

STUDIES OF SOME PERFORMANCE AND BLOOD CONSTITUENTS TRAITS IN JAPANESE QUAIL

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Abstract: *The Present experiment was conducted at to determine the relationship between the body weight at six week of age , performance traits and blood constituents traits of Japanese quail.*

Data on 2654 females and males of Japanese quails at 6-wk of age were used. The females and males were classified according to their BW at 6-wk of age ($X \pm 1$ SD); into three category groups being low body weight averaged (125.35 and 106.98 g.), medium body weight (176.17 and 161.95 g.) and high body weight (217.96 and 197.40 g.) for females and males , respectively. Eggs were recorded daily and weighted throughout the first 90 days after sexual maturity. By the end of the first 90 days of egg production, three consequent fresh eggs were taken from each hen , separately measured for determinate egg quality traits. Blood samples were obtained at 6 weeks of age, at the peak and at the end of 90 days of egg production.

The data were statistically analyzed, discussed and the main results and conclusions are summarized in the following points:-

- 1. Body weight at 6 wk of age was significant different for females and males among the three studied groups.*
- 2. The low BW group at 6-wk of age delayed age at sexual maturity (60.46 d), on the other hand, high BW group matured early at 49.45 d.*
- 3. The mean body weight at sexual maturity were 230.62, 242.47 and 248.62 g. for low, medium and high group respectively with a significant difference between the three studied groups.*
- 4. The high BW group had matured early, high BWSM, increasing in EN, EP, EW and EM than the other groups.*
- 5. The overall means of egg quality traits SI, IQU, YI and ST among the three studied groups were 78.5 %, 70.5, 0.47 and 0.30 mm respectively with significantly differences for IQU only.*

6. The low BW group had significantly higher estimates for Glu. and Ca than the medium and high BW groups (192.47 vs. 190.60 & 187.62 mg/dl) and (16.81 vs. 15.96 and 15.73 mg/dl), respectively, while medium BW group had significantly higher estimates for Cho. and IP concentration than the low and high BW groups (152.71 vs. 146.87 & 149.44 mg/dl) and (7.16 vs. 6.71 and 6.73 mg/dl), respectively also high BW group had significantly higher estimates for TP (3.96g/dl) than the medium and low BW groups (3.69 & 3.75 g/dl).

In conclusion, body weight at 6-wk of age and egg production traits in Japanese quail were correlated with some blood constituents, which were plasma glucose, cholesterol and calcium concentration. Also, heavy body increased total egg production and egg weight.

INTRODUCTION

Japanese quail originally domesticated around the 11th century as a pet song bird (Howes, 1964), has gained in value as a food animal since (Kayang *et al.*, 2004). Quail industry has been developed in recent years in many countries such as Japan, France and Italy, for both meat and egg production (Risse, 1980). Egg production is important in Japan and Southeast Asia, while meat is the main product in Europe (Minvielle, 1998). Also, quail is considered a good economical source for producing animal protein (Singh *et al.*, 1981).

Traditionally, the Japanese quail in Egypt are seasonal game bird because of their annual latitudinal migration, pass twice through Egypt, once in fall and another in the spring. Nowadays, Japanese quail become widely distributed in Egypt as a source of meat production since their meat and eggs have become highly popular to the consumers. On the other hand blood biochemical traits could be important as indicator traits in breeding for high productivity (Obeidah *et al.*, 1978). The level of several blood constituents is quite different in female birds when various reproductive states are compared (Bacon *et al.*, 1980). The important position of glucose in metabolism has led many workers to suggest that levels of blood sugar may be a factor controlling food-seeking behaviors (Richardson, 1970). The highest glucose concentration was reported by Poyraz (1988) for the Japanese quail of 380.4 mg/dl whereas, Moawad (2002) and Abdel Magid (2006) reported the lowest glucose concentration of 89.02 mg/dl for the Dandarawi hens at 8 wk of age, the same value was reported for the Fayoumi hens at the peak. Several investigators reported within breed or strain variability for T.P concentration ranged from 5.57 to 7.37 g/dl in Golden Montazah (Abdel Latif, 2001 and Moawad, 2002), 4.22 to 5.30

g/dl in Alexandria (**El-Dlebs hany et al., 2009**) and 1.88 to 5.16 g/dl in Japanese quail by **EL-Sebai et al., 2002; 2006; and Avci et al., 2007**).

