 4,8, 12, 16 and 20 weeks of age for keel length (Table 10). Also, the selected line had longer keel length than the control line over generations and males keel length from 8 to 20 weeks of age were longer length than that of females in the two lines over generations (Table 9). The selected line had superior longer keel length than the control line at 8, 12, 16 and 20 weeks of age and increased gradually in linear manner (Figure 3).These results are in full agreement with El-Wardany (1999); Abd El-Ghany (2006); Abd El-Karim and Ashour (2014) ; Ramadan et al. (2014) and Abou El-Ghar and Abd El-Karim (2016). The interaction generation x line was highly significant (P≤0.01) at 16 and 20 weeks of age. It noticed that the selected line and control line in second generation showed longer keel than that corresponded in first generation, but at 8 and 12weeks of age it was insignificant (Table 10). There were significant interaction(P≤0.01) generation x sex considering keel length at 12, 16 and 20weeks of age. It noticed that keel length of males and females in the second generation was longer than the corresponding in first generation, respectively,but at 8 weeks of age it were insignificant (Table 10). Results presented in Table 10 indicated that line x sex interaction was insignificant at 8 and 12weeks of age, while at 16 and 20 weeks of age it was highly significant (P≤0.01). Accordingly, the keel length of males and females in the selected line was longer than that of corresponding one in the control line, respectively. There were nosignificant interaction(generation x line x sex)at all ages of study (Table 10). This result agreed with Abd El-Karim and Ashour (2014).

The significant interactions between the main effects which mean that there were other factors affecting on the different variables than the main effects, where theinsignificant interactions showed that the main effects affected directly on the studies traits.

7- Genetic gain in keel length due to selection for body weight:

The genetic gain due to selection in keel length is presented in (Table 11). It was noticed inconsistent increments in keel length where it was 0.27, 0.35, 0.40 and 0.31 (cm) in the first generation, while in the second generation it was 0.21, 0.40, 0.74 and 0.74 (cm) at 8, 12, 16 and 20 weeks of age, respectively. Fluctuations in genetic gains over generations may be due to the fact that the selected number of males and females in each generation were different. These results disagree with that reported by Abou El-Ghar and Abd El-Karim (2016)in the selected Inshas strain of chicken. In conclusion we can summarized our results that selection for body weight at 8 weeks of age led to improve directly the body weight and conformation (shank and keel length) at different ages.

Table (1): The number of parents and old offspring chicks by each generation and line:

Generation	Lines	Parents		Offspring at hatching time	
		Sires	Dams	Male	Female
1 (2016)	C S	15 29	150 290	167 365	411 478
Total		44	440	532	889
2 (2018)	C S	24 28	225 270	341 409	362 399
Total		52	495	750	761

Table (2):[*]Least square means ± S.E of body weight (g) at 0, 4, 8, 12, 16 and 20 weeks of age by generation, line and sex:

	W0	W4	W8	W12	W16	W20
Generation effect:						
G1	33.73±0.09^{b}	275.63±1.05^{b}	690.41±2.19^{b}	1099.20±5.16	1276.35±7.36	1422.81±7.92^{b}
G2	35.50±0.09^{a}	290.35±1.44^{a}	724.85±2.48^{a}	1109.69±6.16	1268.28±8.11	1459.65±8.02^{a}
Line effect:						
C	33.78±0.09^{b}	273.92±1.31^{b}	677.87±2.47^{b}	1044.77±5.19^{b}	1217.78±6.90^{b}	1368.17±7.23^{b}
S	35.31±0.09^{a}	290.43±1.22^{a}	731.65±2.15^{a}	1155.54±5.39^{a}	1333.94±7.90^{a}	1507.41±7.50^{a}
Sex effect:						
F	34.50±0.08	264.84±0.91^{b}	663.52±1.55^{b}	1021.87±2.90^{b}	1204.22±3.29^{b}	1388.16±4.12^{b}
M	34.53±0.10	306.86±1.47^{a}	765.60±2.54^{a}	1295.91±5.93^{a}	1665.97±9.32^{a}	1835.74±11.49^{a}

Table (2): continue…….

