

## **GROWTH PERFORMANCE AND NATURE OF GROWTH OF JAPANESES QUAIL AS AFFCTED WITH DIETARY ENERGY SOURCES, LEVELS AND AGE UNDER THE EGYPTION ENVIROMENTAL CONDITION**

By

**N. F. Abdel-Hakim, Abdel-Hady, A.Amer; Abdel-Azeem F. Abdel-Azeem and G. A. Abdel-Hafez**

Faculty of Agriculture, Al-Azhar University, Naser City, Cairo, Egypt.

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**Abstract:** *The present study was carried out at the Poultry Experimental Unit, belonging to Department of Animal Production, AL-Azhar University, Cairo, Egypt, during the period from 1/1/2008 to 12/2/2008 in order to investigate growth performance and nature of growth of japanese quail as affected by dietary energy source, levels and age. A total number of 1080 unsexed one day old japanese quail chicks were randomly distributed into 9 dietary treatment groups. The nine treatment groups represented three dietary energy sources (carbohydrates, plant oil and animal fats) within each three energy levels (2600, 2900 and 3200 Kcal ME/Kg) were tested. Each dietary treatment was represented in triplicates. The experimental diets were formulated to contain 24% crude protein each with one of the tested energy levels. Experimental diets and drinking water were offered ad libitum and the experiment lasted 6 weeks after start. The following treatment groups are tested for source carbohydrates ( $S_1$ ), plant oil ( $S_2$ ) and animal fats ( $S_3$ ) and for energy levels ( $L_1$ ), ( $L_2$ ) and ( $L_3$ ) represented the energy levels 2600, 2900 and 3200 Kcal ME /Kg. The resulting treatments groups are  $S_1L_1$ ,  $S_1L_2$ ,  $S_1L_3$ ,  $S_2L_1$ ,  $S_2L_2$ ,  $S_2L_3$ ,  $S_3L_1$ ,  $S_3L_2$  and  $S_3L_3$  respectively. Results obtained are summarized in the following:*

*1-The highest ( $P<0.05$ ) average final weights at 6 weeks of age was recorded by the  $S_2L_2$  group, while the lowest ( $P<0.05$ ) values were recorded by  $S_1L_1$ ,  $S_1L_2$ ,  $S_2L_1$  and  $S_3L_1$  groups. Regardless of energy level tested plant oil groups recorded the highest ( $P<0.05$ ) final weights followed in a significant decreasing order by animal fat and carbohydrates, respectively. Both energy levels 2900 and 3200 Kcal ME/Kg recorded significantly higher final weights compared to the lowest level, regardless of energy source.*

2-The best feed conversion ratio ( $P<0.05$ ) was recorded by the both  $S_2L_3$  and  $S_3L_3$  groups, while the worst ones were recorded by the  $S_1L_1$ ,  $S_1L_2$  and  $S_3L_1$  groups. Regardless of energy levels tested both plant oil and animal fat groups recorded the best FCR compared to carbohydrates. Also, the best ( $P<0.05$ ) FCR was recorded by the highest energy levels tested followed in an increasing significant order by the 2900 and 2600 Kcal ME/Kg, respectively, regardless of energy source tested.

3-The best energy conversion ratio ( $P<0.05$ ) were recorded by the  $S_2L_2$ ,  $S_2L_3$ ,  $S_3L_2$  and  $S_3L_3$  groups while the worst ( $P<0.05$ ) were recorded by the other treatments group. Regardless of energy level plant oils and animal fats results in better ( $P<0.05$ ) energy conversion compared to carbohydrates. Also, both ME levels 2900 and 3200 Kcal/Kg recorded the best ( $P<0.05$ ) energy conversion ratio compared to the lowest dietary energy level (2600 Kcal ME/Kg).

4-The performed nutritional treatments released significant effects on total plasma lipids, total plasma triglycerides, total plasma cholesterol, total plasma HDL and total plasma LDL.

5-Both energy sources and energy levels tested as well as age had significant effects on flesh chemical composition. In conclusion it can recommended that the plant oil as energy source and level 2900 Kcal ME /Kg showed the best growth traits for Japanese quail.

## INTRODUCTION

It is well know that Japanese quail is a diversified poultry species reared for commercial egg and meat production. It is blessed with the unique characteristics of fast growth, early sexual maturity, high rate of egg production, short generation interval and shorter incubation period that makes it suitable for diversified animal agriculture *Sarabmeet et al. (2008)*. There are many differences in the metabolism of fat and carbohydrates. The relatively low specific dynamic action of fat is suggested as areason for growth response of substituting dietary carbohydrates by fat *Carew and Hill, (1964)* fat is also reported to enhance feed efficiency via an “extra caloric” effect *Jensen et al., (1970)*. However, *Plavnik et al., (1997)* found that growth and feed efficiency from broilers at 7 weeks of age responded similarly to increase energy either by fat (Soy oil) or carbohydrates (Wheat), without significant differences between the two sources. The observation of *Carre (1993)* showed that age of the birds, particularly during the first 3 weeks of life, has a marked effect on the utilization of dietary nutrients. *Renner and Hill (1960)* suggested that as preceding of age in birds resulted

in an improvement in feed utilization. Growth is one of the main attributes of living thing and is such an obvious process that it hardly seems to justify any particular formal definition. The simple concept of growth meaning getting bigger, in perhaps rather better than many of the complicated attempts to formalize something of such extraordinary complexity *Lawrence and Fowler (1997)*. Several reports revealed that adding animal fats or vegetable oil to growing chick quail ration lower feed intake but improve weight gain and efficiency of feed utilization. An improvement in both growth rate and feed conversion was observed by the incorporation of both vegetable oil and animal fat in chick's diets *Vermeersch and Vanschoubroek (1968)*. *El-Husseiny et al. (1990)* and *Lesson and Atteh (1995)* indicated that weight gain and feed utilization improved in poultry by feeding diet containing oils or fats. However, *Vila and Esteve –Garcia (1996)* showed that in chicken's growth performance influenced by fat source and levels in the rations. *JØrgeensen, et al. (1990)* observed that dry matter, protein and fat of flesh broiler chickens were increased when the age increased from 13 to 46 day but ash was decreased in the same period. *Ensaf (2000)* found that both of moisture and protein percentages were significantly decreased in Japanese quail when the age increased from 4 to 8 week of age, while fat and ash percentages significantly ( $P \leq 0.01$ ) increased. This study aimed to investigate the growth performance, nutrient utilization, some blood plasma parameters nature of growth and carcass chemical composition of Japanese quail, from 1 to 6 weeks of age as affected by feeding diets containing different dietary energy sources and levels.

## MATERILES AND METHODS

The study was carried out at the Poultry Experimental Station, belonging to Faculty of Agriculture, Al – Azahar University, Naser City Cairo, Egypt, in order to study the growth performance of growing Japanese quail at different ages as affected by feeding different dietary energy sources i. e., carbohydrate, animal fat (cow tallow) and plant oil (sunflower oil) each at three energy levels 2600, 2900 and 3200 ME Kcal/Kg of diet, respectively. Also, some blood plasma parameters and chemical carcass composition at different ages were performed. The fattening period lasted 6<sup>th</sup> weeks of age. A total number of 1080 unsexed Japanese quail chicks one day old were randomly distributed at one day of age into 9 experimental groups each in three replicates containing 40 birds each. The electrical batteries were used in brooding of chicks and equipped with waterers and feeders. The temperature degree and humidity percentages were daily measured and recorded approximately  $35 \pm 2.0$  C° and  $65 \pm 3.0$ % as averages at the first week, then the temperature degree was gradually

decreased with age until quail chicks were acclimatized to the environmental condition. Average initial weight of Japanese quail chicks at the experimental start ranged between 8.45 and 8.85  $\pm$ 0.4 g with insignificant differences among the experimental groups indicating the random distribution of individuals among the dietary experimental groups. All diets were formulated to provide the nutrient requirements according to *NRC (1994)*. The formulations and chemical diet composition of the experimental diets are given in Table (1). Feeds and water were offered *ad libitum* for chicks along the experimental period. Continuous lighting program (24hr) was used during the whole experimental period. Individual body weight was recorded at 1, 2, 3, 4, 5 and 6 weeks of age. Also, nutrient utilization was calculated at the end of experimental period. At the end of 6<sup>th</sup> weeks of age individual blood samples were collected in dry clean centrifuge tubes from three males and three females within each treatment. Blood samples were separated by centrifugation at 3000 rpm for 15 minutes. Constituents of blood plasma were determined by using Spectrophotometer apparatus e.g. Total plasma lipids was performed according to *Knight et al.(1972)* triglycerides *McGowan (1983)* cholesterol *Schettler and Nussel (1975)* high density lipoprotein and low density lipoprotein *Richmond(1973)*. The suitable commercial kits (made in Egypt) by Diamond Company, Stanpio, Laboratory Pasteur Lab. Diagnostic and Bioadwic Company were used in analysis. At the end of experimental period i.e. 6 weeks of age, 6 birds (3male and 3 female) were randomly taken from each treatment slaughtered, defeathered, eviscerated and deboned for proximate chemical analysis for moisture, crude protein, ether extract, ash and NFE contents for the breast and thigh meat according to the methods described by *A.O.A.C.(1994)*. All chemical analysis parameters were calculated on dry matter basis and NFE contents were calculated by differences (All components-100). The statistical analysis of obtained data was performed by *SPSS<sup>®</sup> Computer Software 10.00 (SPSS,<sup>®</sup>1999)* based on multi factorial ANOVA and Chi-square procedures was performed to test the significant differences among means at (P<0.05) level of significance. The following model was used:

$X_{ijk} = M + \alpha_i + \beta_j + \alpha\beta_{ij} + e_{ijk}$  where,

M = General mean.

