DIRECT AND CORRELATED RESPONSES AMONG SELECTION FOR FEED CONSUMPTION IN JAPANESE QUAIL

By

Aboul-Seoud, D. I; Mabrouk, M. M. S; Aboul-Hassan , M. A; Attalah, G.E.Y; and Abu Mosallam, M.F.

Department of Animal Production, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt.

ABSTRACT: A total number of 300 birds at 6 weeks of age were taken from the third generation of the base population to construct the generation number zero for selection. The birds were randomly assigned to two mating groups, the first group was established by selection for high feed consumption (**HFC_{4-6}**) and the second was maintained as a random bred control line (**RBC**) to study the direct and correlated responses for selection for feed consumption . The results obtained can be summarized as follow:

1- Feed consumption was highly significantly ($P \leq 0.01$) increased in the selected line (HFC_{4-6}) from 10.12g at generation zero to 13.50g at the third generation of selection, while the control line fluctuated randomly from generation to another, however, there was no significant increase and/or decrease between the mean of generation zero (10.12g) and that of the third generation (12.25g).

2- After three generations of selection for feed consumption, the birds of selected line (HFC_{4-6}) consumed more feed by 10.20%, compared with the birds of control line. Females of the selected line (HFC_{4-6}) consumed more feed by 15.01% than males.

3- Coefficient of variation in the selected trait HFC_{4-6} decreased from 45.45% at generation zero to 23.78% at the third generation among HFC_{4-6} line. The corresponding estimates obtained in the RBC line were 45.45 and 25.63%.

4- The effect of generation, line and sex on (HFC_{4-6}) was highly significant ($P \leq 0.01$), while the effect of the sire and the dam on this trait was not significant.

5- No significant differences were found between the actual and the

expected selection differentials through the three generations of selection, however, the actual selection differential agree well with the expected in the HFC_{4-6} line, where it was averaged 3.03 and 2.86g / generation. The ratio of actual to expected selection differentials was greater than unity, which suggests that natural selection may had a positive effect on selection for FC_{4-6}.

6- The actual response to selection in the (HFC_{4-6}) line was regular through the three generations of selection averaging 2.33g /generation. The cumulative selection response in the (HFC_{4-6}) line was 8.91g after the third generation of selection.

7-Heritability of feed consumption was estimated by different methods:

- The dam variance components, where the values of h^2_D were found to be 0.55, 0.40, 0.50 for the first, second and third generation.
- The sire variance components, where the values of h^2_S were less than those estimated by the previous method, it was 0.28, 0.25, 0.21 for the first, second and the third generation.
- The sire + dam variance components, where the values of h^2_{S+D} were intermediate between the two previous estimates, it was 0.30, 0.28, 0.40 for the first, second and the third generation.
- The realized heritability were found to be 0.77, 0.78, 0.70 for the first, second and the third generation.

8- Correlated responses for other traits when selection was applied for FC_{4-6} were as follow:

a- Growth traits:

BW_0, BW_2, BW_4,and BW_6 were increased significantly ($P \leq 0.05$) from 8.95, 36.58, 92.84 and 160.47g in the first generation to 9.75, 43.01, 95.45 and 172.42g after three generations of selection. However, ADG_{0-2}, ADG_{2-4}, ADG_{4-6} and ADG_{0-6} were increased significantly ($P \leq 0.05$) from 2.32, 5.20, 1.42 and 3.40g/day in the first generation to 2.79, 5.60, 1.71 and 3.88g/day after three generations of selection. On the contrary, the corresponding values for the control line among weights and gains were not significant.

b- Egg production and reproductive traits:

egg weight **(EW)** was increased significantly ($P \leq 0.05$) from 10.32g in the first generation to 10.96g after three generations of selection. ASM was increased significantly ($P \leq 0.05$) from 55.15 day in the first generation to 59.62 day after three generations of selection, while **(TEN_{10})**, Total egg number to 10 weeks of laying **(TEW_{10})** and Total egg weight to 10 weeks of laying, Daily egg mass **(DEM)** were decreased significantly ($P \leq 0.05$) from 54.25egg, 470.25g and 9.40g/day in the first generation to 50.48egg, 458.25g and 9.10g/day after three generations of selection. However, reproductive traits: Fertility percentage **(FR%)** and Hatchability percentage **(HA%)** were decreased significantly ($P \leq 0.05$) from 82.58 and 70.42% in the first generation to 78.69 and 66.21% after three generations of selection, while Early embryonic mortality **(EEM%)**, Lately embryonic mortality **(LEM%)** and Total embryonic mortality **(TEM%)** were increased significantly ($P \leq 0.05$) from 5.64, 16.35 and 21.99% in the first generation to 6.95, 17.02 and 23.97% after three generations of selection. On the contrary, the corresponding values for the control line among egg production and reproductive traits studied were not significant.

c- Carcass traits:

Meat, giblets and dressing % traits were increased significantly ($P \leq 0.05$) from 46.24, 14.36 and 60.21% in the first generation to 49.05, 15.06 and 61.82% after three generations of selection, while bone % was decreased significantly ($P \leq 0.05$) from 8.78% in the first generation to 7.47% after three generations of selection. On the contrary, the corresponding values for the control line among carcass traits studied were not significant.