Interaction generation x line:								
G 1	**C**		33.02±0.12^{c}	263.92±1.45^{c}	688.61±3.53^{c}	1061.99±7.75^{c}	1232.88±11.36^{c}	1359.88±12.19^{d}
	S		34.21±0.12^{b}	283.66±1.39^{b}	706.73±2.65^{b}	1136.41±6.61^{b}	1312.31±9.25^{b}	1485.75±9.15^{b}
G 2	**C**		34.40±0.12^{b}	282.14±2.02^{b}	687.14±3.39^{d}	1028.26±6.85^{d}	1203.67±8.05^{d}	1374.59±8.70^{c}
	S		36.45±0.12^{a}	297.49±2.00^{a}	757.66±3.15^{a}	1191.12±8.96^{a}	1373.95±14.29^{a}	1544.72±12.52^{a}
Interaction generation x sex:								
G 1	**F**		33.78±0.11^{c}	262.27±1.14^{d}	652.14±2.03^{d}	1030.25±3.74^{c}	1206.21±4.61^{b}	1385.52±6.03^{b}
	M		35.32±0.12^{b}	297.96±1.64^{b}	754.36±3.25^{b}	1304.25±7.98^{a}	1669.78±0.41^{a}	1837.19±9.47^{a}
G 2	**F**		33.64±0.14^{c}	267.84±1.45^{c}	676.82±2.29^{c}	1010.33±4.56^{d}	1201.68±4.64^{b}	1391.08±5.56^{b}
	M		35.68±0.13^{a}	313.18±2.20^{a}	773.58±3.64^{a}	1286.09±8.82^{b}	1660.87±16.81^{a}	1834.17±21.76^{a}
Interaction line x sex:								
C	**F**		33.68±0.11^{c}	259.46±1.2^{d}	641.19±2.27^{d}	975.07±3.77^{d}	1156.05±4.28^{d}	1323.74±4.94^{d}
	M		33.72±0.14^{b}	292.14±2.3^{b}	735.71±4.05^{b}	1234.71±7.99^{b}	1581.71±10.5^{b}	1781.77±13.2^{b}
S	**F**		35.32±0.12^{a}	270.00±1.2^{c}	680.27±1.87^{c}	1078.16±3.44^{c}	1263.71±3.93^{c}	1470.75±4.73^{c}
	M		35.35±0.13^{a}	313.47±1.8^{a}	784.86±3.03^{a}	1358.72±6.94^{a}	1754.46±10.4^{a}	1917.98±14.5^{a}
Interaction generation x line x sex:								
G 1	**C**	**F**	33.04±0.14^{d}	257.18±1.62^{f}	636.76±3.11^{f}	989.62±5.61^{g}	1155.22±7.14^{g}	1310.96±8.16^{f}
		M	32.96±0.22^{d}	280.50±2.74^{c}	740.23±6.74^{c}	1259.03±12.38^{c}	1623.86±14.1^{c}	1818.54±14.5^{b}
	S	**F**	34.41±0.15^{bc}	266.64±1.59^{e}	665.42±2.50^{e}	1061.97±4.43^{f}	1247.08±5.11^{f}	1447.65±6.56^{e}
		M	33.94±0.16^{c}	305.94±1.89^{b}	760.82±3.55^{b}	1339.64±9.49^{b}	1714.91±12.4^{b}	1853.18±11.8^{b}
G 2	**C**	**F**	34.32±0.17^{bc}	261.74±2.07^{ef}	645.62±3.31^{f}	960.52±4.92^{h}	1156.88±5.07^{g}	1336.53±5.91^{f}
		M	34.48±0.16^{b}	303.79±3.13^{b}	731.20±5.05^{c}	1210.40±9.8^{d}	1539.56±11.9^{d}	1745.00±18.9^{c}
	S	**F**	36.23±0.16^{a}	273.37±1.97^{d}	705.12±2.40^{d}	1094.35±4.89^{e}	1280.34±5.60^{e}	1493.85±5.38^{d}
		M	36.76±0.17^{a}	321.00±3.03^{a}	808.91±4.49^{a}	1377.80±9.60^{a}	1794.02±15.4^{a}	1982.78±19.6^{a}

*: any two least square means have not the same letter within each column within each classification are significantly different ($p \leq 0.05$).