In Japanese quail the cholesterol concentration ranged from 110.77 to 414.18 mg/dl as reported by **Özbey et al., 2004; ; El-Ghalid, 2005; Abdel Fattah, 2006 and Avci et al., 2007**). **Alm El-Dein et al. (2008)** reported that blood Ca concentration ranged from 8.78 to 10.59 mg/dl for Dokki-4. A wide range has been reported in Japanese quail for Ca concentration from 7.08 to 18.51 mg/dl by (**Abdel Fattah, 2006 and Avci et al., 2007**).

The main objective of this study was to study the performance (growth and egg production traits) and some plasma constituents of Japanese quail.

MATERIALS AND METHODS

The present experiment was conducted at the Poultry Research Center, Poultry Production Department, Faculty of Agriculture, Alexandria University, during 2007 to 2008 to study the relationship between the productive traits and some blood constituents in Japanese quail.

A number of 300 families and 150 males were used to produce progeny (two females were randomly assigned to each male) , five biweekly hatches were taken during the period from October to December. The chicks were marked by wing-banded at hatch day. The chicks were brooded on floor brooders at a starting temperature of 38⁰ C for the first wk after hatching, and then decreased 2-3⁰ C each wk thereafter. At 5 weeks of age, the sexing was done and then the birds were moved to the laying cages, At 6 weeks of age the birds weighted and classified according their average weight plus or minus one unit of the standard deviation with each sex separately ($X \pm$ one unit S.D.); the overall average of body weight for females and males were 174.3 \pm 29.7 g. and 170.2 \pm 29.1 g., respectively. The numbers, ranges and least square means of the three categories for each sex are shown in **Table (1)**.

Table (1): The numbers, ranges, least square means, standard errors and probability for each group for body weight at 6 weeks of age (g) of Japanese quail females and males.

Groups of BW at 6-wk	Females				Males			
	N	Range		Mean $\bar{X} \pm S.E$	N	Range		Mean $\bar{X} \pm S.E$
		Min.	Max.			Min.	Max.	
Low	237	60	144	125.35 ^c ± 1.65	93	50	124	106.98 ^c ± 2.16
Medium	1049	145	174	176.17 ^b ± 0.63	595	125	170	161.95 ^b ± 0.91
High	217	175	265	217.96 ^a ± 1.05	463	171	238	197.40 ^a ± 0.73
Overall mean	1503			174.24	1151			170.20
probability				0.001				0.001

Means having the different small or capital letters are significantly different ($P \leq 0.05$).

Birds were fed ad. libitum with diet contained 24.03% crude protein and 2896 K.Cal.ME until 5 weeks of age , then introduced to a diet contained 20.06% crude protein and 2901K.Cal.ME during the production period. No significant changes have been done in feed and management through the experimental period.

The data of the first egg was recorded for each female. Eggs were recorded daily and weighted throughout the first 90 days after sexual maturity. By the end of the first 90 days of egg production, three consequent fresh eggs were taken from each hen , separately measured for shape index , then broken and the internal contents were placed on a leveled glass surface to determine albumen and yolk heights. Shell thickness was also measured.

Blood samples were obtained at 6 weeks of age, at the peak and at the end of 90 days of egg production. About 1-3cm³ of blood from each female were taken at 9.00 am before feeding, around 100 samples from each the low and high groups, and 200 samples from the medium group in each period of measurements. The blood samples were collected in to dry clean centrifuge tubes containing heparin and immediately centrifuged at 3000 rpm for 20 minutes. The clear plasma samples were carefully drawn and transferred to epindorf tubes and stored at -20°C in the deep freezer until the time of chemical determinations. The biochemical characteristics of blood were determined calorimetrically on **Jenway 6100** spectrophotometer using **EMABOL** commercial kits and diagnostic examinations. Plasma glucose, cholesterol, calcium concentration, , total protein and inorganic phosphorus concentrations were measured by the method of **Jakubowski et al.(1996)**.