INTRODUCTION

The usefulness of selection procedures to increase either productive or reproductive traits depends not only upon the direct response itself, but also upon the associated changes in other economically or biologically important traits caused by correlated response to selection. However, selection for a certain trait may indirectly affect other traits not considered in the program due to the fact that the improved trait is correlated with these traits. Correlated responses may be classified into three types according to **Falconer, (1954); Marks, (1971) and Nestor *et al.*, (1983):**

a- If the two characters are uncorrelated genetically, no correlated responses would be expected, but the secondary character may nevertheless show indirect departure from normality following selection for the primary character.

b- If the two characters are correlated genetically, the secondary character will show a direct change following selection for the primary character.
c- If the secondary character forms an important component of total fitness, it may by expected to decline in response to selection for the primary character in both directions.

Japanese quail, despite their small body size, have an important place in commercial production because of their high egg and meat production capacity. Quails are generally reared for egg production in the Far East and Asian countries, and primarily for meat production in European and American countries (**Minvielle, 2004**).

The feed conversion (FCR) is usually measured as the ratio of feed intake to body weight gain. Feed conversion is a complex, highly aggregate trait that is the net result of the interaction of many different component traits. Selection for feed conversion, and other ratio traits, influences component traits in a relatively undirected manner (**Gunsett, 1984; Emmerson, 1997**). For example, selection for improved FCR can either increase growth, decrease feed intake or both. Several studies on poultry species have estimated genetic parameters for FCR and its components traits in poultry species (**Thomas *et al.,* 1958; Wilson, 1969; Gill and Washburn, 1974; Pym and Nicholls, 1979; Chambers *et al.,* 1984; Leenstra *et al.,* 1986; Koerhuis and Hill, 1995; Gaya *et al.,* 2006; N'Dri *et al.,* 2006; Aggrey *et al.,* 2010**).

The present work was designed to estimate the direct responses to selection for increased TFC_{4-6} and correlated responses with some productive and reproductive traits during early three generations of selection. As well as to study the heritability of feed consumption and to study the genetic and phenotypic correlations between feed consumption and each of growth, egg production, reproductive and carcass studied traits.

MATERIALS AND METHODS

Data of the present study were collected on the flock of Japanese quail (***Coturnix coturnix japonica***) maintained by the Department of Animal Production, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt, during the period from January 2012 until August 2013.

Breeding plan and management:

A total number of 300 birds (100 males and 200 females) at 6 weeks of age were taken at random from the flock under consideration as parents of the present study. The mating system in the base population was in a ratio of one male to two females avoiding full and half-sib matings. The birds were randomly assigned to two mating groups, the first group was established by selection for increased feed consumption **(HFC_{4-6}).** The second group was maintained as a random bred control line **(RBC)** to study the direct response for high feed consumption. Family selection was carried out within each of the selected line (**HFC_{4-6}**), however higher families in feed consumption (one male and two females) were selected according to their deviation from the line mean.

Eggs were collected for hatch when females were 10 to 12 weeks of age, marked and incubated for 15 days. After incubation, the eggs were transferred to the hatcher for 3 days. Immediately after hatch individual birds were permanently identified by wing-bande and placed in quail battery brooders. All birds were sexed according to plumage color and remained for 4 weeks period then moved to individual laying cages and stud matings started about two weeks later.

The selected breeders were housed in breeding cages with the dimensions of 20x20x25cm (one male and two females per cage) with sloping floor for collecting the eggs. Eggs were collected twice daily in a pedigree system for each family. The relative humidity of the hatcher was maintained at 64.5% relative humidity, respectively. Since the quail egg shells were colored, tinted and botched, accurate assessment of the condition of the embryo by candling during incubation was not possible.

All birds were housed in the same room in order to keep temperature, humidity, light intensity and other variables uniform as possible. However, environment and management practices were at conventional levels through the whole study. At 5 weeks of age, males were separated from the females and at 6 weeks of age, randomly assigned to the three mating groups. The eggs of each family were isolated in a separate plastic net inside the hatcher marked and incubated for 15 days and 3 days later in the hatcher.