$\alpha_i$  = Effect of A factor (Source).

$\beta_j$  = Effect of B factor (Levels).

$\alpha\beta_{ij}$  = Interaction between A and B.

$e_{ijK}$  = Stander error for observations.

Then, the one way ANOVA analysis was performed to analyze the effect of energy source and levels alone. The following model was used.

$$Y_{ij} = M + T_i + e_{ij}$$

M = General mean.

T = The effect of nutritional treatment

e = The stander error.

Arcsine of the square root of the some variable was used to convert all percentages to absolute figures prior to analysis. Multiple range tests was used to determine the significant differences among means (*Duncan's 1955*).

## RESULTS AND DISCUSSION

### Effecte of energy sources and levels on growth performance of Japanese quail:

#### Body weight (BW).

Results of Table (2) and Fig (1) revealed that averages of initial weights of Japanese quail (one day old) at the start of the experiment ranged between 8.45 g to 8.85 g with insignificant differences among the experimental groups indicating the random distribution of individual into experimental groups. At one week of age group  $S_1L_2$  had significantly ( $P < 0.05$ ) the highest (28.13g) body weight compared to the other treatment groups, followed in a significant ( $P < 0.05$ ) decreasing order by groups ( $S_1L_1$ ,  $S_1L_3$ ,  $S_3L_3$ ,  $S_2L_3$ ,  $S_2L_1$ ,  $S_2L_2$ ) then groups ( $S_3L_2$  and  $S_3L_1$ ) respectively. At the second week of age groups ( $S_3L_3$ ,  $S_1L_2$  and  $S_3L_2$ ) recorded the highest body weights followed in a significant ( $P < 0.05$ ) decreasing order by  $S_3L_1$  and  $S_2L_3$  groups which showed higher ( $P < 0.05$ ) body weights than  $S_2L_2$ ,  $S_1L_3$  and  $S_2L_1$  groups respectively. At the third week of age groups ( $S_1L_2$  and  $S_3L_3$ ) had significantly ( $P < 0.05$ ) higher body weights (105.87 and 99.65g respectively), followed in a significant ( $P < 0.05$ ) decreasing order by  $S_2L_2$ ,  $S_2L_3$  and  $S_1L_1$  than  $S_1L_3$ ,  $S_3L_2$ ,  $S_2L_1$  and  $S_3L_1$  respectively. At the four week of age groups ( $S_1L_2$ ,  $S_3L_3$ ,  $S_2L_3$  and  $S_2L_2$ ) recorded the highest ( $P < 0.05$ ) weights, followed by ( $S_1L_1$ ,  $S_1L_3$  and  $S_3L_2$ ) then by ( $S_2L_1$  and  $S_3L_1$ ) groups respectively. At the five week of age groups  $S_2L_3$  recorded significantly ( $P < 0.05$ ) higher body weight (184.32 g) while group  $S_3L_2$  recorded the lowest body weight (149.00 g).

Results of Table (2) revealed that at the 6<sup>th</sup> weeks of age the highest ( $P < 0.05$ ) final weight was obtained by the groups  $S_2L_2$ ,  $S_2L_3$  and  $S_3L_2$ ,

followed by groups S<sub>3</sub>L<sub>3</sub> and S<sub>1</sub>L<sub>3</sub>. The groups S<sub>2</sub>L<sub>1</sub>, S<sub>3</sub>L<sub>1</sub>, S<sub>1</sub>L<sub>2</sub> and S<sub>1</sub>L<sub>1</sub> recorded the lowest (P<0.05) values of live body weight. The results indicated that incorporation of plant oil at a dietary level of 8.07% improved final body weight, followed by levels of 8.89% plant oil, 8% and 8.97% animal fat. The results of the same Table indicate also that incorporation of carbohydrates (yellow corn, wheat bran) at all tested energy level resulted in negative (P<0.05) effects on final weights of Japanese quail.

Regardless of energy level, Table (3) and Fig (2) indicated that there were significant (P≤0.05) differences among the dietary energy sources for body weight of Japanese quail at different ages of fattening period extended from 1 to 6<sup>th</sup> weeks of age. The quail fed plant oil at 6 weeks of age recorded higher value (P≤0.05) of body weight, followed by quail fed animal fat and carbohydrate sources respectively. Concerning the effect of energy level on live body weight regardless of energy source (Table 4) showed that live body weights were significantly (P<0.05) heavier when quail were fed on diets containing 2900 and 3200 Kcal ME/Kg as compared with 2600 level, expect for values of body weight recorded at one day and 5 weeks of age, where insignificant difference was observed among dietary levels. These results are harmony with those reported by *Akinwande (1981)* who showed that the growth rate of broiler chicken increased when fed diets containing fat as high energy sources. Also, *Jerryl and William (1981)* showed that increasing fat levels from 1.0 to 8% in the diet of Turkey body weight significantly increased and the increase was more pronounced at older ages. *El-Helaly (1983)* reported that chicks gained much more with increasing dietary oil and fat level up to 7.5% of the diet. Also, *Blair et al. (1986)* showed that the using different levels of fat in the diet (5, 10 and 15%) of broiler chickens body weight was increased. In similar studies reported by *Elias et al. (1985)* found that final body weight gain of quail increased when levels of energy increases from 2642 to 2880 Kcal ME/Kg. *Crespo and Esteve-Garcia (2001 and 2002)* found that the addition 10.0% of tallow and sunflower oil in the diets of broiler chickens resulted in increases of body weight. However *Gunes and Cerit (2001)* found that body weight of Japanese quail increased with advance of age from hatch to sexual maturity.

#### **Body weight gain and nutrient utilization.**

As presented in Table (5) averages of body weight gain of Japanese quail during the period from one to 6<sup>th</sup> weeks of age ranged between 210.60 g for group S<sub>2</sub>L<sub>2</sub> and 183.15 g for group S<sub>1</sub>L<sub>1</sub> with significant (P<0.05) differences among the treatment groups. The results indicated that the group

of quail fed diets containing plant oil (S<sub>2</sub>L<sub>2</sub>) with an energy content of 2900 Kcal ME/Kg and a C/P ratio of 120.83 showed the highest (P<0.05) total body weight gain records, followed in an insignificant order by S<sub>2</sub>L<sub>3</sub>, S<sub>3</sub>L<sub>2</sub> and S<sub>3</sub>L<sub>3</sub> groups and significant (P<0.05) order by the remaining treatment groups. The increase of body weight of Japanese quail may due to the fact that plant oil had more unsaturated fatty acids which, digest and absorption faster than saturated fatty acids as compared with other diets **Lopez-Ferrer et al. (2001)**. These results are in accordance with results of **Chung et al. (1993)** who found that broiler chickens fed diets supplemented with sunflower oil had higher live body weight gain than birds fed on diets containing tallow. Also, **Scaife et al. (1994)** found that live body weight gain of broiler chickens was significantly improved when fed on diet containing oils. Concerning total feed intake results of Table (5) revealed that group S<sub>1</sub>L<sub>1</sub> recorded the highest (P≤0.05) total feed intake, while both S<sub>2</sub>L<sub>3</sub> and S<sub>3</sub>L<sub>3</sub> recorded the lowest values. These results indicated that within each energy source feed intake decreased as the dietary energy level increased in the diet. These results may due to the fact that oils and fat contain more available energy compared to carbohydrates, these results are in agreement with the finding of **Brown and McCarthy (1982)** who noticed that feed intake was significantly decreased with increasing poultry fat in broiler diet. **Blair et al. (1986)** found that feed intake of broiler chickens decreased when dietary fat increased in the diet. On the other hand, **Sanz et al. (2000)** indicated that feed intake of broiler chickens was not significantly affected when fed diets containing sunflower oil or tallow.