Studied traits:-

1. Body weight for each sex in grams at 2 and 6 wks of age.

2. Relative growth rate was calculated as follows:

$$\text{R.G.R} = \frac{W_2 - W_1}{1/2 (W_2 + W_1)} * 100$$

Where: $W_1 = \text{BW 2-wk}$ $W_2 = \text{BW 6-wk}$

3. Age at the first egg in days (AFE).

4. Body weight at sexual maturity in grams (BWSM).

5. Egg number (EN) during the first 90 days of egg production.

6. Rate of egg production (%) during the first 90 days of egg production.

7. Average egg weight (EW) during the first 90 days of egg production.

8. Egg mass (EM) from maturity up to 90 days of egg production.

9. Shape index (SI,%) was calculated according to **Romanoff and Romanoff (1949)**.

10. Yolk index (YI): was estimated by dividing the height of yolk on its diameter, as reported by **Funk (1948)**.

11. International quality unit (IQU): quality unit for quail eggs was established by **Kordaiah et al.(1983)** to replace the haugh unit and was calculated:

$$\text{IQU} = 100 \text{ Log } (H + 4.18 - 0.8989W^{0.6674})$$

Where: H= Albumen high, mm

W= Egg weight, gm

4.18, 0.8989 and 0.6674 are constants

12. Shell thickness (ST,mm): was determined with shell membranes by using a micrometer screw gauge

The following traits were determined for the blood plasma constituents:

1-Glucose concentration (Glu, mg/dl).

2- Total protein concentration (TP, g/dl).

3- Cholesterol concentration (Cho, mg/dl).

4- Calcium concentration (Ca ,mg/dl).

5- Inorganic phosphorus concentration (IP, mg/dl).

Data were analyzed using (SAS, 2005) for statistical analysis program. All percentage data were transformed to their corresponding arcsin angles according to **Snedecor and Cochran (1981)** before analysis. The significant tests for the differences between each two means for any studied trait were done according to **Duncan's multiple rang test (1955)**.

RESULTS AND DISCUSSION

Growth traits:

Least-squares means for 2 and 6 wks BW and G.R during 2 – 6 wks of age for females and males Japanese quail of the three studied groups are presented in **Table (2)**. The average of 2-wk BW were 44.91, 61.33 and 77.91 g. for females, the corresponding values were 39.37, 52.11 and 69.22 g. for males in the low, medium and high studied groups, respectively. The overall mean for 2-wk BW was 59.73 g. These values were nearly equal with finding by **El-Full *et al.*(2001)** and **Abdel-Fattah *et al.*(2006)**. Whether for, females and males quails of the high group of BW had higher 2-wk BW and the differences among groups, sex and interaction were highly significant ($P \leq 0.001$).

The overall mean for 6-wk BW of females and males were 174.24 and 170.20 g., respectively. Also, the overall mean for all population was 172.72 g. These values are nearly equal with finding by **El-Full *et al.*(2001)**; **Abdel-Fattah *et al.*(2006)** and **Badawy (2008)**.

Also the differences among all sources of variance studied were highly significant ($P \leq 0.01$), These results are in agreement with finding by (**Wilson *et al.*,1961**; **Bahie El-Deen, 1999**; **El-Full *et al.*, 2001**; and **Badawy, 2008**) who indicated that BW for females quail being heavier than males at 42-d.

However, **Caron *et al.*(1990)** indicated that females grow faster and yielded larger muscles and more abdominal fat than males at the same age. As for the differences among the three studied groups at 2 and 6 wk of age, it is clearly shown that high BW group was significantly heavier than the other studied groups.

The general mean of G.R during 2-6 wk of age were 93.44, 99.77 and 95.41 % for low, medium and high BW , respectively (Table 2). These results agreed with those obtained by **Shalan (1998)** and **Badawy (2008)**.

Egg production traits:

Least-squares means of age at first egg and BWSM among the three studied groups, are presented in **Table (3)**. The means for low, medium and high BW groups for AFE were 60.64, 53.73 and 49.45-d, respectively. While the overall mean of AFE was 53.48-d. The differences between the studied groups were significant. These results are in agreement with the corresponding values reported by (**Kosba *et al.*,2002; Debes, 2004 and Meki, 2007**), also it were found to be disagree with those obtained by **Nofal (2006)**.

In conclusion the results revealed that low group of BW had matured later than those of medium and high groups, the delay in AFE in low group may due to the delay in sex organs development. On the other word, heavy female was matured earlier than the light female. This result was in agreement with **Meki (2007)** who indicated that small body weight birds delayed age at sexual maturity; on the other hand, early sexual maturity birds had heavies' body weight.