G= Generation, C= control line, S= selected line, M= males, F= females.

Table (3): ANOVA table (M.S. values) for body weight at 0, 4, 8, 12, 16 and 20 weeks of age by generation, line and sex:

Source of var.	D.F	BW_0	BW_4	BW_8	BW_{12}	BW_{16}	BW_{20}
Gen.	1	**	**	**	N.S	N.S	**
Line	1	**	**	**	**	**	**
Sex	1	N.S	**	**	**	**	**
Gen .x Line	1	**	N.S	**	**	**	**
Gen .x Sex	1	**	**	N.S	N.S	N.S	N.S
Line x Sex	1	N.S	**	N.S	*	**	N.S
Gen .x Line x Sex	1	N.S	N.S	**	N.S	**	**
Error		10.54	1898.88	5026.72	9664.74	9712.55	10561.64
Error(D.F)		2924	2924	2924	1769	1345	1034

Gen. = Generation.*:$p \leq 0.05$, **:$P \leq 0.01$, N .S: Not significant.

Table (4): Differences in body weight of males and females as sexual dimorphism (%) over generations:

Generation	Line	Sex	BW_4	BW_8	BW_{12}	BW_{16}	BW_{20}
1	Contro	Males	280.50	740.23	1259.03	1623.86	1818.54
		Females	257.18	636.76	989.62	1155.22	1310.96
	Difference(males – fem		23.32	103.47	269.41	468.64	507.58
	Sexual dimorphism%		9.06	16.24	27.22	40.56	38.71
	Selected	Males	305.94	760.82	1339.64	1714.91	1853.18
		Females	266.64	665.42	1061.97	1247.08	1447.65
	Difference(males – fem		39.3	95.4	277.67	467.83	405.53
	Sexual dimorphism%		14.73	14.33	26.14	37.51	28.01
2	Control	Males	303.79	731.20	1210.40	1539.56	1745.00
		Females	261.74	645.62	960.52	1156.88	1336.53
	Difference(males – fem		42.05	85.58	249.88	382.68	408.47
	Sexual dimorphism%		16.06	13.25	26.01	33.07	30.56
	Selected	Males	321.00	808.91	1377.80	1794.02	1982.78
		Females	273.37	705.12	1094.35	1280.34	1493.85
	Difference(males – fem		47.63	103.79	283.45	513.68	488.93
	Sexual dimorphism%		17.42	14.71	25.90	40.12	32.72
PooledControl		Males	292.14	735.71	1234.71	1581.71	1781.77
		Females	259.46	641.19	975.07	1156.05	1323.74
Difference(males – females)			32.68	94.52	259.64	425.66	458.03
Sexual dimorphism%			12.59	14.74	26.62	36.82	34.60
Pooled Selected		Males	313.47	784.86	1358.72	1754.46	1917.98
		Females	270.00	680.27	1078.16	1263.71	1470.75
Difference(males– females)			43.47	104.59	280.56	490.75	447.23
Sexual dimorphism%			16.1	15.37	26.02	38.83	30.41

Table (5): Least square means± S.E of genetic gain in body weight (g) over generations at 0, 4, 8, 12, 16 and 20 weeks of age:

