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NUTRITIONAL AND MANAGEMENT STUDIES ON THE PIGEON: ESTIMATE OF METABOLIZABOL ENERGY REQUIREMENTS.

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Abstract: *An experiment was conducted to estimate the* metabolizable energy levels *(ME) and its effects on productive and reproductive performance of Local Baladi squabs and Pigeons under Egyptian conditions. 1st EXP: growing period. A total number of 48 pairs of squabs Baladi pigeons (aged 28 days till age at onset of egg production), were used. 2nd EXP: laying period. A total of 32 pairs of Baladi pigeons (6 - 7 months old) were distributed according to its consistent mating systems were used. At the beginning of each experiment squabs and pigeons were divided randomly into four treatments containing 12 pairs (3 replicates of 4 pairs each) in the growing period (S. Exp.) and 8 paris (4 replicates of 2 pairs each) in the laying period (P. Exp.).The dietary ME levels were* (2600,2800,3000 and 3200 ME Kcal /kg of diet).*The diets were isonitrogenous (15.5% CP). Diets were formulated in mash form contining vitamin and mineral premix. Birds were maintained on a 14 hours of lighting regimen along the experimental period. Feed and water were given ad libitum along the experiment.*

Results obtained are summarized as follows:

Growing period (S. EXP.):

1- Live body weight (LBW) and weight gain (BWG) at different ages studied were significantly affected by the dietary energy levels

2- Feed intake of youngest pigeon on the diets content (2600 and 2800 Kcal ME/kg of diet) was significantly higher compared to those fed other diets. Feed intake was significantly ($P<0.05$) decreased as the ME levels increased from 2600 to 3200 ME Kcal /kg of diet.

3- Dietary ME levels (2600, 2800, 3000 and 3200 Kcal ME/kg of diet) had highly significant effect on daily ME intake only during the first and last month in growing period..

Laying period (P. EXP.):

1- Body weight, hatchability, mortality rate (during the 28 old days) and egg number produced during the whole experimental period (180 days) were not significantly affected by the increase of ME levels in the diet.

2- Increasing the dietary energy levels from 2600 to 3200 ME Kcal/ kg increased feed intake for pigeons without or with squabs all experimental periods.

3- Dietary ME levels had significant ($P \leq 0.05$) effect on age at onset of egg production. Pigeon fed high ME diets (3200 ME Kcal /kg of diet) had the short length of the egg cycle compared with low ME diets (2600 ME d Kcal /kg of diet).

4- Egg weight, Fertility and hatchability were significantly ($P < 0.05$) increased as dietary ME levels increased in the diet.

5- Squabs fed diets containing the higher level of ME (3200 ME Kcal /kg of diet) had significantly the highest body weight at 7, 14, 21 and 28 days of age compared with those fed the lowest ME level (2600 ME Kcal /kg of diet).

6- Livability percentage and economic efficiency (EE) of squab increased with the increase in ME level in the diet.

INTRODUCTION

The pigeon's natural diet consists mostly of seeds, whole grain are a natural feeds and could supply enough protein, carbohydrates and fat, it had insufficient of necessary vitamins, macro and micro nutrients.

Birds have been a frequent subject of bioenergetics studies; few of these studies have dealt with the breeding cycle. Estimations of energy requirements during the major phases of the breeding cycle have been based, for the most part, on indirect measurements. Direct measurements of energy intake and utilization have been difficult to obtain because of the reluctance of most birds to nest and raise young under captive conditions that would permit frequent weightings of adults and young and quantification of food intake **(Lehrman, 1955, 1964)**,.

Dietary energy and protein levels have the greatest effect on the feeding and laying performance of hens. Dietary energy level is the most important factor in determining feed intake of layers which consume feed to satisfy an inner craving for energy **(Leeson et al., 2001)**.