Least-squares means for BWSM for low, medium and high groups of BW were 230.62, 242.47 and 248.62 g., respectively (**Table 3**). The differences among groups of BWSM were statistically significant ($P \leq 0.05$) with the increase of BWSM with decreasing ASM. Generally, the results revealed that high group of BW was heavier BWSM of Japanese quail than the other groups. This result is in agreement with (**Bahie El-Deen, 1994; Shalan, 1998 and Kosba *et al.*, 2003**), who indicated that improving BW at 6-wk of age had positive effect on increasing BWSM. These results cleared that the females (hens) of Japanese quail lay eggs when it will be optimum body weight, above 230 g. at least regardless age at sexual maturity.

Least-squares means of egg number (EN) and egg production (EP) during the first 90-d of laying for the three experimental groups, are presented in **Table (4)**. The results showed an increase in EN for high group of BW than medium and low groups (64.21 vs. 49.92 and 60.76) with highly significant differences ($P \leq 0.001$) between groups. May be that is due to the effect of earlier maturity on increase the length of laying cycle and/or the increase in clutch size. These results are in agreement with finding by **Shalan (1998) and Meki (2007)**.

The overall mean for EP rate was 67.15 % and the differences among the three studied groups were highly significant ($P \leq 0.001$). Higher EP % to 90 d of age ranged from 69.2 to 94.4% reported by (**Charappa *et al.*, 1993**

and Meky, 2007), while the lowest EP % ranged from 36 to 65% reported by **(Bahie El-Deen and Shalan, 2005)**.

Least square means for egg weight (EW) and egg mass during the first 90-d of laying by groups are shown in **Table (5)**. The mean of EW during the 90 d of laying was 10.69, 11.09 and 11.16 g. for low, medium and high groups of BW, respectively and the differences among the three studied groups were highly significant ($P \leq 0.01$). These results indicated that EW for high and medium BW groups was heavier than low BW group. Similar results were reported by **Nestor *et al.* (1996a) ; Kosba *et al.* (2002) and (2003)** . While, **Marks (1979)** showed that EW increased but not in proportion to the increase in BW. In conclusion, improving BW of 6 wk of age had positive effect on EN and EW in Japanese quail **(Meky, 2007)**.

The high group of BW produced heavier EM than the medium and low groups (713.76 vs. 671.26 and 536.96). Results indicated that EM was linearly increased with increasing of BW at 6 wk of age and this resulted was related decrease in EN . These results indicated that, Japanese quail with heavy BW at 6 wk of age matured earlier and produced heavier EM than the other groups with matured later. These results are in line with thus of **Debes (2004) and Meki (2007)**.

Generally, genetic factors which increase in body weight were associated with increase egg weight and mass as shown by **Nestor *et al.*(1996)**.

Egg quality traits:

Least-squares means of egg shape index, international quality unit, yolk index and shell with membrane thickness (mm) among the three studied group, are presented in **Table (6)**. Generally, the differences among the three studied groups for egg quality traits were non-significant except IQU was significant ($P \leq 0.05$).

The overall mean of SI was 78.5% for the three studied groups. This result was around the values with the results obtained on quails by **Navarro and Murillo (1976); Bahie El-Deen (1991) and El-Nagar *et al.*(2007)**.

The overall mean of IQU was 70.5 while, the overall mean of YI was 0.47 % for the three studied groups. These results were around the values with the results obtained on quails by **Shalan (1998) and El-Ghalid (2005)**. The overall mean of ST was 0.30 mm for the three studied groups. This result is in agreement with values reported by **Abdel-Hakim *et***

al.(2005) and higher estimates than reported by **Bahie El-Deen (1991); Shalan (1998) and El-Ghalid (2005).**

Blood constituents:

Least-squares means of glucose concentration (Glu.), mg/dl for the three studied groups during different periods, are presented in **Table (7)**. the differences among groups, periods and interactions were significant ($P \leq 0.001$). The highest Glu. concentration was shown at 13 wk of age (peak of egg production) 197.36 mg/dl, however the lowest concentration was found at the end of 90 d of egg production 183.62 mg/dl. These values was higher estimates than those reported by **(Poyraz, 1988 and Abaza, 2002)** and nearest with values estimated by **El-Ghalid (2005)** in Japanese quail and **Obeidah *et al.*(1978)** in Fayoumi chicken .