Generation	Line	BW_0	BW_4	BW_8	BW_{12}	BW_{16}	BW_{20}
1	Control	33.02±0.12	263.92±1.45	688.46±3.53	1061.99±7.75	1232.88±11.36	1359.88±12.19
	Selected	34.21±0.12	283.66±1.39	706.12±2.65	1136.41±6.61	1312.31±9.25	1485.75±9.15
	genetic gain	1.19	19.74	17.66	74.42	79.43	125.87
2	Control	34.40±0.12	282.14±2.02	687.14±3.39	1028.26±6.85	1203.67±8.05	1374.59±8.70
	Selected	36.45±0.12	297.49±2.00	757.66±3.15	1191.12±8.96	1373.95±14.29	1544.72±12.52
	genetic gain	2.05	15.35	70.52	162.86	170.28	170.13
Pooled Control		33.78±0.09	273.92±1.31	677.87±2.47	1044.77±5.19	1217.78±6.90	1368.17±7.23
Pooled Selected		35.31±0.09	290.43±1.22	731.65±2.15	1155.54±5.39	1333.94±7.90	1507.41±7.50
genetic gain		1.53	16.51	53.78	110.77	116.16	139.24

Table (6): *Least square means ± S.E of shank length (cm) at 4, 8, 12, 16 and 20 weeks of age by generation, line and sex:

			SL4	SL8	SL12	SL16	SL20
Generation effect:							
G1			4.15 ± 0.01^{b}	6.49 ± 0.02^{b}	7.52 ± 0.03^{b}	7.78 ± 0.03^{b}	7.98 ± 0.03^{b}
G2			4.65 ± 0.01^{a}	6.85 ± 0.02^{a}	7.95 ± 0.03^{a}	8.41 ± 0.03^{a}	8.82 ± 0.03^{a}
Line effect:							
C			4.34 ± 0.02^{b}	6.51 ± 0.02^{b}	7.56 ± 0.03^{b}	7.90 ± 0.03^{b}	8.30 ± 0.03^{b}
S			4.46 ± 0.01^{a}	6.80 ± 0.02^{a}	7.87 ± 0.03^{a}	8.20 ± 0.04^{a}	8.48 ± 0.04^{a}
Sex effect:							
F			4.28 ± 0.01^{b}	6.40 ± 0.01^{b}	7.36 ± 0.02^{b}	7.84 ± 0.02^{b}	8.24 ± 0.02^{b}
M			4.58 ± 0.02^{a}	7.03 ± 0.02^{a}	8.60 ± 0.04^{a}	9.15 ± 0.06^{a}	9.67 ± 0.07^{a}
Interaction generation x line:							
G1		C	4.02 ± 0.02^{d}	6.30 ± 0.03^{d}	7.36 ± 0.04^{d}	7.60 ± 0.04^{d}	7.86 ± 0.04^{d}
		S	4.24 ± 0.02^{c}	6.62 ± 0.02^{c}	7.66 ± 0.04^{c}	7.91 ± 0.04^{c}	8.07 ± 0.04^{c}
G2		C	4.61 ± 0.02^{b}	6.69 ± 0.02^{b}	7.75 ± 0.03^{b}	8.19 ± 0.03^{b}	8.63 ± 0.03^{b}
		S	4.69 ± 0.02^{a}	7.00 ± 0.02^{a}	8.26 ± 0.05^{a}	8.77 ± 0.05^{a}	9.17 ± 0.05^{a}
Interaction generation x sex:							
G1		F	4.07 ± 0.01^{d}	6.25 ± 0.02^{d}	7.18 ± 0.02^{d}	7.54 ± 0.02^{d}	7.82 ± 0.02^{d}
		M	4.29 ± 0.02^{c}	6.89 ± 0.03^{b}	8.46 ± 0.05^{b}	8.91 ± 0.07^{b}	9.46 ± 0.08^{b}
G2		F	4.52 ± 0.02^{b}	6.58 ± 0.02^{c}	7.61 ± 0.02^{c}	8.22 ± 0.02^{c}	8.71 ± 0.03^{c}
		M	4.78 ± 0.02^{a}	7.13 ± 0.02^{a}	8.76 ± 0.05^{a}	9.53 ± 0.08^{a}	9.90 ± 0.10^{a}
Interaction line x sex:							
C		F	4.21 ± 0.02^{c}	6.31 ± 0.02^{d}	7.24 ± 0.02^{d}	7.74 ± 0.02^{d}	8.18 ± 0.03^{d}
		M	4.55 ± 0.02^{a}	6.82 ± 0.03^{b}	8.42 ± 0.04^{b}	8.87 ± 0.06^{b}	9.43 ± 0.08^{b}
S		F	4.34 ± 0.02^{b}	6.48 ± 0.02^{c}	7.50 ± 0.03^{c}	7.94 ± 0.03^{c}	8.32 ± 0.04^{c}
		M	4.59 ± 0.02^{a}	7.16 ± 0.02^{a}	8.77 ± 0.06^{a}	9.38 ± 0.09^{a}	9.96 ± 0.10^{a}
Interaction generation x line x sex:							
G1	C	F	3.96 ± 0.02^{g}	6.40 ± 0.02^{g}	6.99 ± 0.02^{g}	7.39 ± 0.02^{f}	7.71 ± 0.03^{f}
		M	4.16 ± 0.03^{f}	6.66 ± 0.04^{d}	8.33 ± 0.06^{c}	8.63 ± 0.06^{c}	9.25 ± 0.13^{c}
	S	F	4.61 ± 0.01^{f}	6.32 ± 0.02^{f}	7.32 ± 0.03^{f}	7.65 ± 0.03^{e}	7.91 ± 0.03^{f}
		M	4.34 ± 0.02^{e}	6.99 ± 0.02^{b}	8.55 ± 0.06^{b}	9.10 ± 0.11^{b}	9.64 ± 0.08^{b}
G2	C	F	4.48 ± 0.02^{d}	6.48 ± 0.03^{e}	7.47 ± 0.02^{e}	8.05 ± 0.02^{d}	8.54 ± 0.03^{e}
		M	4.74 ± 0.02^{a}	6.90 ± 0.03^{c}	8.49 ± 0.05^{b}	9.16 ± 0.07^{b}	9.56 ± 0.08^{b}
	S	F	4.56 ± 0.03^{c}	6.67 ± 0.02^{d}	7.84 ± 0.04^{d}	8.50 ± 0.03^{c}	9.02 ± 0.04^{d}
		M	4.81 ± 0.02^{a}	7.31 ± 0.02^{a}	9.07 ± 0.09^{a}	9.93 ± 0.12^{a}	10.44 ± 0.14^{a}