Concerning feed conversion ratio results of Table (5) indicated that within each energy source feed conversion ratio decreased (improved) almost in a significant manner with each increases in energy levels fed and the improvement related to both factors i.e. reduced feed intake and improved gain in live weight Table (5). The feed conversion ratio value was obtained by groups S<sub>2</sub>L<sub>3</sub> and S<sub>3</sub>L<sub>3</sub> were significantly decreased (improved) compared to the other treatment groups. These results are in accordance with the finding of **Shoeb (1997)** who showed that the addition of fats in broiler diet improved feed conversion ratio compared to the control group. **Balevi et al. (2000)** found that when broiler chickens feed diets containing 4.5% sunflower oil feed conversion ratio deceased as (improved) compared with diet containing 4.5% tallow. Furthermore, **Pesti et al. (2002)** reported that increasing fat content from 3 to 6% in the diet of broiler chickens decreased feed conversion. As presented in Table (5) the highest (P<0.05) total ME intake was recorded for S<sub>1</sub>L<sub>3</sub> and S<sub>1</sub>L<sub>2</sub>, followed in a significant decreasing order by group S<sub>1</sub>L<sub>1</sub> and then other groups, where insignificantly differences were detected among them. Concerning ME conversion ratio

Table (5) indicated that the best (lowest) records were obtained by the S<sub>2</sub>L<sub>2</sub>, S<sub>2</sub>L<sub>3</sub>, S<sub>3</sub>L<sub>3</sub> and S<sub>3</sub>L<sub>2</sub> groups followed by other treatment groups, where S<sub>1</sub>L<sub>2</sub>, S<sub>1</sub>L<sub>1</sub>, S<sub>1</sub>L<sub>3</sub>, S<sub>3</sub>L<sub>1</sub> and S<sub>2</sub>L<sub>1</sub> groups recorded the highest (P<0.05) values. These results may indicate that the energy levels of 2900 and 3200 Kcal ME/Kg may be sufficient for the best ME utilization when energy is derived from plant or animal fat sources.

Results of Table (5) indicate that the highest total protein intake (P<0.05) were recorded by the S<sub>1</sub>L<sub>1</sub>, S<sub>3</sub>L<sub>1</sub> and S<sub>2</sub>L<sub>1</sub> groups compared to the other treatment groups. These results indicate that total protein intake decreased within each energy source with increasing the dietary energy level. Concerning protein conversion ratio (PCR), results of Table (5) revealed that the worst PCR values were recorded by S<sub>1</sub>L<sub>1</sub>, S<sub>3</sub>L<sub>1</sub> and S<sub>2</sub>L<sub>1</sub> groups and the best values (P<0.05) were recorded by S<sub>2</sub>L<sub>3</sub>, S<sub>3</sub>L<sub>3</sub>, S<sub>2</sub>L<sub>2</sub>, S<sub>3</sub>L<sub>2</sub> and S<sub>1</sub>L<sub>3</sub> which indicate in general that increasing energy level in quail diets whether from carbohydrate, plant oils or animal fat improved the PCR. Concerning the effect of interaction between energy sources and levels on mortality rate, results of Table (5) revealed that mortality percentage during the whole experimental period ranged between 5 to 7.50 % and almost all mortalities recorded in the present study had due to accidental factors during handling of birds and not to treatments performance. Regardless of energy level results of Table (6) revealed that dietary energy source had significant effects on final body weights for the favor of oil and animal fat and on feed intake for the favor of carbohydrate sources. The same Table shows also that groups fed on diets containing oils or fat as energy sources recorded the best (P<0.05) FCR compared to the carbohydrates. The same trend was observed in energy conversion ratio where both oil and fat groups had significantly better (P<0.05) metabolizable energy conversion ratio. Results of the same table indicate clearly that protein conversion ratio of birds fed on diets containing oils or fats had better (P<0.05) protein conversion ratio compared to carbohydrate. These results are in agreement with the finding of **Chung et al. (1993)** who found that broiler chickens fed diets supplemented with sunflower oil was had higher live body weight gain as compared with birds fed diets containing tallow. Also, **Scaife et al. (1994)** found that live body weight gain of broiler chickens was significantly improved when fed on diet containing oils. **Brown and Mc-Carthy (1982)** noticed that feed intake was significantly decreased with increasing poultry fat in broiler chickens. **Blair et al. (1986)** found that feed intake of broiler diet decreased when dietary fat increased in the diet. **Pesti et al. (2002)** reported that increasing fat from 3 to 6% in the diet resulted decreased feed conversion ratio. Also, **Balevi et al. (2000)** found that when broiler chickens

feed diets containing 4.5% sunflower oil feed conversion ratio decreased as compared with diet containing 4.5% tallow. *Zeweil (1996)* observed that protein conversion ratio was decreased when addition corn oil to diets of growing Japanese quail.

Concerning the effect of energy levels, regardless of source, results of Table (7) show that total feed intake decreased almost in a significant linear ( $P < 0.05$ ) with each increase in the dietary energy level from 2600 to 3200 Kcal ME/Kg, respectively. Feed conversion ratio behaved similar to the feed intake where it decreased significantly (improved) better ( $P < 0.05$ ) with each increase in energy level fed. Furthermore, results of the same Table show that dietary energy level had no significant effects on energy consumption which indicate that birds adjusted their energy intake through feed intake, thus birds fed diets containing higher energy levels decreased their feed intake according to energy density in the diets. As presented in table (7) metabolizable energy conversion ratio improved significantly ( $P < 0.05$ ) with diets containing higher levels of energy (2900 or 3200 Kcal ME/Kg) compared to the lowest level. The same trend was observed with protein conversion ratio thus the values were improved significantly ( $P < 0.05$ ) with each increase in dietary energy level (Table 7). These results are in agreement with the finding of *Al-Gamal (2005)* who found that feed intake of Japanese quail decreased when ME level increased from 2500 to 2750 KCal ME/Kg of diet. *Hasanien (1995)* indicated that feed conversion ratio of Japanese quail decreased with increasing energy levels in diets from 2600 to 3000 KCal ME/Kg.

#### **Effect of energy sources and levels on some blood plasma parameters of Japanese quail.**

The results in Table (8) indicated that the group of quail fed animal fat ( $S_3L_3$ ) with (3200ME Kcal/ Kg) showed the highest value of total plasma lipids, followed in a significant decreasing order by groups fed  $S_3L_2$ ,  $S_3L_1$ ,  $S_2L_3$ ,  $S_2L_2$ ,  $S_2L_1$ ,  $S_1L_3$ ,  $S_1L_2$  and  $S_1L_1$ , respectively. Concerning total plasma triglycerides (TPT) the  $S_3L_3$  and  $S_3L_2$  groups showed the highest total plasma triglycerides values (animal fat group) compared to the other groups. In general TPT in plasma at 6<sup>th</sup> weeks of age of Japanese quail increased for groups fed animal fat diets, followed by plant oil and carbohydrate, respectively. Averages of total plasma cholesterol (TPC) at 6 weeks of age illustrated that the highest TPC value was recorded for  $S_3L_3$  group (236.32 mg/dl) and lowest ( $P \leq 0.05$ ) value was recorded for  $S_1L_1$  group (174.66 mg/dl). The obtained results indicated that the increase TPC at 6<sup>th</sup> weeks of age with increasing energy level within each source tested and the increases were more pronounced in diets containing animal fat or plant oil as energy

sources. As presented in Table (8) averages of total plasma high density lipoprotein (HDL) contents of Japanese quail at 6 weeks of age indicate clearly that increasing dietary energy levels under each energy sources in diets of Japanese quail 3200 Kcal ME/ Kg diet within each source tested  $S_1L_3$ ,  $S_2L_3$  and  $S_3L_3$  caused a drastic significant ( $P \leq 0.05$ ) decrease in plasma HDL levels compared to lower energy levels. Regarding total plasma low density lipoprotein (LDL) contents at 6<sup>th</sup> weeks of age as affected by dietary energy sources and levels, results of Table (8) revealed that group  $S_3L_3$  recorded the highest LDL (171.34 mg/dl), followed by the  $S_3L_2$  group with significant differences then in a decreasing significant ( $P \leq 0.05$ ) order, where group  $S_1L_1$  recorded the lowest plasma LDL value. These results may indicate that the use of carbohydrates as energy source at energy levels between 2600 to 3200 Kcal/ME/Kg showed no drastic increase in plasma LDL levels. These results are in accordance with the findings by *El-Husseiny et al. (1983)* and *El-Helaly (1983)* who showed that the addition of both corn oil and animal fat to diets of broiler chickens increased total cholesterol in blood. Also, *Butala and Rajagopal(1991)* found that serum cholesterol increased ( $P \leq 0.01$ ) with increasing tallow in the white Leghorn chickens diets. As well as, *Aggoor et al. (2000)* found that the concentration of total plasma lipids and total plasma cholesterol were increased with adding sunflower oil and palm oil in the diet of broiler chickens. *El-Husseiny et al. (2000)* found that total serum lipid was increased when addition sunflower oil to broiler diets. *Abou-El Wafa et al. (2000)* observed that total plasma lipid significantly ( $P \leq 0.05$ ) increased when animal fat added to broiler diets. However, *Khaled et al. (2005)* observed that total serum triglycerides significantly ( $P \leq 0.05$ ) increased from 96.69 to 111.85 mg/dl when diet of broiler chickens supplemented with vegetable oil at a level of 3 to 5 %. Regardless of dietary energy levels the results presented in Table (9) showed that there were significant ( $P \leq 0.05$ ) increase of total plasma lipids, total plasma triglycerides, total plasma cholesterol and total plasma low density lipoprotein when Japanese quail fed animal fat source as compared with plant oil or carbohydrate source, while total plasma high density lipoprotein showed the converse trend, where carbohydrate source recorded the highest ( $P \leq 0.05$ ) value, followed by plant oil or animal fat source respectively. Regardless of energy sources, Table (10) indicated that the same trend was observed for blood plasma constituents. These results are in agreement with the finding of *Frank and Waibel (1960)* who observed that total serum cholesterol increased when broiler chickens fed diet containing high energy levels. *El-Husseiny and Ghazalah (1989)* reported that total plasma lipids were increased when the dietary energy levels increased in diets of broiler chickens. *Hasanien (1995)* found that as

the dietary energy levels increased from 2600, 2800 to 3000 Kcal/ME/Kg of diet resulted increases of total plasma lipids, triglycerides and cholesterol in blood of quail.