Feed and water were provided ***ad-libitum***. The experimental diet contained 28% protein and 2920 k cal-ME/Kg until 2 weeks of age and 25% protein with 2850 k cal-ME/Kg during 3-6 weeks of age, then changed to a ration contained 20% protein with 2820 k cal-ME/Kg during the laying period. The same diets were provided to birds on the selection process across various generations. The minerals and vitamins were adequately supplied to cover the requirements according to **N R C, (1994)** throughout the experimental duration. Temperature started with 37.5°C for the first week after hatching, then decreased 2-3°C weekly to 26-28°C at the fourth week of age till the end of brooding period. No vaccination and/or beak trimming programs were carried out to the breeding stocks.

Statistical analysis :

Statistical analysis were conducted using the General Linear Models (GLM) procedure of base SAS software (**SAS Institute, 1988**). Differences between each two means were done according to Duncan's Multiple Range Test. Data of the selected trait (HFC_{4-6}) were analyzed using mixed model **(Harvey, 1987, model type 5)** including each of generation, line and sex as a fixed effects and sire and dam within sire as a random effects.

The following model was adopted:

$$Y_{ijklmn} = \mu + G_i + L_j + S_k + D_{lk} + Sx_m + e_{ijmkln}$$, where:

where:

Y_{ijmkln} = the observation of ijmkln th bird.

μ = the overall mean, common element to all observations.

G_i = the fixed effect of i^{th} generation.

L_j = the fixed effect of j[th] line.

Sx_m = the fixed effect of m[th] sex.

S_k = the random effect of k[th] sire.

D_{lk} = the random effect of l[th] dam nested within a random effect of k[th] sire.

e_{ijmkln} = the random error term.

Henderson Method 3 (**Henderson, 1953**) was utilized to estimate the genetic variance components for the different traits studied.

RESULTS AND DISCUSSION

1-Direct response:

The actual means of feed consumption among three generations of selection in the selected and control lines are presented in (Table, 1). FC_{4-6} was highly significantly ($P \leq 0.01$) increased in the selected line (HFC_{4-6}) from 10.12g at generation zero to 13.50g at the third generation of selection. On the other hand, feed consumption in the control line fluctuated randomly from generation to another, however, there was no significant increase and/or decrease between the mean of generation zero (10.12g) and that of the third generation (11.14g). However, after three generations of selection for HFC_{4-6} the birds of selected line were consumed more feed by 10.20% compared with the birds of control line. The same trend was reported by **Aboul-Hassan (2001)** and **Abdel- Tawab (2006)** when they selected Japanese quail for increased (**TEN_{10}**) and Total egg number to 10 weeks of laying and (**TEW_{10}**) Total egg weight to 10 weeks of laying.

As FC_{4-6} increased in the HFC_{4-6} line, the C.V% of this trait decreased from 45.45% at generation zero to 23.78% at the third generation, respectively (Table, 1). The corresponding estimates obtained in the RBC line were 45.45 and 25.63%. The change in C.V% from generation zero to generation three in HFC_{4-6} and RBC lines were significant ($P \leq 0.01$). These results was in agreement with those reported by **Aboul-Hassan (2001)** and **Abdel-Tawab (2006)** when they selected Japanese quail for increased (TEN_{10}) and (TEW_{10}).

The least-square means, their standard errors and test of significance for factors affecting feed consumption are presented in tables (2 and 3). Results obtained in (Table, 2) indicated that among HFC_{4-6} line, feed consumption increased significantly ($P \leq 0.05$) from 11.08g at the first generation to 12.92g at the third generation. Females of the selected line (HFC_{4-6}) consumed more feed by 15.01% than males. On the other hand, the FC_{4-6} in the RBC line fluctuated randomly from generation to another, however, there was no significant increase and/or decrease between the mean of the first and the third generation of selection (Table, 2), while females of the control line consumed more feed by 10.84% than males. The same trend was reported by **Kosba *et al.*, (1996); Aboul-Hassan (1997)** and **El-Fiky (2005)** when they selected Japanese quail for increased BW_6 and by **El-Bourhamy (2004)** when he selected Japanese quail for increased feed consumption.

The least-square means for feed consumption among the three generations of selection varied significantly ($P \leq 0.05$) from generation to another and between the two sexes and two lines(Table, 2).

The least-square means for factors affecting $\mathbf{FC_{4-6}}$ varied significantly ($P \leq 0.05$) among generations, lines and sex, while the sire and the dam had non-significant effect on this trait (Table, 3). The same trend was observed by **Aboul Hassan (1997)** and **El-Fiky (2005)** when they selected Japanese quail for increased BW_6 and **El-Bourhamy (2004)** when he selected Japanese quail for increased feed consumption.

The dam variance component in $\mathbf{FC_{4-6}}$ were higher than the sire components of variance and consequently percentage of variations due to dam effect were larger than that of the sire effects (17.39 and 15.79% vs 5.07 and 4.74%) as shown in table (4). These results were in agreement with those obtained by **Aboul Hassan (1997); El-Fiky (2005)** and **Aboul-Seoud *et al.*, (2009)** when they selected Japanese quail for increased BW_6 & BW_4 and **El-Bourhamy (2004)** when he selected Japanese quail for increased feed consumption.