The scarcity of experimental data available on the nutrients of pigeons is likely attributable to the above factors**, (Waldie et al. 1991, and Sales and Janssens 2003).** Reported that energy is considered one of the most important nutrients in poultry diets. **George and Jvoti (1955)** indicated that at least 77% of the energy expended in a pigeon subjected to sustained muscular activity is due to the oxidation of fat. However, **Waldie et al. (1991)** showed that feed intake decreased as dietary energy level of pigeons increased from 2650, 2900 to 3150 Kcal ME/kg of diet. Also, they added that egg production, fertility, hatchability, egg breakage as well as number and mortality rate of squabs produced were not affected by feed energy level. Furthermore**, Sales and Janssens (2003)** showed that a dietary crude protein content of 12 to 18 % and metabolizable energy content of around 12 MJ/kg (2868 Kcal ME/kg), based on production of offspring, is recommended for feeding of adult pigeons. No nutritional requirements for pigeons were included in the summary for poultry published by the **National Research Council (1984) or (1994). Abd El-Azeem et al., (2007)** showed that the highest energy levels of pigeons (3200 Kcal ME/kg) was the best as compared with other energy levels (2600, 2800 and 3000 Kcal ME/kg). No nutritional requirements for pigeons were included in the summary for poultry published by the **National Research Council (1984) or (1994).**

In this study estimate requirements in metabolizabol energy levels of pigeons (2600, 2800, 3000 and 3200 ME Kcal/kg diet) on the productive and reproductive performance in the growing and laying term under Egyptian condition.

MATERIALS AND METHODS

The experimental work was carried out at El-Gimmizah Production Sector and El-Gimmizah Poultry Research Farm, Agriculture Research Center, Ministry of Agriculture; during the period from June, 2007 up to June, 2008. This experiment was designed to determine the effect of feeding dietary different metabolizable energy levels on the performance of pigeons and squabs. This study included two experiments. The first one is squabs experiment (S.Exp.). A total of 48 pairs of squabs Baladi pigeons (ranged from 28 to 30 old days). While the second parents experiment (P.Exp.) was contained 32 pairs of Baladi pigeons (6 to 7 months old) were distributed according to its consistent mating systems (sex ratio of pigeons 1:1). These pigeons which were used in the first experiment (S. Exp.). At the beginning of each experiment squabs and pigeons were divided randomly into equal four treatments each containing 12 pairs (3 replicates of 4 pairs each) in the

squabs experimental (S.Exp.) and 8 Paris (4 replicates of 2 pairs each) each in the parents experimental (P.Exp.). The birds were housed in an environmentally controlled home, all pairs were randomly collocated to wire poultry cages 100 x 70 x 40 cm high, The fronts of the cage batteries were modified to suspend feed and water, which were provided to the birds ad-libitum. In each breeding cage, four squab pairs were allowed unsexed on a random basis in the growing period (S.Exp.), while the second laying period (P.Exp.) two male and two female pigeons (Baladi pigeons) were allowed to form couples on a random basis. In each breeding cage the parents were able to feed their squabs up to the age of 28 days, the weaning stage. At this age squabs were ready and in prime condition for slaughter or were transferred to be reared further. The pigeons were maintained on a 14 h. light regimen.

Diets were formulated as mash form constant dietary protein levels was provided 15.5% and 4 energy levels were used (2600,2800,3000 and 3200 ME Kcal /kg of diet). The composition of the experimental diets is shown in Table 1.

During the Exp.1 (growing period) the following measurements were recorded performed or calculated initial body weight at 28 day of age, final body weight at 180 day of age, changes in body weight in male and female squab, daily feed intake per pair, total feed intake per pair (during 6 month), daily ME intake per pair, total ME intake per pair (during 6 month) and sexual maturity of squabs in each treatment. Since the sexual maturity was determined the first egg laying.

Also during the Exp. 2 (laying period) the following measurements were performed or calculated initial body weight, final body weight, changes in body weight, daily feed intake per pair with or without squab, total feed intake per pair (during 6 month), daily ME intake per pair, total ME intake per pair with or without squab (during 6 month), egg cycle, egg number, egg weight, fertility, infertile eggs, deed embryo. hatchability, squabs production per pair, squabs growth during 28 day, body weight gain (BWG) in squabs during 28 day, squabs mortality rate, livability and Net Return (NR) and Economic Efficiency (EE).