Furthermore, Glu concentration in the high BW group decreased through the periods of measurement during the egg production, so the high egg producing hens had lower plasma Glu. in agreement with results found by **Kalamah (1995)**. According to **Sturkie (1976)**, age and state of egg production affect the blood glucose.

Least-squares means of total protein (TP), g/dl for the three studied groups during different periods, are presented in **Table (8)**. The differences among groups and periods were highly significant at ($P \leq 0.01$).

The results showed that the high BW group had the highest TP concentration than the medium and low groups were (3.96 vs. 3.69 and 3.75 g/dl). TP concentration had a constant trend which decreases with increasing in the age of measurement, however the highest TP concentration was obtained at 6 wk of age (4.50 g/dl) and the lowest TP concentration was obtained at the end of 90 d of egg production (3.22 g/dl).

These results in agreement with **Moawad (2002)** in Danadarawi and Golden Montazah and with **Abdel Magid (2006)** in Fayoumi chicken, who indicated that the age of measurements significantly affected on TP concentration. Also, these values were around the range with finding in Japanese quail by **Poyraz (1988); El-Sebai *et al.*(2002) and El-Ghalid (2005)**.

Least-squares means of cholesterol (Cho.) concentration (mg/dl) for thee three studied groups during different periods, are presented in **Table (9)**. The differences among groups were significant ($P \leq 0.05$) and highly significant among periods.

The Cho. concentration for the low, medium and high BW groups were 146.87, 152.71 and 149.44 mg/dl, respectively. On the other hand the highest Cho. concentration was at 6 wk of age 154.65 mg/dl, while the lowest concentration was at 13 wk of age (peak of egg production) 146.83 mg/dl. These results in agreement with **El-Ghalid (2005)** for Japanese quail and **Abdel-Magid (2006)** for Fayoumi chicken, who reported the same trend for Cho. concentration during the periods of measurement .

Generally, the results showed that the Cho. concentrations decreased at 13 wk of age (peak of egg production) in compared with the other periods of measurement in agreement with **Mady (1990)** who explained that the decrease in serum Cho. As egg production level increased may be due to a Cho. shift from the blood to the ovarian tissue for egg yolk formation. The magnitude of such a trend appears to be a metabolic phenomenon, but to a continuous serum Cho. supply which may replenish losses due to egg production.

Least-squares means of calcium (Ca) concentration, mg/dl for the three studied groups during different periods, are presented in **Table (10)**. Highly significant differences ($P \leq 0.001$) for all source of variances.

The low BW group had the highest Ca concentration than the medium and high groups were (16.81 vs. 15.96 and 15.73 mg/dl. While Ca concentration was high at 6 wk of age (18.93 mg/dl) and low at the end of 90 d of egg production (12.52 mg/dl) also, the results showed that Ca concentration decreased with increasing of age of measurements in agree with **Bar *et al.*, (1978)** and **El-Ghalid (2005)** who confirmed that the lowering in serum Ca concentration after hens sexual maturity may refer to enhancement of Ca metabolism, which necessary for egg shell formation.

Ghany *et al.*, (1961) indicated that Ca level decreased in accordance with the increase of egg number, there was a significant negative correlation between these two variables in Rod Island Red. But the results were disagree with finding by **El-Sebai *et al.*(2002)** . As for the differences among the three studied groups it is clearly that Ca concentration negatively affected higher performance.

Least-squares means of inorganic phosphorus (IP) concentration, mg/dl for the three studied groups during different periods, are presented in **Table (11)**. The medium BW group had the highest IP concentration than the low and high groups were (7.16 vs. 6.71 and 6.73 mg/dl. While IP concentration was high at the end of 90 d of egg production (8.34 mg/dl) and low at the 6 wk of age (5.92 mg/dl) also, the results showed that IP

concentration increase with decreasing of age of measurements in reverse of Ca. The same trend for IP concentration was found in Fayoumi hens by **Abdel Magid (2006)** who indicated that IP concentration increased at the peak of egg production and decreased at the age before that. Also, these results were around the values finding by **El-Sebai *et al.* (2002)** and **Abdel Fattah (2006)** in Japanese quail and by **Abdel Magid (2006)** in Fayoumi hens.