Table(1):Actual means, standard deviations (S.D) and coefficients of variation (C.V%) for feed consumption (g) in the selected (HFC_{4-6}) and control (RBC) lines among generations of selection.

Gen. \ Line	HFC_{4-6}	C.V%	RBC	C.V%
0	10.12±4.60	45.45	10.12±4.60	45.45
1	11.78±3.87	32.85	11.62±3.92	33.73
2	12.90±3.61	27.98	12.25±3.14	33.75
Average	12.08±3.51	29.06	11.28±3.82	33.87

Table (2): Least-square means and standard errors (S.E) of HFC_{4-6} (g) in the selected (HFC_{4-6})and control (RBC) lines among generations of selection.

Items	HFC_{4-6}		RBC	
	No.	Mean ± S.E	No.	Mean ± S.E
Generation:				
1^{st}	210	$11.08{\pm}0.28^{a}$	150	$11.08{\pm}0.32^{a}$
2^{nd}	212	$11.81{\pm}0.36^{b}$	160	$10.81{\pm}0.30^{a}$
3^{rd}	220	$12.92{\pm}0.26^{c}$	160	$11.12{\pm}0.38^{a}$
Sex:				
Male	320	$11.19{\pm}0.22^{a}$	230	$10.89{\pm}0.32^{a}$
Female	322	$12.87{\pm}0.30^{b}$	240	$12.07{\pm}0.41^{b}$

a,b,c = Means in the same column with different superscripts differ significantly ($P \leq 0.01$).

Table (3): F- ratios and test of significance for factors affecting HFC_{4-6}.

S.O.V.	d.f	F-ratio
Gen.	2	20.13**
Sire: G.	240	1.71
Dam:(S) : (G)	270	1.09
Line	1	58.88**
Sex	1	45.57**
Remainder	1256	

** = Significant at 1% level of probability.

Table (4): Variance components (δ^2) and percentage of variation (V%) estimated for random effects on feed consumption.

Var. comp. / *Line*	Sire		Dam : Sire		Remainder	
	δ^2s	V%*	δ^2D:s	V%*	δ^2e	V%*
HFC_{4-6}	0.21	5.07	2.72	17.39	3.21	77.54
RBC	0.18	4.74	0.60	15.79	3.02	79.47

* V% : Percentage of variation.

Selection differential:

Selection differential calculated as expected and actual as well as the ratio between the actual and expected selection differentials (Actual/Expected) are presented in (Table, 5) for **HFC_{4-6}** line. However, no significant differences were found between the actual and expected selection differentials from generation zero to generation three. This means that the distribution of **FC_{4-6}** confirm with the properties of a normal distribution closely enough to allow fairly accurate prediction. The same trend was noticed by **Aboul-Hassan (1997)** and **El-Fiky (2005)** when they selected Japanese quail for high HBW_6.

The corresponding values for actual selection differentials were 8.8, 10.4g at the first generation and 8.5, 10.4g at the sixth generation.

The ratio of actual to expected selection differentials (Table, 5) was greater than unity, which suggests that natural selection may had a positive effect on selection for HFC_{4-6}.

Table (5): Actual and expected selection differentials (g) and the ratio of actual to expected selection differentials for HFC_{4-6}.

Generation	Actual	Expected	Actual / Expected
0	2.72±0.12	2.51±0.10	1.08
1	3.21±0.08	3.10±0.08	1.04
2	2.86±0.10	2.62±0.12	1.09
3	3.31±0.05	3.22±0.03	1.03
Average	3.03±0.09	2.86±0.08	1.06

Cumulative (actual and expected) selection differentials are presented in table (6). The values for cumulative selection differentials (Actual and Expected) were 12.51 and 12.02g at generation zero among the (HFC_{4-6}) line increased to 21.89 and 20.96g at generation three. The cumulative actual selection differential takes into account of the effects of natural selection expressed through fertility of selected phenotypes **(Falconer, 1960).**

Table (6): Cumulative (actual and expected) selection differentials (g) for feed consumption.

Generation	Cumulative (Actual)	Cumulative (Expected)
0	12.51	12.02
1	15.72	15.12
2	18.58	17.74
3	21.89	20.96
Average	17.18	16.46

Selection response :

The actual and cumulative selection response are presented in (Table, 7). The actual response to selection in the line (HFC_{4-6}) decreased from generation to another through the three generations of selection. The estimated response to selection after the first generation of selection was 2.46g, then it decreased gradually as the selection continued to 2.32 and 2.22g after the second and the third generation of selection among HFC_{4-6} line.