**Body chemical composition of Japanese quail at different ages of fattening period.**

Regardless of energy sources and levels results of Table (11) and fig (4) revealed that moisture contents significantly ( $P \leq 0.05$ ) decreased from 75.33% at first week of age to 69.83% at 6<sup>th</sup> week of age and the decrease of moisture was significant among all ages tested. As presented in Table (11) and fig (4) dry matter contents in whole quail bodies showed the converse trend, where it significantly ( $P \leq 0.05$ ) increased as the preceding of age. Concerning the results of crude protein Table (11) and fig (4) show that CP contents in quail flesh bodies significantly ( $P \leq 0.05$ ) decreased with each advance in age from 1 to 6<sup>th</sup> weeks of age. Concerning ether extract (EE) contents in quail flesh results of Table (11) and fig (4) show that EE contents significantly ( $P \leq 0.05$ ) increased with each advance in age from 1 to 6 weeks of age and it was duplicated (two folds) at 6<sup>th</sup> weeks compared to the values obtained at the first weeks of age. As regard with ash and nitrogen free extract (NFE) contents in flesh results revealed that ash and NFE percentages significantly ( $P \leq 0.05$ ) increased with each advance in age from 1 to 6<sup>th</sup> weeks of age. These results confirmed by *Combs (1968)* who observed that the protein and fat content of broiler chickens carcass increased with age, while the moisture content was decreased. *Lepore and Marks (1971)* found that age of quail had a significant effect on carcass water, fat and protein composition. Also, they added that from 2 to 8 weeks of age moisture content decline, fat content increased and protein content increased to 4 weeks and then decreased at 8<sup>th</sup> weeks of age. *Kubena et al. (1972)* reported that protein and ether extract content of carcass chicks increased with the age and the moisture content decreased. *Hardy and Edwards (1981)* showed that the water content of the carcass decreased with the preceding age of Japanese quail, while the protein levels increased. Lower level of ash was found in the young birds. *Ensaf (2000)* found that both of moisture and protein percentages were significantly decreased in Japanese quail when the age increased from 4 to 8 week of age, while fat and ash percentages significantly ( $P \leq 0.01$ ) increased.

**Table (1):** Formulation and diet composition of growing quail.

Ingredients	Sources and energy levels								
	Carbohydrates			Plant oil*			Animal fat**		
	2600 S <sub>1</sub> L <sub>1</sub>	2900 S <sub>1</sub> L <sub>2</sub>	3200 S <sub>1</sub> L <sub>3</sub>	2600 S <sub>2</sub> L <sub>1</sub>	2900 S <sub>2</sub> L <sub>2</sub>	3200 S <sub>2</sub> L <sub>3</sub>	2600 S <sub>3</sub> L <sub>1</sub>	2900 S <sub>3</sub> L <sub>2</sub>	3200 S <sub>3</sub> L <sub>3</sub>
Ground yellow corn (8.5%).	45.00	57.89	65.06	19.3	29.15	39.5	20	29.19	39.7
Soybean meal (44%).	31.83	31.65	9.35	33.00	32.5	30	34	33.00	34.27
Wheat bran (15.7%).	15.1	-	-	34.7	22.26	9.92	32	21.00	7
Broiler concentrates (52%). ***	7.15	9.79	5.00	4.5	7.1	10	4.48	7.00	8.5
Gluten meal (60%) Cow fat.	-	-	18.025	-	-	1	-	-	-
Sun flower oil.	-	-	-	-	-	-	8	8.97	9.9
L-Lysine.	-	-	-	7.22	8.07	8.89	-	-	-
L-Lysine.	0.07	0.07	0.57	0.05	0.05	0.09	0.04	0.04	0.03
Premix. ****	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Sodium chloride(NaCl).	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Calcium carbonate.	0.25	-	0.9	0.63	0.27	-	0.55	0.2	-
Di- Calcium phosphate.	-	-	0.495	-	-	-	0.33	-	-
<b>Total (Kg)</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
<b>Calculated:</b>									
C.P %.	24.00	24.01	23.99	24.00	24.01	24.03	24.05	23.98	24.00
MEK Cal Kg diet .	2598.0	2897.0	3188.0	2600.0	2900.0	3216.0	2605.0	2892.0	3204.0
Lysine%.	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.29
Methionine+ cystein%.	0.82	0.85	0.94	0.79	0.81	0.84	0.79	0.81	0.82
Available phosphorus%.	0.40	0.45	0.36	0.32	0.37	0.44	0.37	0.37	0.41
Ca %.	0.81	0.91	0.90	0.77	0.82	0.94	0.80	0.80	0.82
C.F%.	5.01	3.65	2.39	6.61	5.48	4.23	6.41	5.37	4.18
<b>Determined:</b>									
C.P %.	23.96	23.98	24.01	23.93	23.91	24.05	23.99	23.92	24.03
E.E%.	4.50	5.05	5.31	6.12	6.73	7.50	6.91	7.32	8.50
Ash%.	3.40	4.01	3.62	4.014	4.54	5.02	3.90	4.30	5.11
C.F%.	4.91	3.52	2.41	6.09	5.31	4.10	6.10	5.20	4.01

\* Plant oil: Sunflower oil

\*\*Animal fat: Cow fat

\*\*\*Concentrates composition: 52% crude protein, 8.3% Calcium, 3.1% Available phosphorus, 2.4% Methionine+ cystein, 2.3% Lysine, 2580Kcal ME/Kg diet, 1.6% crude fiber.

\*\*\*\*Each3Kg of growing premix contain Vita A 12000000.U – Vita D2000000 – Vita E10000 mg – Vita K1000mg – Vita B<sub>1</sub>1000mg –B<sub>2</sub>5000mg – B<sub>6</sub>1500mg –B<sub>12</sub>10mg – Pantothenic acid 10000mg – folueic acid 1000mg –Biotin50mg –Niacin20000mg –Fe30000-Mn60000 –Cu4000mg –Zn 5000mg – I30000mg –Selenium 100mg.

**Table (2):** Live body weight at different ages of growing Japanese quailed dietary different sources and energy levels ( Means  $\pm$  S.E ).