*: any two least square means have not the same letter within each column within each classification are significantly different ($p\leq0.05$).

SL= shank length, G= Generation, C= control, S= selected,M= males, F= females.

Table (7): ANOVA table (M.S values) for shank length at 4, 8, 12, 16 and 20 weeks of age by generation, line and sex:

Source of var.	D.F	Sl_4	Sl_8	Sl_{12}	Sl_{16}	Sl_{20}
Gen.	1	**	**	**	**	**
Line	1	**	**	**	**	**
Sex	1	**	**	**	**	**
Gen .x Line	1	**	N.S	**	**	**
Gen .x Sex	1	N.S	N.S	**	N.S	**
Line x Sex	1	N.S	**	N.S	**	**
Gen .x Line x Sex	1	N.S	N.S	N.S	N.S	N.S
Error		0.23	0.30	0.38	0.33	0.27
Error(D.F)		2924	2924	1769	1345	1034

Gen. = Generation

*:p≤ 0.05 , **:P≤ 0.01 , N .S: Not significant

Table (8): Least square means± S.E of genetic gain in shank length (cm) over generations at 4, 8, 12, 16 and 20 weeks of age:

Generation	Line	Sl_4	Sl_8	Sl_{12}	Sl_{16}	Sl_{20}
1	Control	4.02±0.02	6.30±0.03	7.36±0.04	7.60±0.04	7.86±0.04
	Selected	4.24±0.02	6.62±0.02	7.66±0.04	7.91±0.04	8.07±0.04
	genetic gain	0.22	0.32	0.30	0.31	0.21
2	Control	4.61±0.02	6.69±0.02	7.75±0.03	8.19±0.03	8.63±0.03
	Selected	4.69±0.02	7.00±0.02	8.26±0.05	8.71±0.05	9.17±0.05
	genetic gain	0.08	0.31	0.51	0.52	0.54
Pooled Control		4.34±0.02	6.51±0.02	7.56±0.03	7.90±0.03	8.30±0.03
Pooled Selected		4.46±0.01	6.80±0.02	7.87±0.03	8.20±0.04	8.48±0.04
genetic gain		0.12	0.29	0.31	0.30	0.18