This regularity of the selection response had been observed in many selection experiments reported in the literature. The cumulative response to selection in the HFC_{4-6} line was 7.22 after the third generation of selection. However, **El-Fiky (2005)** reported that the actual response to selection for HBW_6 was 2.58g after the first generation of selection and fluctuated to be 1.82g after the fourth generation of selection. Moreover, **Aboul-Seoud *et al.,* (2009)** reported that the actual response to selection in the line (HBW_4) was decreased from generation to another through the three generations of selection. The estimated response to selection after the first generation of selection was 3.36g, then it decreased gradually as the selection continued to 3.19 and 2.69g after the second and the third generation of selection among HBW_4 line.

Table(7):Actual and cumulative selection responses (g) for feed consumption.

Generation	Actual	Cumulative
0-1	2.46±0.85	2.46
1-2	2.32±0.54	4.78
2-3	2.22±0.17	7.00

Heritability estimates:

- Components of variance:

Heritability estimates for feed consumption calculated from components of variance i.e. sire (paternal half-sibs), dam within sire (maternal half-sibs) and sire plus dam (full-sibs) among the HFC_{4-6} line are presented in (Table, 8). However, the dam component is expected to be larger in magnitude by the variances due to the dominance deviations and maternal effects. Heritabilities computed from the sire component (h^2_S) ranged between 0.21 and 0.28 among the three generations of selection and that computed from the dam components (h^2_D) are generally higher than those computed from the sire components, it ranged between 0.40 and 0.55. This may be due to the large dam variance components obtained and the non-genetic effects, primarily dominance and maternal, normally result in the h^2_D estimates being considerably larger than h^2_S estimates. While, heritabilities computed from full-sib components (h^2_{S+D}) ranged between moderate and high in magnitude (0.28 - 0.40).

These results were in agreement with those reported by **Aboul-Hassan (1997),** who estimated h^2_S , h^2_D and h^2_{S+D} as 0.20, 0.45 and 0.32, respectively when selection was applied for BW_6. **El-Fiky (2005)** reported higher estimates of heritabilities computed from the regression coefficients of trait selected (BW_6) ranged between 0.37 and 0.79.

Generally, **Abdel-Fattah (2006)** reported that, all estimates of heritability for body weights or growth rates showed considerable variations throughout different ages or periods of growth, regardless of estimation method.

Another trend that males showed higher heritability estimates than females were observed by **Siegel (1962), Reddy *et al.* (1976), Saikia *et al.* (1976), Mukherjee and Friars (1970)** and **El-Gindy (1984)**. However, **Marks (1971)** found opposite results in quail that females had higher estimates than males. The dam component heritability estimates based on male and female progeny weights were generally higher than those of the sire component heritability estimates, this may be due to non-additive effects, primarily dominance and maternal, which is normally the reason for the maternal (h^2_D) heritability being considerably larger than the paternal heritability estimates (h^2_S). The sire estimate indicated only the additive genetic variance effect as suggested by **Siegel (1962)** and **Falconer (1989).**

Table(8):Heritability estimates computed from sire, dam, sire plus dam components of variance as well as realized heritability for HFC_{4-6}.

Heritability Generation	Sires h^2_S ±S.E	Dams: Sires $h^2_{D:S}$ ±S.E	Full-sibs h^2_{S+D} ±S.E	Realized h^2±S.E
1	0.28±0.22	0.55±0.18	0.30±0.15	0.77±0.22
2	0.25±0.18	0.40±0.15	0.28±0.16	0.78±0.31
3	0.21±0.27	0.50±0.10	0.40±0.08	0.70±0.26

- Realized heritability:

The realized heritability estimated for feed consumption as the ratio between response to selection and selection differential (R/S) calculated from the HFC_{4-6} line presented per generation in (Table, 8). The estimates of the realized heritability for feed consumption decreased from 0.77 at the first generation to 0.70 at the third generation.

2-Correlated responses:

Selection for HFC_{4-6} had consequence for some other traits. The weights and/or the weight gains recorded at different ages and growth periods, egg production, reproductive traits and the carcass traits may be changed. The actual means of the correlated traits associated with selection for HFC_{4-6} are presented in tables from 9-11

- Growth traits:

Body weight and body weight gain traits in the HFC_{4-6} line: BW_0, BW_2, BW_4 and BW_6 were increased significantly ($P \leq 0.05$) from 8.95, 36.58, 92.84 and 160.47g in the first generation to 9.75, 43.01, 95.45 and 172.42g after three generations of selection (Table, 9).