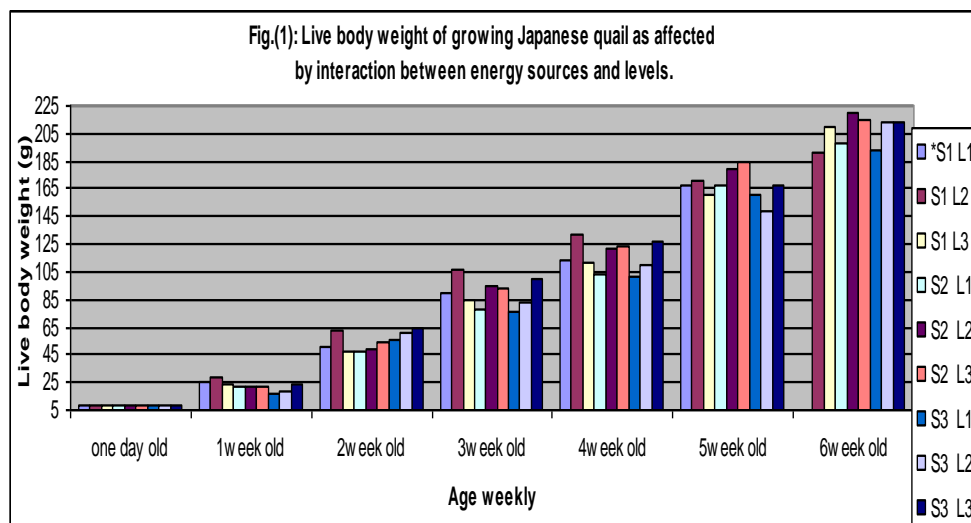
Energy Sources	Carbohydrates (CH)			Plant oil (PO)			Animal fat (AF)			Significant effect
Energy levels Ages	2600 *S <sub>1</sub> L <sub>1</sub>	2900 S <sub>1</sub> L <sub>2</sub>	3200 S <sub>1</sub> L <sub>3</sub>	2600 S <sub>2</sub> L <sub>1</sub>	2900 S <sub>2</sub> L <sub>2</sub>	3200 S <sub>2</sub> L <sub>3</sub>	2600 S <sub>3</sub> L <sub>1</sub>	2900 S <sub>3</sub> L <sub>2</sub>	3200 S <sub>3</sub> L <sub>3</sub>	
one day old	8.85 $\pm$ 0.32	8.70 $\pm$ 0.26	8.78 $\pm$ 0.19	8.66 $\pm$ 0.28	8.77 $\pm$ 0.24	8.72 $\pm$ 0.16	8.45 $\pm$ 0.29	8.56 $\pm$ 0.27	8.70 $\pm$ 0.23	N.S
1week old	25.14 <sup>b</sup> $\pm$ 0.53	28.13 <sup>a</sup> $\pm$ 0.79	23.25 <sup>b</sup> $\pm$ 0.43	21.80 <sup>b</sup> $\pm$ 0.46	21.68 <sup>b</sup> $\pm$ 0.94	21.93 <sup>b</sup> $\pm$ 0.95	17.56 <sup>c</sup> $\pm$ 1.01	18.10 <sup>c</sup> $\pm$ 1.01	23.21 <sup>b</sup> $\pm$ 0.99	*
2week old	50.09 <sup>bc</sup> $\pm$ 2.58	62.37 <sup>a</sup> $\pm$ 1.03	47.73 <sup>d</sup> $\pm$ 1.98	46.93 <sup>d</sup> $\pm$ 1.71	48.83 <sup>cd</sup> $\pm$ 2.33	53.88 <sup>b</sup> $\pm$ 2.06	55.04 <sup>b</sup> $\pm$ 2.78	61.16 <sup>a</sup> $\pm$ 1.06	63.4 <sup>a</sup> $\pm$ 1.44	*
3week old	89.90 <sup>b</sup> $\pm$ 1.5	105.87 <sup>a</sup> $\pm$ 4.10	83.88 <sup>c</sup> $\pm$ 1.22	78.35 <sup>d</sup> $\pm$ 2.28	95.00 <sup>b</sup> $\pm$ 2.88	93.67 <sup>b</sup> $\pm$ 4.02	76.79 <sup>d</sup> $\pm$ 6.68	83.35 <sup>c</sup> $\pm$ 2.01	99.65 <sup>a</sup> $\pm$ 2.32	*
4week old	112.48 <sup>b</sup> $\pm$ 3.33	132.32 <sup>a</sup> $\pm$ 2.02	111.79 <sup>b</sup> $\pm$ 1.48	103.15 <sup>c</sup> $\pm$ 3.80	122.33 <sup>ab</sup> 2.84	124.27 <sup>a</sup> $\pm$ 2.57	100.62 <sup>c</sup> $\pm$ 2.80	109.73 $\pm$ 1.50 <sup>b</sup>	126.94 <sup>a</sup> $\pm$ 2.13	*
5week old	166.98 <sup>b</sup> $\pm$ 7.18	170.87 <sup>ab</sup> $\pm$ 6.52	160.17 <sup>bc</sup> $\pm$ 4.80	167.27 <sup>b</sup> $\pm$ 2.83	180.0 <sup>ab</sup> 2.88	184.32 <sup>a</sup> $\pm$ 1.78	161.02 <sup>bc</sup> 8.34	149.00 <sup>c</sup> $\pm$ 1.57	166.88 <sup>b</sup> $\pm$ 1.83	*
6week old	192.00 <sup>c</sup> $\pm$ 3.51	192.00 <sup>c</sup> $\pm$ 3.51	209.18 <sup>b</sup> $\pm$ 1.47	197.33 <sup>c</sup> $\pm$ 1.20	219.67 <sup>a</sup> $\pm$ 3.92	215.33 <sup>ab</sup> $\pm$ 1.88	192.67 <sup>c</sup> $\pm$ 2.33	213.99 <sup>ab</sup> $\pm$ 2.90	212.33 <sup>ab</sup> $\pm$ 2.01	*

a, b ,c , d Means in the same rows have the different superscript are significantly different at (  $P \leq 0.05$  ).

S.E: Meaning standard error N.S: No significant effect.

S: Sources of energy

L: Levels of energy

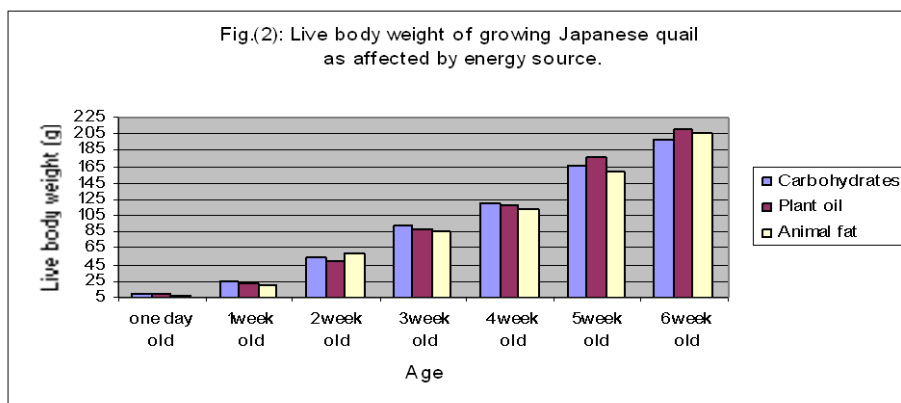


**Table (3):** Live body weight at different ages of growing Japanese quail as affected by feeding dietary different energy sources ( Means  $\pm$  S.E ).

Ages	Energy Sources			Significant effect
	Carbohydrates (CH)	Plant oil (PO)	Animal fat (AF)	
one day old	8.78 $\pm$ 0.13	8.72 $\pm$ 0.11	8.57 $\pm$ 0.14	N.S
1week old	25.50 <sup>a</sup> $\pm$ 0.77	21.80 <sup>b</sup> $\pm$ 0.40	19.62 <sup>c</sup> $\pm$ 0.94	*
2week old	53.4 <sup>b</sup> $\pm$ 2.40	49.88 <sup>c</sup> $\pm$ 1.46	59.87 <sup>a</sup> $\pm$ 1.57	*
3week old	93.22 <sup>a</sup> $\pm$ 3.51	89.00 <sup>ab</sup> $\pm$ 3.10	86.60 <sup>b</sup> $\pm$ 3.96	*
4week old	118.86 <sup>a</sup> $\pm$ 3.57	116.58 <sup>ab</sup> $\pm$ 3.71	112.43 <sup>b</sup> $\pm$ 4.39	*
5week old	166.01 <sup>b</sup> $\pm$ 3.49	177.19 <sup>a</sup> $\pm$ 2.82	158.97 <sup>b</sup> $\pm$ 3.61	*
6week old	197.72 <sup>c</sup> $\pm$ 3.23	210.77 <sup>a</sup> $\pm$ 3.62	206.33 <sup>b</sup> $\pm$ 3.59	*

a, b, c .. Means in the same rows have the different superscript are significantly different at ( $P \leq 0.05$ ).  
 S.E: Meaning standard error.  
 N.S: No significant effect

## Growing Japanese quail, Growth, growth rate, nutrient utilization



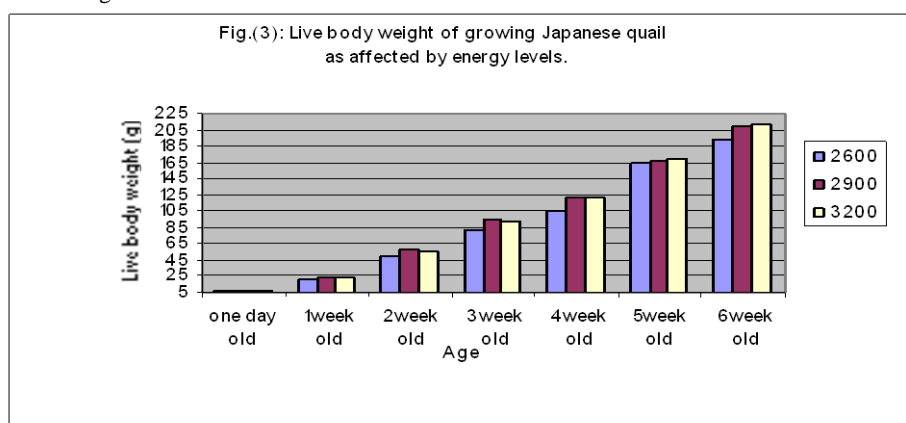
**Table (4):** Live body weight at different ages of growing Japanese quail as affected by feeding dietary different energy levels ( Means  $\pm$  S.E ).