Table (2): Least squares means (X) and standard errors (S.E), for body weight (g.) at 2 and 6 weeks and growth rate during 2 to 6 of age for three groups of Japanese quail females and males.

Groups	X ± SE		Overall mean
	Females	Males	
	BW2		
Low	44.91 ^e ± 1.21	39.37 ^f ± 2.24	43.52 ^C
Medium	61.33 ^c ± 0.60	52.11 ^d ± 0.91	58.36 ^B
High	77.91 ^a ± 1.27	69.22 ^b ± 0.94	72.65 ^A
Overall mean	61.21 ^A	57.31 ^B	59.73
	BW6		
Low	125.35 ^e ± 1.65	106.98 ^f ± 2.16	120.76 ^A
Medium	176.17 ^c ± 0.63	161.95 ^d ± 0.91	171.59 ^B
High	217.96 ^a ± 1.05	197.40 ^b ± 0.73	205.50 ^C
Overall mean	174.24 ^A	170.20 ^B	172.72
	2-6wk		
Low	94.49 ^d ± 0.47	92.39 ^e ± 0.99	93.44 ^C
Medium	96.71 ^c ± 0.27	102.63 ^c ± 0.20	99.77 ^B
High	94.67 ^a ± 0.17	96.15 ^b ± 0.13	95.41 ^A
Overall mean	95.29	97.06	96.18

Means having the different small or capital letters are significantly different (P≤0.05)

Table (3): Least squares means (\bar{X}) and standard errors (S.E), for age at first egg (AF E) (days) and body weight at sexual maturity (BWSM) (g.) until 90 days after sexual maturity three groups of Japanese quail females.

Groups	X ± SE	
	AFE	BWSM
Low	60.46 ^a ± 4.14	230.62 ^b ± 6.84
Medium	53.73 ^{ab} ± 1.48	242.47 ^{ab} ± 2.18
High	49.45 ^b ± 2.82	248.62 ^a ± 3.88
Overall mean	53.48	242.64

a, b and c means with different superscripts are significantly different (P ≤ 0.05)

Table (4):Least squares means (X) and standard errors (S.E), for egg number (EN) and egg production (EP %) until 90 days of egg production percentage in three groups of Japanese quail females.

Groups	X ± SE	
	EN	EP%
Low	49.92 ^c ± 2.19	55.46 ^c ± 2.45
Medium	60.76 ^b ± 0.76	67.52 ^b ± 0.84
High	64.21 ^a ± 1.56	71.09 ^a ± 1.69
Overall mean	60.84	67.15

a, b and c means with different superscripts are significantly different (P ≤ 0.05)

Table (5): Least squares means (\bar{X}) and standard errors (S.E), for egg weight (Ew) and egg mass (EM) per (g.) until 90 days of egg production in three groups of Japanese quail females.

Groups	X ± SE	
	EW	EM
Low	10.69 ^b ± 0.11	536.96 ^b ± 23.39
Medium	11.09 ^a ± 0.04	671.26 ^a ± 8.94
High	11.16 ^a ± 0.08	713.76 ^a ± 18.37
Overall mean	11.07	667.74

^{a, b and c} means with different superscripts are significantly different (P≤0.05)

Table (6): Least squares means (X) and standard errors (S.E), for the egg quality traits, shape index (SI %), international quail unit (IQU) index (YI) and shell with membrane thickness (ST,mm) at the end of 90 egg production in three groups of Japanese quail females.

Groups	X ± SE			
	SI	IQU	YI	ST
Low	77.6 ± 0.61	77.8 ^a ± 2.19	46.22 ± 0.16	0.32 ± 0.02
Medium	78.7 ± 0.49	70.2 ^{ab} ± 1.81	49.68 ± 6.69	0.29 ± 0.01
High	78.3 ± 1.20	65.8 ^b ± 4.39	47.93 ± 0.18	0.31 ± 0.03
Overall mean	78.5	70.5	47.94	0.30

^{a, b and c} means with different superscripts are significantly different (P≤0.05)

Table (7): Least squares means (\bar{X}) and standard errors (S.E), for glucose concentration (Glu, mg/dl) at 6 & 13 weeks of age and at the end of 90 days of egg production in three groups of Japanese quail females.