However, ADG_{0-2}, ADG_{2-4}, ADG_{4-6} and ADG_{0-6} were increased significantly ($P \leq 0.05$) from 2.32, 5.20, 1.42 and 3.40g/day in the first generation to 2.79, 5.60, 1.71 and 3.88g/day after three generations of selection. On the contrary, the corresponding values for the control line among weights and gains were fluctuated from generation to another with no significant trend (Table, 9).The same trend was observed by **Abdel-**

Tawab (2006) and **Aboul-Seoud** ***et al.,*** **(2009)** when they selected Japanese quail for increased BW_4, TEW_{10} and EW.

Table(9): Actual means and standard deviations for growth traits studied in both sexes for lines and generations of selection when selection was applied for HFC_{4-6}.

Gen	HFC_{4-6}			RBC		
Trait	**1**	**2**	**3**	**1**	**2**	**3**
BW_0	8.95±0.64	9.57±0.65	9.75±0.42	8.85±0.89	8.64±0.77	8.59±0.85
BW_2	36.58±4.20	38.05±4.28	43.01±5.32	36.25±4.74	35.20±4.22	36.66±4.82
BW_4	92.84±14.50	95.87±15.47	95.45±17.65	90.52±12.55	91.22±14.54	91.58±16.47
BW_6	160.47±16.51	168.02±17.11	172.42±16.35	155.78±17.24	152.54±16.10	154.05±11.822.
ADG_{0-2}	2.32±0.44	2.72±0.42	2.79±0.54	2.34±0.42	2.22±0.54	32±0.67
ADG_{2-4}	5.20±0.66	5.48±0.62	5.60±0.62	5.16±0.40	4.95±0.61	5.11±0.44
ADG_{4-6}	1.42±0.33	1.60±0.55	1.71±0.61	1.45±0.39	1.49±0.45	1.42±0.62
ADG_{0-6}	3.42±0.57	3.74±0.92	3.88±0.92	3.54±0.41	3.40±0.35	3.55±0.41

-Egg production and reproductive traits:

Egg weight (EW) was increased significantly ($P \leq 0.05$) from 10.32g in the first generation to 10.96g after three generations of selection (Table, 10).

ASM was increased significantly ($P \leq 0.05$) from 55.15 day in the first generation to 59.62 day after three generations of selection (Table, 10) while TEN_{10}, TEW_{10} and DEM were decreased significantly ($P \leq 0.05$) from, 54.25egg, 470.25g and 9.40 g/day in the first generation to 50.48 egg, 458.25g and 9.10g/day after three generations of selection (Table, 10). However, reproductive traits: FR% and HA% were decreased significantly ($P \leq 0.05$) from 82.58 and 70.52% in the first generation to 78.69 and 66.21% after three generations of selection (Table, 10), while EEM%, LEM% and TEM% were increased significantly (P≤0.05) from 5.64, 16.35 and 21.99% in the first generation to 6.95, 17.02 and 23.97% after three generations of selection. On the contrary, the corresponding values for the control line among egg production and reproductive traits studied were fluctuated from generation to another with no significant trend (Table, 10). The same trend was observed by **Aboul-Seoud *et al.,* (2009)** when they selected Japanese quail for increased BW_4 and TEW_{10}.

The same trend was observed by **Abdel-Tawab (2006)** when he selected Japanese quail for increased EW. **Aboul-Hassan *et al.*, (1999)** reported negative correlated responses in egg production traits when selection was applied for increase BW_6. However, ASM was significantly (P≤0.05) increased from 45.11 days at the first generation to 49.88 days after three generations and the females of the selected line reached the ASM by 5.71 days later than the control females. While, TEN_{10}, TEW_{10}, DEM were significantly (P≤0.05) decreased from 56.92 eggs, 480.11 g, 9.21 g/day at the first generation to 50.01 eggs, 458.65 g, 7.42 g/day after three generations and the females of selected line produced TEN_{10}, TEW_{10}, DEM lower by 7.16 eggs, 15.22 g, 1.14 g/day than the control females. However, both FRP and HAP% significantly (P≤0.05) decreased from 80.15, 73.91% at the first generation to 72.58, 63.54% after three generations and the females of selected line had lower FRP, HAP% estimates by 6.04, 5.92% than the control females, respectively. When selection was applied for increasing TEN_{10} produced during the first ten weeks of laying. **Aboul-Hassan (2001)** reported positive correlated responses in some egg production traits. However, TEW_{10}, DEM were significantly (P≤0.05) increased from 454.8 g, 8.2 g/day in the first generation to 498.2g, 9.4 g/day, while ASM, BWSM were decreased from 54.2 day, 210.2g in the first generation to 49.8 day, 192.1g after three generations.

Table(11):Actual means and standard deviations for carcass traits studied in both sexes for lines and generations of selection when selection was applied for HFC_{4-6} .