Ages	Energy levels (ME.Kcal/diet)			Significant effect
	2600	2900	3200	
one day old	8.65 $\pm$ 0.16	8.68 $\pm$ 0.13	8.73 $\pm$ 0.15	N.S
1week old	21.50 <sup>b</sup> $\pm$ 1.15	22.63 <sup>a</sup> $\pm$ 1.51	22.8 <sup>a</sup> $\pm$ 1.37	*
2week old	50.69 <sup>b</sup> $\pm$ 1.68	57.45 <sup>a</sup> $\pm$ 2.30	55.01 <sup>a</sup> $\pm$ 2.39	*
3week old	81.68 <sup>b</sup> $\pm$ 2.91	94.74 <sup>a</sup> $\pm$ 3.56	92.40 <sup>a</sup> $\pm$ 2.68	*
4week old	105.42 <sup>b</sup> $\pm$ 3.04	121.46 <sup>a</sup> $\pm$ 3.44	121.00 <sup>a</sup> $\pm$ 2.56	*
5week old	165.09 $\pm$ 3.43	166.62 $\pm$ 5.04	170.46 $\pm$ 3.89	N.S
6week old	194.00 <sup>b</sup> $\pm$ 1.51	208.55 $\pm$ 1.56 <sup>a</sup>	212.28 <sup>a</sup> $\pm$ 1.04	*

a, b ,c .. Means in the same rows have the different superscript are significantly different at ( $P \leq 0.05$ ).

S.E: Meaning standard error.

N.S: No significant effect.



**Table (5):** Nutrient utilization of growing Japanese quail during the whole experimental period as affected by dietary energy sources and levels ( Means $\pm$  S.E).

Energy Sources Energy levels parameters	Carbohydrates (CH)			Plant oil (PO)			Animal fat (AF)			Significant effect
	2600 *S1 L1	2900 S1 L2	3200 S1 L3	2600 S2 L1	2900 S2 L2	3200 S2 L3	2600 S3 L1	2900 S3 L2	3200 S3 L3	
C/P ratio	108.33	120.83	133.33	108.33	120.83	133.33	108.33	120.83	133.33	
Gains in weight at 6 th weeks of age.	183.15 c $\pm$ 3.50	183.29 c $\pm$ 3.54	200.39 b $\pm$ 1.58	188.67 c $\pm$ 1.92	210.60 a $\pm$ 4.13	206.60 ab $\pm$ 2.88	184.21 c $\pm$ 2.50	205.42 ab $\pm$ 3.16	203.63 ab $\pm$ 1.10	*
Total gain as% of the lowest value S1 L1 (100%)	100	100.08	110.25	103.28	116.49	113.94	100.03	113.24	112.17	-
Total feed intake (g)/bird.	639.67 a $\pm$ 10.13	593.00 bc $\pm$ 12.58	561.33 cd $\pm$ 18.55	616.33 ab $\pm$ 10.92	551.32 d $\pm$ 12.01	491.31 e $\pm$ 6.66	624.67 ab $\pm$ 12.01	541.35 d $\pm$ 17.63	484.66 e $\pm$ 8.81	*
Total feed intake as% of the lowest value S3 L3 (100%)	131.98	122.35	115.81	127.16	113.75	101.37	128.88	111.69	100	-
Feed conversion ratio.	3.49 a $\pm$ 0.08	3.24 a $\pm$ 0.14	2.80 b $\pm$ 0.12	3.26 a $\pm$ 0.16	2.61 bc $\pm$ 0.11	2.38 c $\pm$ 0.14	3.39 a $\pm$ 0.11	2.63 bc $\pm$ 0.08	2.38 c $\pm$ 0.04	*
Total metabolizable energy intake. (KcalME/Kg diet)	1663.13 bc $\pm$ 26.35	1719.70 ab $\pm$ 36.49	1796.26 a $\pm$ 59.38	1602.46 c $\pm$ 28.41	1598.86 c $\pm$ 34.85	1572.26 c $\pm$ 21.33	1624.13 c $\pm$ 31.24	1569.87 c $\pm$ 51.15	1550.93 c $\pm$ 28.22	*
Total metabolizable energy intake as% of the lowest value S3 L2 (100%)	107.23	110.88	115.81	103.32	103.09	101.37	104.71	101.22	100.00	-
Metabolizable energy conversion ratio.(M.E.C.R)	9.08 ab $\pm$ 0.22	9.39 a $\pm$ 0.38	8.96 ab $\pm$ 0.35	8.49 b $\pm$ 0.15	7.58 c $\pm$ 0.02	7.61 c $\pm$ 0.13	8.82 ab $\pm$ 0.24	7.64 c $\pm$ 0.23	7.61 c $\pm$ 0.12	*
Total protein intake (g)/bird.(P.I)	153.52 a $\pm$ 2.43	142.32 bc $\pm$ 3.01	134.72 cd $\pm$ 4.45	147.92 ab $\pm$ 2.62	132.32 d $\pm$ 2.88	117.92 e $\pm$ 1.60	149.90 ab $\pm$ 2.88	129.9 d $\pm$ 4.23	116.32 e $\pm$ 2.11	*
Total protein intake as% of the lowest value S3 L3 (100%)	131.98	122.35	115.81	127.16	113.75	101.37	128.86	111.67	100	-
Protein conversion ratio.(P.C.R)	0.84 a $\pm$ 0.02	0.77 b $\pm$ 0.03	0.67 c $\pm$ 0.03	0.78 ab $\pm$ 0.01	0.62 cde $\pm$ 0.01	0.57 e $\pm$ 0.01	0.81 ab $\pm$ 0.03	0.63 cd $\pm$ 0.02	0.57 e $\pm$ 0.01	*
Total mortality rate (M.R) %	5.00	5.00	6.66	5.83	7.50	5.00	6.66	5.83	5.83	-

*a, b, c, d Means in the same rows have the different superscript are significantly different at ( P $\leq$ 0.05 ).*

*S.E: Meaning standard error. N.S: No significant effect.*

*S: Sources of energy L: Levels of energy*

Growing Japanese quail, Growth, growth rate, nutrient utilization

**Table (6):** Nutrient utilization of growing Japanese quail at 6<sup>th</sup> weeks of age as affected by energy sources ( Means± S.E).

Parameters	Energy Sources			Significant effect
	Carbohydrates (CH)	Plant oil (PO)	Animal fat (AF)	
Final Body weight gain at 6week old	188.94 <sup>b</sup> ±3.23	202.05 <sup>a</sup> ± 3.62	197.75 <sup>a</sup> ±3.60	*
Total gain as% of the lowest value (100%).	100.00	107.53	105.06	-
Total feed intake (g)/bird. (F.I)	598.00 <sup>a</sup> ±13.41	553.00 <sup>b</sup> ±18.75	550.22 <sup>b</sup> ±21.39	*
Total feed intake as% of the lowest value (100%)	108.68	100.50	100.00	-
Feed conversion ratio.(F.C.R)	3.17 <sup>a</sup> ±0.12	2.75 <sup>b</sup> ±0.13	2.80 <sup>b</sup> ±0.16	*
Total metabolizable energy intake.(M.E.I) (KCalME/Kg diet)	1726.36 <sup>a</sup> ±35.38	1591.20 <sup>b</sup> ±15.17	1581.64 <sup>b</sup> ±19.42	*
Total metabolizable energy intake as% of the lowest value (100%)	109.15	100.60	100.00	-
Metabolizable energy conversion ratio.(M.E.E.R)	9.15 <sup>a</sup> ±0.18	7.89 <sup>b</sup> ±0.16	8.02 <sup>b</sup> ±0.22	*
Total protein intake (g)/bird.(P.I)	143.52 <sup>a</sup> ±3.21	132.72 <sup>b</sup> ±4.49	132.05 <sup>b</sup> ±5.13	*
Total protein intake as% of the lowest value (100%)	108.68	100.50	100.00	-
Protein conversion ratio.(P.C.R)	0.76 <sup>a</sup> ±0.03	0.66 <sup>b</sup> ±0.03	0.67 <sup>b</sup> ±0.04	*
Total mortality rate (M.R) %	5.55	6.11	6.11	-

a, b, c Means in the same rows have the different superscript are significantly different at ( P≤0.05 ).

S.E: Meaning standard error.

N.S: No significant effect.

**Table (7):** Nutrient utilization of growing Japanese quail at 6<sup>th</sup> weeks of age as affected by energy levels ( Means± S.E).

Parameters	Energy levels (ME.Kcal/diet)			Significant effect
	2600	2900	3200	
Final Body weight gain at 6week old	185.34 <sup>b</sup> ±1.52	199.87 <sup>a</sup> ±4.59	203.54 <sup>a</sup> ±1.08	*
Total gain as% of the lowest value (100%).	100.00	107.83	109.81	-
Total feed intake (g)/bird. (F.I)	626.88 <sup>a</sup> ± 6.49	561.89 <sup>b</sup> ±10.66	512.44 <sup>c</sup> ±13.75	*
Total feed intake as% of the lowest value (100%)	122.33	109.64	100.00	-
Feed conversion ratio.(F.C.R)	3.38 <sup>a</sup> ±0.06	2.83 <sup>b</sup> ±0.11	2.52 <sup>c</sup> ±0.08	*
Total metabolizable energy intake M.E.I) (KCalME/Kg diet).	1629.44±16.89	1629.47±30.92	1639.82±44.01	N.S
Total metabolizable energy intake as% of the lowest value (100%)	100.00	100.01	100.60	-
Metabolizable energy conversion ratio.(M.E.E.R)	8.80 <sup>a</sup> ±0.14	8.20 <sup>b</sup> ±0.32	8.06 <sup>b</sup> ±0.25	*
Total protein intake (g)/bird.(P.I)	150.45 <sup>a</sup> ±1.55	134.85 <sup>b</sup> ±2.55	122.98 <sup>c</sup> ±3.30	*
Total protein intake as% of the lowest value (100%)	122.33	109.65	100.00	-
Protein conversion ratio.(P.C.R)	0.81 <sup>a</sup> ±0.01	0.67 <sup>b</sup> ±0.03	0.60 <sup>c</sup> ±0.02	*
Total mortality rate (M.R) %	5.83	6.11	5.83	-

a, b, c Means in the same rows have the different superscript are significantly different at ( P≤0.05 ).