Table (9): *Least square means ± S.E of keel length (cm) at 8, 12, 16 and 20 weeks of age by generation, line and sex:

			KL8	KL12	KL16	KL20
Generation effect:						
G1			7.17±0.02^{b}	8.16±0.03^{b}	8.46±0.03^{b}	8.76±0.03^{b}
G2			7.68±0.02^{a}	8.66±0.03^{a}	9.43±0.03^{a}	9.97±0.03^{a}
Line effect:						
C			7.32±0.02^{b}	8.24±0.03^{b}	8.71±0.03^{b}	9.23±0.03^{b}
S			7.52±0.02^{a}	8.52±0.03^{a}	9.06±0.04^{a}	9.47±0.04^{a}
Sex effect:						
F			7.11±0.02^{b}	8.01±0.02^{b}	8.67±0.02^{b}	9.20±0.02^{b}
M			7.85±0.02^{a}	9.31±0.04^{a}	9.95±0.06^{a}	10.66±0.07^{a}
Interaction generation x line:						
G1		C	7.01±0.03^{d}	7.96±0.04^{d}	8.24±0.04^{d}	8.59±0.04^{d}
		S	7.28±0.02^{c}	8.31±0.04^{c}	8.64±0.04^{c}	8.90±0.04^{c}
G2		C	7.57±0.03^{b}	8.50±0.04^{b}	9.15±0.03^{b}	9.71±0.03^{b}
		S	7.78±0.02^{a}	8.90±0.05^{a}	9.89±0.04^{a}	10.45±0.05^{a}
Interaction generation x sex:						
G1		F	6.89±0.02^{d}	7.78±0.02^{d}	8.20±0.03^{d}	8.60±0.02^{d}
		M	7.64±0.03^{b}	9.19±0.05^{b}	9.67±0.07^{b}	10.30±0.08^{b}
G2		F	7.37±0.02^{c}	8.33±0.03^{c}	9.26±0.03^{c}	9.86±0.02^{c}
		M	8.00±0.03^{a}	9.44±0.05^{a}	10.41±0.07^{a}	11.04±0.11^{a}
Interaction line X sex:						
C		F	7.06±0.02^{d}	7.88±0.03^{d}	8.55±0.03^{d}	9.10±0.03^{d}
		M	7.72±0.03^{b}	9.20±0.05^{b}	9.69±0.06^{b}	10.46±0.08^{b}
S		F	7.16±0.02^{c}	8.15±0.03^{c}	8.81±0.04^{c}	9.32±0.04^{c}
		M	7.93±0.02^{a}	9.42±0.05^{a}	10.18±0.08^{a}	10.89±0.12^{a}
Interaction generation X line X sex:						
G1	C	F	6.84±0.02^{f}	7.56±0.03^{g}	8.01±0.03^{h}	8.43±0.03^{f}
		M	7.41±0.04^{d}	9.04±0.06^{c}	9.38±0.06^{e}	10.21±0.13^{c}
	S	F	6.92±0.02^{f}	7.94±0.03^{f}	8.36±0.03^{g}	8.74±0.03^{e}
		M	7.73±0.03^{c}	9.31±0.06^{b}	9.86±0.10^{c}	10.39±0.10^{c}
G2	C	F	7.29±0.03^{e}	8.18±0.03^{e}	9.02±0.02^{f}	9.62±0.03^{d}
		M	7.86±0.04^{b}	9.34±0.06^{b}	10.06±0.07^{b}	10.66±0.10^{b}
	S	F	7.44±0.03^{d}	8.56±0.04^{d}	9.68±0.03^{d}	10.31±0.04^{c}
		M	8.10±0.03^{a}	9.56±0.08^{a}	10.78±0.09^{a}	11.66±0.16^{a}

*: any two least square means have not the same letter within each column within each classification are significantly different ($p \leq 0.05$).