Gen. / Trait	HFC_{4-6}			RBC		
	1	2	3	1	2	3
Meat%	46.24	47.58	49.05	45.98	45.25	46.02
Bone%	8.78	7.76	7.47	7.87	8.78	7.95
Giblets%	14.36	14.94	15.06	14.87	15.05	14.33
Dressing%	60.21	61.47	61.82	60.47	61.22	60.42

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الاستجابة المباشرة والمرتبطة من خلال الإنتخاب لصفة إستهلاك الغذاء فى السمان اليابانى

دياب إبراهيم أبو السعود – محمد منير شعبان مبروك – محمد أبوالحسن أحمد
جمال الدين يوسف عطا الله – مصطفى أبو مسلم فوزى أبو مسلم

قسم الإنتاج الحيوانى – كلية الزراعة – جامعة الأزهر - القاهرة

الملخص العربي

أجريت هذه الدراسة في مزرعة السمان البحثية التابعة لقسم الإنتاج الحيواني - كلية الزراعة – جامعة الأزهر بمدينة نصر - القاهرة في الفترة من يناير ٢٠١٢ إلى أغسطس٢٠١٣م حيث تم إجراء تجربة إنتخاب لصفة إستهلاك الغذاء العالى فى السمان اليابانى لمدة ثلاثة أجيال وقد قسمت الطيور عشوائيا إلى مجموعتين تزاوجيتين:

المجموعة الأولى للإنتخاب لصفة إستهلاك الغذاء العالى (HFC_{4-6}).

المجموعة الثانية لتكوين خط غير منتخب معاصر ومقارن للخط المنتخب (RBC).

تهدف هذه الدراسة إلى قياس الإستجابة المباشرة للإنتخاب لصفة إستهلاك الغذاء العالى وكذلك الإستجابة المرتبطة مع بعض الصفات الإنتاجية والتناسلية.

وقد أوضحت الدراسة النتائج الآتية :

١ـ ازداد معدل استهلاك الغذاء فى الفترة من ٤ـ٦ أسابيع من العمر من ١٠،١٢ جم عند الجيل رقم صفر إلى ١٣،٥٠ جم عند الجيل الثالث من الإنتخاب فى الخط المنتخب لمعدل إستهلاك الغذاء العالى ولم يلاحظ وجود أى زيادة أو نقص فى متوسط معدل إستهلاك الغذاء فى الخط المقارن حيث كان ١٠،١٢ جم فى الجيل الأول و١٢،٢٥ جم فى الجيل الثالث من الإنتخاب.

٢ ـ ازداد معدل إستهلاك الغذاء فى الفترة من ٤ـ٦ أسابيع من العمر بعد ثلاث أجيال من الإنتخاب فى الخط المنتخب لهذه الصفة بمقدار ١٠،٢٠% بالمقارنة بالخط المقارن.

٣ـ انخفض معامل الاختلاف لصفة معدل إستهلاك الغذاء فى الفترة من ٤ـ٦ أسابيع من العمر من ٤٥،٤٥% فى الجيل رقم صفر إلى ٢٣،٧٨% فى الجيل الثالث من الإنتخاب فى الخط المنتخب لوزن البيض الكلى العالى كما إنخفضت قيم معامل الإختلاف فى الخط المقارن من ٤٥،٤٥% فى الجيل رقم صفر إلى ٢٥،٦٣% فى الجيل الثالث.

٤ـ كان تأثير كل من الجيل والخط والجنس على صفة معدل إستهلاك الغذاء فى الفترة من ٤ـ٦ أسابيع من العمر عالى المعنوية بينما لم يكن للآباء والأمهات تأثير معنوى على هذه الصفة .

٥ـ لم يكن هناك اختلافات معنوية بين قيم الفارق الإنتخابى الفعلى والمتوقع خلال الأجيال الثلاثة من الإنتخاب حيث إتفقت قيم الفارق الإنتخابى الفعلى والمتوقع فى الخط المنتخب لصفة معدل إستهلاك الغذاء فى الفترة من ٤ـ٦ أسابيع من العمر حيث كان متوسط هذه القيم ٣،٠٣ و ٢،٨٦ جم لكل جيل كما وجد أيضا أن نسبة الفارق الإنتخابى الفعلى إلى المتوقع كانت أكبر من الوحدة وهذا يعنى أن الإنتخاب الطبيعى يمكن أن يكون له تأثير إيجابى على الإنتخاب لهذه الصفة.

٦ـ كانت الإستجابة الواقعية لفعل الإنتخاب منتظمة فى الخط المنتخب لصفة معدل إستهلاك الغذاء فى الفترة من ٤ـ٦ أسابيع من العمر ٢،٣٣ جم كما كانت الإستجابة المتراكمة لفعل الإنتخاب بعد ثلاثة أجيال من الانتخاب لهذه الصفة ٨،٩١ جم .