Groups	$\bar{X} \pm SE$			Overall mean
	6 weeks	13 weeks	end of 90 days of egg production	
Low	178.10 ± 3.77 ^d	205.22 ± 5.02 ^a	193.20 ± 4.24 ^{bc}	192.47 ^A
Medium	190.96 ± 2.05 ^{bc}	196.32 ± 2.61 ^{ab}	184.09 ± 1.65 ^{cd}	190.60 ^B
High	196.96 ± 3.61 ^{ab}	193.03 ± 5.21 ^{bc}	174.68 ± 3.14 ^d	187.62 ^C
Overall mean	189.73 ^B	197.36 ^A	183.62 ^C	190.35

Means having the different small or capital letters are significantly different ($P \leq 0.05$)

Table (8): Least squares means (\bar{X}) and standard errors (S.E), for plasma total protein concentration (TP,g/dl) at 6 &13 weeks of age and at the end of 90 days of egg production in three groups of Japanese quailfemales.

Groups	$\bar{X} \pm SE$			Overall mean
	6 weeks	13 weeks	end of 90 days of egg production	
Low	4.37 ± 0.09 ^b	3.82 ± 0.10 ^c	3.03 ± 0.02 ^f	3.75 ^B
Medium	4.43 ± 0.07 ^b	3.48 ± 0.06 ^d	3.22 ± 0.03 ^{ef}	3.69 ^B
High	4.83 ± 0.12 ^a	3.75 ± 0.09 ^c	3.38 ± 0.06 ^{ed}	3.96 ^A
Overall mean	4.50 ^A	3.59 ^B	3.22 ^C	3.57

Means having the different small or capital letters are significantly different ($P \leq 0.05$)

Table (9): Least squares means (\bar{X}) and standard errors (S.E), for cholesterol concentration (Cho.,mg/dl) at 6 & 13 weeks of age and at the end of 90 days of egg production in three groups of Japanese quail females.

Groups	$\bar{X} \pm \text{SE}$			Overall mean
	6 weeks	13 weeks	end of 90 days of egg production	
Low	148.82 ± 3.28 ^{ab}	145.55 ± 3.33 ^b	146.31 ± 3.36 ^b	146.87 ^B
Medium	157.47 ± 1.94 ^a	148.23 ± 2.03 ^{ab}	153.10 ± 1.90 ^{ab}	152.71 ^A
High	151.26 ± 5.01 ^{ab}	142.78 ± 4.23 ^b	152.73 ± 3.15 ^{ab}	149.44 ^{AB}
Overall mean	154.65 ^A	146.83 ^B	151.86 ^A	151.01

Means having the different small or capital letters are significantly different ($P \leq 0.05$)

Table (10): Least squares means (\bar{X}) and standard errors (S.E), for calcium concentration (Ca, mg/dl) at 6 & 13 weeks of age and at the end of 90 days of egg production in three groups of Japanese quail females.

Groups	$\bar{X} \pm \text{SE}$			Overall mean
	6 weeks	13 weeks	end of 90 days of egg production	
Low	18.29 ± 0.25 ^b	18.45 ± 0.36 ^b	13.40 ± 0.42 ^d	16.81 ^A
Medium	19.00 ± 0.19 ^{ab}	16.67 ± 0.16 ^c	12.37 ± 0.14 ^e	15.96 ^B
High	19.32 ± 0.33 ^a	16.13 ± 0.26 ^c	12.23 ± 0.23 ^e	15.73 ^B
Overall mean	18.93 ^A	16.90 ^B	12.52 ^C	16.07

Means having the different small or capital letters are significantly different ($P \leq 0.05$)

Table (11): Least squares means (\bar{X}) and standard errors (S.E), for inorganic phosphorous concentration (IP, mg/dl) at 6 & 13 weeks of age and at the end of 90 days of egg production in three groups of Japanese quail females.