S.E: Meaning standard error.

N.S: No significant effect.

Growing Japanese quail, Growth, growth rate, nutrient utilization

**Table (8):** Some Blood plasma parameters of growing Japanese quail during the whole experimental period as affected by dietary energy sources and levels ( Means± S.E).

Energy Sources	Carbohydrates (CH)			Plant oil (PO)			Animal fat (AF)			Signifi- cant effect
Energy levels Traits	2600 *S <sub>1</sub> L <sub>1</sub>	2900 S <sub>1</sub> L <sub>2</sub>	3200 S <sub>1</sub> L <sub>3</sub>	2600 S <sub>2</sub> L <sub>1</sub>	2900 S <sub>2</sub> L <sub>2</sub>	3200 S <sub>2</sub> L <sub>3</sub>	2600 S <sub>3</sub> L <sub>1</sub>	2900 S <sub>3</sub> L <sub>2</sub>	3200 S <sub>3</sub> L <sub>3</sub>	
Total plasma lipids (TPL) (g/dl).	3.92 <sup>i</sup> ±0.02	4.02 <sup>h</sup> ±0.02	4.12 <sup>g</sup> ±0.02	4.27 <sup>f</sup> ±0.02	4.37 <sup>e</sup> ±0.02	4.47 <sup>d</sup> ±0.02	4.63 <sup>c</sup> ±0.01	4.74 <sup>b</sup> ±0.04	4.91 <sup>a</sup> ±0.04	*
Total plasma triglyceride (TPT) (mg/dl).	173.00 <sup>f</sup> ±2.88	178.00 <sup>ef</sup> ±2.88	188.33 <sup>d</sup> ±3.17	183.00 <sup>de</sup> ±2.82	188.00 <sup>d</sup> ±2.82	203.00 <sup>c</sup> ±2.82	208.00 <sup>c</sup> ±2.82	218.90 <sup>b</sup> ±2.55	244.09 <sup>a</sup> ±2.73	*
Total plasma cholesterol (TPC) (mg/dl).	174.66 <sup>f</sup> ±0.88	184.70 <sup>e</sup> ±0.88	194.66 <sup>d</sup> ±0.88	184.67 <sup>e</sup> ±0.88	206.65 <sup>c</sup> ±1.66	212.33 <sup>c</sup> ±3.71	208.33 <sup>c</sup> ±3.33	228.65 <sup>b</sup> ±1.85	236.32 <sup>a</sup> ±4.91	*
Total plasma * (HDL) ( mg/dl).	99.33 <sup>a</sup> ±2.96	76.31 <sup>b</sup> ±2.33	64.00 <sup>c</sup> ±2.08	81.38 <sup>b</sup> ±3.75	51.00 <sup>de</sup> ±2.08	52.00 <sup>cde</sup> ±3.01	60.67 <sup>cd</sup> ±3.48	46.34 <sup>e</sup> ±2.72	43.00 <sup>e</sup> ±1.52	*
Total plasma ** (LDL) (mg/dl).	109.59 <sup>f</sup> ±0.87	119.62 <sup>e</sup> ±0.88	129.76 <sup>d</sup> ±0.89	119.61 <sup>e</sup> ±0.88	141.76 <sup>c</sup> ±1.66	147.32 <sup>c</sup> ±3.70	143.31 <sup>c</sup> ±3.32	163.70 <sup>b</sup> ±1.85	171.34 <sup>a</sup> ±4.91	*

a, b ,c , d Means in the same rows have the different superscript are significantly different at ( P≤0.05 ).

S.E: Meaning standard error.

N.S: No significant effect.

S: Sources of energy

L: Levels of energy

\* HDL: High density lipoprotein

\*\* LDL: Low density lipoprotein

**Table (9):** Blood plasma parameters of growing Japanese quail at 6<sup>th</sup> weeks of age as affected by energy sources ( Means± S.E).

Traits	Energy Sources			Significant effect
	Carbohydrates (CH)	Plant oil (PO)	Animal fat (AF)	
Total plasma lipids (TPL) (g/dl).	4.02 <sup>c</sup> ±0.03	4.37 <sup>b</sup> ±0.03	4.76 <sup>a</sup> ±0.04	*
Total plasma triglyceride (TPT) (mg/dl).	179.77 <sup>c</sup> ±2.70	191.33 <sup>b</sup> ±3.33	223.66 <sup>a</sup> ±5.51	*
Total plasma cholesterol (TPC) (mg/dl).	184.65 <sup>c</sup> ±2.92	201.24 <sup>b</sup> ±4.38	224.41 <sup>a</sup> ±4.54	*
Total plasma* (HDL) ( mg/dl).	79.87 <sup>a</sup> ±5.32	61.43 <sup>b</sup> ±5.74	50.00 <sup>c</sup> ±3.02	*
Total plasma ** (LDL (mg/dl).	119.66 <sup>c</sup> ±2.92	136.22 <sup>b</sup> ±4.38	159.41 <sup>a</sup> ±4.54	*

a, b ,c Means in the same rows have the different superscript are significantly different at ( P≤0.05 ).

S.E: Meaning standard error.

N.S: No significant effect.

\* HDL: High density lipoprotein

\*\* LDL: Low density lipoprotein

**Table (10):** Some Blood plasma parameters of growing Japanese quail at 6<sup>th</sup> weeks of age as affected by energy levels ( Means± S.E).

Traits	Energy levels (ME.Kcal/ diet)			Significant effect
	2600	2900	3200	
Total plasma lipids (TPL) (g/dl).	4.27 <sup>c</sup> ±0.01	4.37 <sup>b</sup> ±0.01	4.50 <sup>a</sup> ±0.03	*
Total plasma triglyceride (TPT) (mg/dl).	188.00 <sup>c</sup> ±5.10	194.96 <sup>b</sup> ±6.30	211.80 <sup>a</sup> ±8.47	*
Total plasma cholesterol (TPC) (mg/dl).	189.22 <sup>c</sup> ±5.09	206.66 <sup>b</sup> ±6.39	214.44 <sup>a</sup> ±6.29	*
Total plasma* (HDL) ( mg/dl).	80.41 <sup>a</sup> ±5.84	57.86 <sup>b</sup> ±4.81	53.01 <sup>b</sup> ±4.07	*
Total plasma ** (LDL (mg/dl).	124.22 <sup>c</sup> ±5.09	141.62 <sup>b</sup> ±6.39	149.43 <sup>a</sup> ±6.29	*

a, b, c Means in the same rows have the different superscript are significantly different at ( P≤0.05 ). S.E: Meaning standard error.

N.S: No significant effect.

\* HDL: High density lipoprotein

\*\* LDL: Low density lipoprotein

**Table (11):** Effect of age on carcass chemical composition of growing Japanese quail from 1 to 6<sup>th</sup> weeks of age ( Means± S.E).