KL= keel length, G= Generation, C= control, S= selected, M= males, F= females.

Table (10): ANOVA table (M.S. values) for keel length at 8, 12, 16 and 20 weeks of age by generation, line and sex:

Source of var.	D.F	Kl_8	Kl_{12}	Kl_{16}	Kl_{20}
Gen.	1	**	**	**	**
Line	1	**	**	**	**
Sex	1	**	**	**	**
Gen .x Line	1	N.S	N.S	**	**
Gen .x Sex	1	N.S	**	**	**
Line x Sex	1	**	**	N.S	N.S
Gen .x Line x Sex	1	N.S	N.S	N.S	N.S
Error		0.39	0.46	0.34	0.30
Error(D.F)		2924	1769	1345	1034

Gen. = Generation Gent. = Genotype
*:p≤ 0.05 , **:P≤ 0.01 , N .S: Not significant

Table (11): Least square means± S.E of genetic gain in keel length (cm) over generations at 8, 12, 16 and 20 weeks of age:

Generation	Line	Kl_8	Kl_{12}	Kl_{16}	Kl_{20}
1	Control	7.01±0.03	7.96±0.04	8.24±0.04	8.59±0.05
	Selected	7.28±0.02	8.31±0.04	8.64±0.04	8.90±0.04
	genetic gain	0.27	0.35	0.40	0.31
2	Control	7.57±0.03	8.50±0.04	9.15±0.03	9.71±0.03
	Selected	7.78±0.02	8.90±0.05	9.89±0.04	10.45±0.05
	genetic gain	0.21	0.40	0.74	0.74
Pooled Control		7.32±0.02	8.24±0.03	8.71±0.03	9.23±0.04
Pooled Selected		7.52±0.02	8.52±0.03	9.06±0.04	9.47±0.04
genetic gain		0.20	0.28	0.35	0.24

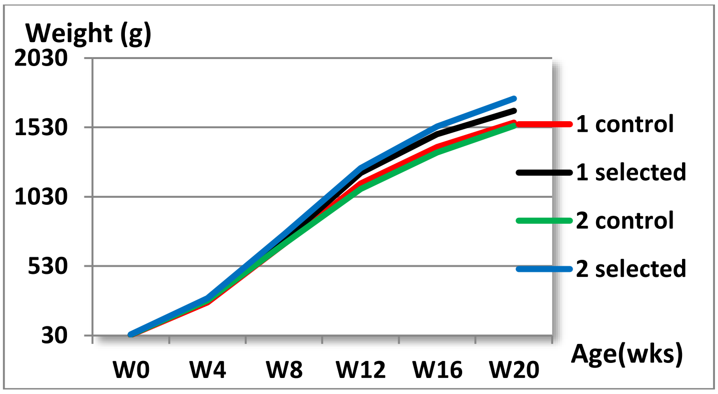

Figure (1): Least square means of body weight (g) at 0, 4, 8, 12, 16 and 20 weeks of age by generation and line.

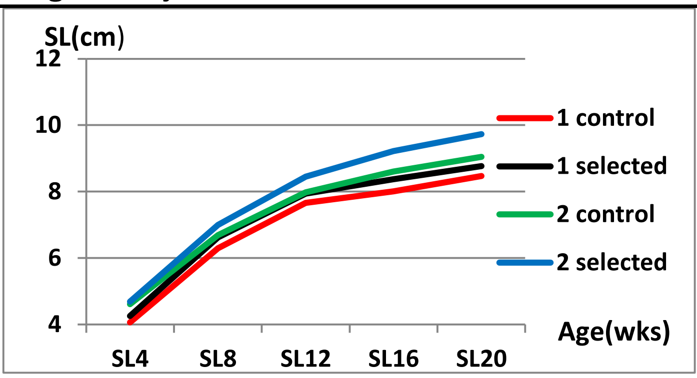

Figure (2): Least square means of shank length (cm) at 4, 8, 12, 16 and 20 weeks of age by generation and line.