Groups	$\bar{X} \pm SE$			Overall mean
	6 weeks	13 weeks	end of 90 days of egg production	
Low	5.63 ± 0.15^f	6.21 ± 0.13^d	8.40 ± 0.13^a	6.71^B
Medium	6.06 ± 0.09^{ed}	6.91 ± 0.09^c	8.45 ± 0.07^a	7.16^A
High	5.78 ± 0.17^{ef}	6.28 ± 0.18^d	7.95 ± 0.13^b	6.73^B
Overall mean	5.92^C	6.66^B	8.34^A	6.99

Means having the different small or capital letters are significantly different ($P \leq 0.05$)

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الملخص العربي

دراسة بعض الصفات الإنتاجية و مكونات الدم في السمان الياباني

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أجريت هذه الدراسة بمركز بحوث الدواجن - قسم إنتاج الدواجن - كلية الزراعة - جامعة الإسكندرية خلال الفترة 2007 إلى 2008. وذلك لدراسة العلاقة بين بعض مكونات بلازما الدم وبعض الصفات الإنتاجية في السمان الياباني.

تم تسجيل بيانات الأوزان فردياً لعدد 2917 سمانة :- تم حساب وزن الجسم عند عمر 6 اسابيع عمر لهم حيث قسمت الذكور و الإناث إلى 3 مجاميع تجريبية (المتوسط \pm وحدة إنحراف قياسي) المجموعة منخفضة في وزن الجسم 125.35 و 106.98 جم، والمجموعة متوسطة وزن الجسم 176.17 و 161.95 جم، والمجموعة مرتفعة وزن الجسم 217.96 و 197.40 جم لكلا من الذكور و الإناث على الترتيب.

تم تحليل البيانات إحصائياً ولخصت النتائج فيما يلي:-

- 1- وزن الجسم عند 6 اسابيع من العمر كان مرتفع المعنوية لصالح الأناث عن الذكور خلال الثلاث مجموعات المدروسة.
 - 2- المجموعة المنخفضة في وزن الجسم حدث لها تأخر في عمر البلوغ (60.64 يوم) على العكس من المجموعة المرتفعة في وزن الجسم التي بلغت مبكراً (49.45 يوم).
 - 3- متوسط وزن الجسم عند البلوغ كان 230.62 و 242.74 و 248.62 يوم للثلاث مجموعات المنخفضة و المتوسطة و المرتفعة في وزن الجسم على الترتيب .
 - 4- المجموعة المرتفعة في وزن الجسم سجلت أعلى قيم لصفات إنتاج البيض، حيث بلغت مبكراً و أعطت أعلى وزن عند البلوغ الجنسى بالإضافة الى الزيادة في عدد البيض و إنتاج البيض و وزن البيض و كتلة البيض بالمقارنة بالمجموعتين الأخرتين.
 - 5- المتوسط العام لصفات جودة البيض و هي معامل شكل البيضة و الوحدات الدولية للبياض و معامل الصفار و سمك القشرة للمجموعات الثلاثة المدروسة كانت 78.5% و 70.5 و 0.47 و 0.30 ملليمتر على الترتيب. و لم يكن للمجموعات الثلاثة المدروسة أى تأثير على صفات إنتاج البيض بخلاف الوحدات الدولية للبياض حيث كانت الإختلافات عند مستوى معنوية (0.05).
 - 6- المجموعة المنخفضة الوزن كانت اعلى معنويًا لتركيز الجلوكوز و الكالسيوم بالمقارنة بالمجموعة المتوسطة و العالية الوزن (192.47 مقابل 190.60 و 187.62 مجم/ديسيليتير) على الترتيب، بينما كانت المجموعة المتوسطة الوزن هي التي كانت أعلى معنويًا لتركيز الكوليسترول و الفسفور الغير عضوى (152.71 مقابل 146.87 و 149.44 مجم/ديسيليتير) و (7.16 مقابل 6.71 و 6.73 مجم/ديسيليتير) على الترتيب، و كانت المجموعة المرتفعة في الوزن هي الأعلى معنويًا في تركيز البروتين الكلى (3.96 جم/ديسيليتير) بالمقارنة بالمجموعة المتوسطة و المنخفضة في وزن الجسم (3.69 و 3.75 جم/ديسيليتير).
- بوجه عام وزن الجسم عند عمر 6 أسابيع و صفات إنتاج البيض في السمان اليابانى ترتبط بعلاقات مع بعض مكونات بلازما الدم (الجلوكوز و الكوليسترول و الكالسيوم) و أيضا زيادة وزن الجسم تزيد من إنتاج البيض الكلى و وزن البيض.