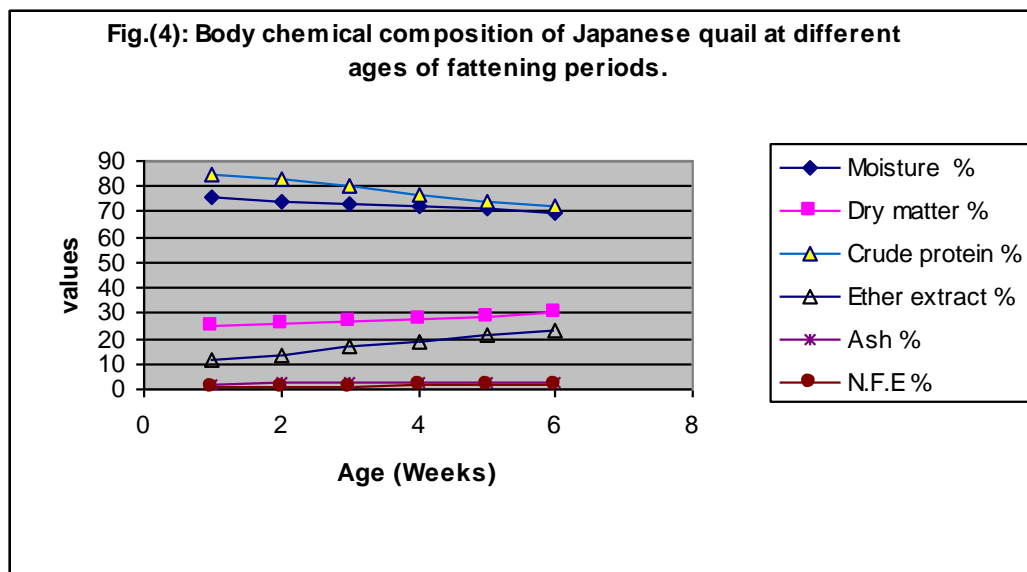
Traits	Ages (week)						Significant effect
	1 week	2 week	3 week	4 week	5 week	6 week	
Moisture, %	75.33 <sup>a</sup> ±0.03	74.33 <sup>b</sup> ±0.04	73.03 <sup>c</sup> ±0.03	72.03 <sup>d</sup> ±0.05	71.03 <sup>e</sup> ±0.03	69.83 <sup>f</sup> ±0.02	*
Dry matter, %	24.66 <sup>f</sup> ±0.04	25.66 <sup>e</sup> ±0.03	26.96 <sup>d</sup> ±0.05	27.96 <sup>c</sup> ±0.03	28.96 <sup>b</sup> ±0.04	30.16 <sup>a</sup> ±0.03	*
Crude protein, %	84.79 <sup>a</sup> ±0.44	83.12 <sup>b</sup> ±0.30	79.77 <sup>c</sup> ±0.30	76.92 <sup>d</sup> ±0.30	73.92 <sup>e</sup> ±0.28	71.96 <sup>f</sup> ±0.27	*
Ether extract, %	11.27 <sup>f</sup> ±0.26	13.27 <sup>e</sup> ±0.26	16.62 <sup>d</sup> ±0.30	18.98 <sup>c</sup> ±0.30	21.37 <sup>b</sup> ±0.29	23.00 <sup>a</sup> ±0.26	*
Ash, %	2.18 <sup>b</sup> ±0.08	2.25 <sup>b</sup> ±0.08	2.34 <sup>b</sup> ±0.06	2.70 <sup>a</sup> ±0.07	2.87 <sup>a</sup> ±0.08	2.96 <sup>a</sup> ±0.13	*
N.F.E, %*	1.26 <sup>d</sup> ±0.07	1.15 <sup>d</sup> ±0.05	1.21 <sup>d</sup> ±0.06	1.46 <sup>c</sup> ±0.05	1.82 <sup>b</sup> ±0.03	1.99 <sup>a</sup> ±0.05	*

a, b, c, d, e, f . Means in the same rows have the different superscript are significantly different at (P≤0.05).

S.E: Meaning standard error.

N.S: No significant effect.

\* NFE: Nitrogen free extract.



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## الملخص العربي

### أداء وطبيعة النمو للسمن الياباني المغذى على مصادر ومستويات مختلفة من الطاقة تحت الظروف البيئية المصرية.

د. نبيل فهمى عبد الحكيم، عبد الهادي عامر، د. عبد العظيم فهمى عبد العظيم.

جمال على عبد الحافظ

قسم الإنتاج الحيواني - كلية الزراعة - جامعة الأزهر - مدينة نصر - مصر.

أجريت هذه التجربة في محطة بحوث الدواجن التابعة لقسم الإنتاج الحيواني - كلية الزراعة - جامعة الأزهر - مدينة نصر بالقاهرة - جمهورية مصر العربية.

أجريت هذه الدراسة لمعرفة تأثير مصادر ومستويات الطاقة على أداء وطبيعة النمو للسمن الياباني تحت الظروف البيئية المصرية حيث تهدف هذه الدراسة إلى الوصول إلى أفضل مصادر ومستويات الطاقة التي يمكن استخدامه وذلك لتقليل نفقات التغذية في فترة التسمين. واستخدم عدد ١٠٨٠ طائر سمن ياباني غير مجنس عمر يوم و استمرت التجربة لمدة ستة اسابيع ابتداء من ٢٠٠٨/١/١ حتى ٢٠٠٨/٢/١٢م. وتم تقسيم التجربة إلى ٩ مجاميع وقسمت كل مجموعة إلى ٣ مكررات و داخل كل مكررة ٤٠ طائر. وتم استخدام ٣ مصادر للطاقة هي الزيت النباتي، الدهن الحيواني، الكربوهيدرات بحيث تمثل ٢٥% من طاقة العليقة وثلاث مستويات للطاقة هي ٢٦٠٠، ٢٩٠٠، ٣٢٠٠ كيلو كالوري طاقة ممثلة /كجم علف. وكانت الإضاءة مستمرة طوال فترة التجربة. وتم تسجيل كل المقاييس الخاصة بأداء النمو. وأخذ عينات دم و لحم للتحليل الكيماوي في نهاية التجربة.

وكانت أهم النتائج المتحصل عليها من خلال هذه الدراسة كالتالي:

١- أظهرت النتائج أن هناك تأثيراً معنوياً لمصادر ومستويات الطاقة المستخدمة على الوزن النهائي حيث سجلت المجموعة التي غذيت على عليقة تحتوي على الزيت النباتي مع مستوى ٢٩٠٠ كيلو كالوري طاقة ممثلة أعلى قيمة لوزن الجسم النهائي مقارنة بباقي المجاميع التجريبية. ولقد سجلت المجموعات التي غذيت على الكربوهيدرات مع مستوى طاقة ٢٦٠٠، ٢٩٠٠ كيلو كالوري طاقة ممثلة على أقل قيمة وكذلك المجموعة التي تغذت على عليقة تحتوي على الزيت النباتي و الدهن الحيواني مع مستوى ٢٦٠٠ كيلو كالوري طاقة ممثلة. كان لتأثير مصادر الطاقة أثراً معنوياً على وزن الجسم النهائي حيث أدى استخدام الزيت النباتي في العلائق إلى الوصول لأعلى قيمة لوزن الجسم النهائي تلاها المجموعات التي تغذت على الدهن الحيواني ثم الكربوهيدرات. كان لتأثير مستوى الطاقة ٢٩٠٠، ٣٢٠٠ كيلو كالوري طاقة ممثلة أثراً معنوياً على وزن الجسم النهائي حيث سجلت أعلى قيمة لوزن الجسم النهائي بينما سجلت المستوي ٢٦٠٠ كيلو كالوري طاقة ممثلة أقل قيمة لوزن الجسم النهائي.

٢- كان هناك تأثير معنوي للتداخل بين مصادر ومستويات الطاقة أثراً معنوياً على معامل تحويل الغذاء حيث أدى استخدام الزيت النباتي أو الدهن الحيواني مع مستوى ٣٢٠٠ كيلو كالوري طاقة ممثلة أقل قيمة (الأفضل) مقارنة بباقي المجاميع. بينما سجلت المجموعات التي تغذت على الكربوهيدرات مع مستوى طاقة ٢٦٠٠، ٢٩٠٠ كيلو كالوري طاقة ممثلة على أعلى قيمة (الأسوأ) وكذلك المجموعة التي تغذت على عليقة تحتوي على الدهن الحيواني مع مستوى ٢٦٠٠ كيلو كالوري طاقة ممثلة كما بينت النتائج أيضاً أنه كان لمصادر الطاقة تأثيراً معنوياً على معامل تحويل الغذاء حيث أدى استخدام الزيت النباتي أو الدهن الحيواني في العلائق إلى أعلى قيمة لمعامل تحويل

الغذاء ثم الكربوهيدرات. ومن ناحية اخرى ادى زيادة مستوى الطاقة فى العلائق الى تحسن فى معامل تحويل الغذاء حيث قلت القيمة بزيادة المستوى.

٣- كان هناك أثرا معنويا للتداخل على معامل تحويل طاقة الغذاء حيث أدى استخدام الزيت النباتى او الدهن الحيوانى مع مستوى ٢٩٠٠ ، ٣٢٠٠ كيلو كالوري طاقة ممثلة اقل قيمة (الافضل) مقارنة بباقي المجاميع. اظهرت النتائج ان استخدام الزيت النباتى او الدهن الحيوانى فى العلائق ادى الى تحسن فى معامل تحويل طاقة الغذاء معنويا مقارنة بالكربوهيدرات. كما سجل المستويين ٢٩٠٠ و ٣٢٠٠ كيلو كالوري طاقة ممثلة اقل قيمة (الافضل) فى معامل تحويل طاقة الغذاء معنويا مقارنة بالمستوى ٢٦٠٠ كيلو كالوري طاقة ممثلة.

٤- اظهرت النتائج ان هناك فروق معنوية فى بعض مقاييس الدم مثل الدهون الكلية و الدهون الثلاثية و الكوليستيرول الكلى و الكوليستيرول عالى الكثافة و الكوليستيرول منخفض الكثافة.

٥- اظهرت النتائج ايضا ان مصادر ومستويات الطاقة وكذلك العمر كان لة تأثير على التركيب الكيمى او لمكونات الذبيحة.

- الخلاصة : ادى استخدام الزيت النباتى مع مستوى طاقة ٢٩٠٠ كيلو كالوري طاقة ممثلة افضل النتائج لصفات النمو فى السمان اليابانى.