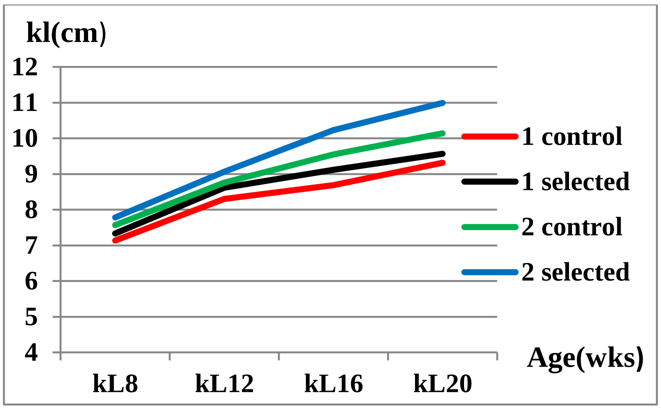

Figure (3): Least square means of keel length (cm) at 8, 12, 16 and 20 weeks of age by generation and line.

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الملخص العربى

الإستجابة المباشرة نتيجة الإنتخاب لوزن الجسم عند عمر٨ أسابيع في دجاج الدندراوي: وزن الجسم والتكوين

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هذه الدراسة أجريت في مزرعة الدواجن بكلية الزراعة جامعة أسيوط خلال جيلين متعاقبين وذلك لدراسة تأثير الأنتخاب لوزن الجسم العالي عند عمر ٨ أسابيع علي وزن الجسم ومقاييس (طول عظمة الساق وطول عظمة القص) في دجاج الدندراوي. أشتملت الدراسة علي بيانات تم الحصول عليها من ٢٩٣٢من الكتاكيت المنسبة ناتجة من تزاوج ٩٦ ذكر مع ٩٣٥ أنثي علي مدي جيلين متتابعين. الكتاكيت في كل جيل قسمت الي خطين، خط منتخب لوزن الجسم العالي وخط كنترول. وزن الجسم سجل من عمر يوم وحتي الأسبوع ٢٠من العمر بالجرام ، تم قياس طول عظمة الساق من الأسبوع ٤ حتي الأسبوع٢٠من العمر و عظمة الصدر من الأسبوع ٨ حتي الأسبوع٢٠من العمربالسنتيمتر للخطين في كل جيل.

أظهرت النتائج أن هناك فروق معنوية جداً بين الجيلين وتحسن في وزن الجسم عند عمر صفر، ٤، ٨، ٢٠ اسبوع بسبب الأنتخاب الفردي. أيضا هناك فروق معنوية جداً بين الخطوط في وزن الجسم من عمر صفر حتي٢٠ أسبوع من العمر و الخط المنتخب كان اعلي وزنا من خط الكنترول في كل الأجيال و هناك فروق معنوية جداً في وزن الجسم بين الجنسين من عمر ٤ حتي٢٠ أسبوع من العمر ووزن الجسم في الذكور من عمر ٤ حتي٢٠ أسبوع من العمركان اعلي من الاناث في كلا الخطين في الجيلين. الفرق في وزن الجسم بين الجنسين زاد تدريجيا من الأسبوع ٤ حتي الأسبوع٢٠من العمر.هناك فروق معنوية جداً بين الاجيال والخطوط و الجنس في طول عظمة الساق و عظمة الصدر في كل الاعمار في الدراسة.

من النتائج وجد بعض التداخلات المعنوية بين العوامل الرئيسية المدروسة مما يعني ان التأثير علي الصفات المدروسة لم يكن بسبب هذه العوامل الرئيسية ولكن يرجع الي عوامل أخري غيرها، كما ان هناك بعض التداخلات الغير معنوية مما يعني ان الفروق الموجودة ترجع الي العوامل الرئيسية المدروسة.

نستنتج أنهبإجراء الإنتخاب لوزن الجسم عند عمر٨أسابيع قد أدي الي تحسين وزن وتكوين الجسم علي أعمار مختلفة وحتي عمر ٢٠ أسبوع في دجاج الدندراوي.