٧ـ تم قياس المكافىء الوراثى بعده طرق هى :

أـ مكون التباين الوراثى الأمى وكانت القيم المقاسة للمكافىء الوراثى خلال الأجيال الثلاثة هى ٠،٥٥ و ٠،٤٠ و ٠،٥٠ .

ب ـ مكون التباين الوراثى الأبوى وكانت القيم المقاسة بهذه الطريقة أقل من تلك المقاسة بالطريقة السابقة خلال الأجيال الثلاثة وكانت ٠،٢٨ و ٠،٢٥ و ٠،٢١ .

جـ- مكون التباين الوراثى الأبوى والأمى معا وكانت القيم المقاسة وسط بين تلك القيم المقاسة بالطريقتين السابقتين وكانت ٠،٣٠ و ٠،٢٨ و ٠،٤٠ .

د- كانت قيم المكافىء الوراثى المحقق المقاسة خلال الأجيال الثلاثة هى ٠،٧٧ و ٠،٧٨ و ٠،٧٠ .

٨- بالنسبة للاستجابة المرتبطة مع الصفات الأخرى عند الإنتخاب المباشر لصفة معدل إستهلاك الغذاء فى الفترة من ٤-٦ أسابيع من العمر لوحظ الآتى:

أ – بالنسبة لصفات النمو :

إزداد وزن الجسم عند ٠ و ٢ و ٤ و ٦ أسبوع من العمر من ٨،٩٥ و ٣٦،٥٨ و٩٢،٨٤و١٦٠،٤٧ جم فى الجيل الأول إلى ٩،٧٥ و ٤٣،٠١ و٩٥،٤٥و١٧٢،٤٢ جم فى الجيل الثالث معنويا كما ازداد معدل النمو اليومي في فترات النمو المختلفة من صفر-٢ و ٢-٤ و ٤-٦ و صفر-٦ أسابيع من العمر من ٢،٣٢ و ٥،٢٠ و ١،٤٢ و ٣،٤٠ جم/يوم فى الجيل الأول إلى ٢،٧٩ و ٥،٦٠ و ١،٧١ و ٣،٨٨ جم / يوم فى الجيل الثالث معنويا بينما لم يلاحظ وجود إختلافات معنوية فى أوزان الجسم المقاسة عند الأعمار المختلفة أو معدلات النمو المحسوبة بين فترات النمو المختلفة فى الخط المقارن

ب- بالنسبة لصفات إنتاج البيض والصفات التناسلية : حدثت زيادة معنوية فى وزن البيضة من ١٠،٣٢ جم فى الجيل الأول إلى ١٠،٩٦ جم فى الجيل الثالث كم ازداد عمر الإناث عند النضج الجنسى معنويا من ٥٥،١٥ يوم فى الجيل الأول إلى ٥٩،٦٢ يوم فى الجيل الثالث بينما نقص العدد والوزن الكلى للبيض وكتلة البيض اليومية الناتجة خلال الـ ١٠ أسابيع الأولى من الإنتاج من ٥٤،٢٥ بيضة و ٤٧٠،٢٥ جم و ٩،٤٠ جم / يوم فى الجيل الأول إلى ٥٠،٤٨ بيضة و ٤٥٨،٢٥ جم و ٩،١٠ جم / يوم فى الجيل الثالث معنويا كما نقصت النسبة المئوية لكل من الخصوبة والفقس من ٨٢،٥٨ و٧٠،٤٢ % فى الجيل الأول إلى ٧٨،٦٩ و ٦٦،٢١% فى الجيل الثالث معنويا بمقدار ٤،١٠ و ٣،٥٢% بينما ازدادت النسبة المئوية للأجنة النافقة فى المرحلة المبكرة والمتأخرة والكلية من التحضين معنويا من ٥،٦٤ و ١٦،٣٥ و ٢١،٩٩% فى الجيل الأول إلى ٦،٩٥ و ١٧،٠٢ و ٢٣،٩٧% فى الجيل الثالث بينما لم يلاحظ وجود اختلافات معنوية فى النسبة المئوية لكل من الخصوبة والفقس فى الخط المقارن.

جـ - بالنسبة لصفات الذبيحة

ازدادت النسبة المئوية لكل من اللحم والأجزاء المأكولة من الذبيحة والتصافى معنويا من ٤٦،٢٤ و ١٤،٣٦ و ٦٠،٢١% فى الجيل الأول إلى ٤٩،٠٥ و ١٥،٠٦ و ٦١،٨٢% فى الجيل الثالث بينما نقصت النسبة المئوية للعظم معنويا من ٨،٧٨% فى الجيل الأول إلى ٧،٤٧% فى الجيل الثالث بينما لم يلاحظ وجود اختلافات معنوية فى النسبة المئوية لكل من اللحم والعظم والأجزاء المأكولة من الذبيحة والتصافى فى الخط المقارن.