Data were analyzed according to one- way analysis of variance, to estimate the significant differences between treatments. **Duncan's (1955)** Multiple range test was calculated by using **SPSS (1997)** computer program.

RESULTS AND DISCUSSION

Performance of squabs (Exp. 1):

Data on Table 2 showed the live body weight (LBW) and weight gain (BWG) at different ages studied were than a significantly affected by the energy levels, except LBW in body weight at end of 2nd and 3rd month. The squab pigeons fed the lowest dietary 2600 Kcal ME/kg of diet recorded significantly ($P \leq 0.05$) the lowest body weight compared to those fed diet containing 3200 Kcal ME/kg of diet. Also, significant differences were observed in LBW between males and females. Body weight of the male was significantly higher than the female pigeons with the increasing of ME level in the diet during all periods. The weight gain from 29 to 180 days of age (sexual maturity) was decreased with the lower level of energy.

It was noticed that the increase of weight afterwards (differences in weight) is very low. Similarly, **Sales and Janssens (2003)** indicated that pigeon reach to mature body weight at 28 days of age and the increase in weight after that is very low. **Abed Al-Azeem, (2005)** showed that the weight gain during 8 to 14 days of age was higher compared with other periods. While the weight gain from 29 to 180 days of age (sexual maturity) was very poor, where the pigeon squabs reach to the maximum weight gain during the first 28 days of age. Also, **Levi (1974)** who found that growth rate of squabs is very rapid, especially at the first 7 days of age, and the growth peak was at 26 to 28 days of age. However, **Essam (1997)** indicated that the highest growth rate of squabs was obtained during feeding on the crop milk and the lowest was observed during seeds feeding.

Daily feed intake and metabolizable energy of the squabs and young squabs (Exp. 1):

Feed intake values (gm./pair/day) were not affected significantly by squab's pigeons during the first month (Table 3). While during the 2nd, 3rd, 4th, 5th and 6th month had significant effect on daily feed intake. Feed intake was significantly higher for youngest pigeon fed diets containing 2600 and 2800 Kcal ME/kg compared to those fed other diets. The data indicated that feed intake was significantly ($P<0.05$) decreased as the ME levels increased from 2600 to 3200 ME Kcal /kg of diet.

Results in Table (3) indicated that the dietary ME levels (2600, 2800, 3000 and 3200 Kcal ME/kg of diet) had highly significant effect on daily ME intake during the first and last month in growing period (28 days – age at onset of egg production). While during the 2nd, 3rd, 4th and 5th month had no significant effect on daily ME intake. Concerning the dietary ME

levels intake, the daily ME consumption values of squab's pigeons increased due to increasing dietary ME levels. This result is in agreement with that of **Waldie et al. (1991)** *)* indicated that feed intake and protein intake decreased with the increase of dietary energy levels in the diet (2650, 2900, and 3150 Kcal ME/kg of diet), while metabolizable energy intake was not affected.

Body weight and changes in body weight of adult pigeons (P. EX.):

Results in (Table 4) showed that the initial body weight of the male parent pigeons were higher than those of the female pigeons. There were no significant differences in initial body weight (live body weight in age at onset of egg production) between the treatments. Increasing dietary energy level had no significant effect on body weight at the end of the experiment. The results showed that the weight gain from (sexual maturity) to (6 months) of age was very low in all treatments. This result is in agreement with that of **Waldie et al. (1991)** who indicated that body weight of pigeons were not significantly affected when they fed different energy levels (2650, 2900, and 3150 Kcal ME/kg of diet). Also, **Abd El-Azeem et al., (2007)** indicated that final body weight and differences in weight were not significantly affected when dietary ME levels increased from 2600 to 3200 ME Kcal /kg of diet.

Daily feed intake and ME of the adult pigeons without or with squabs (Exp. 2):

Data indicated that feed and ME intake were significantly ($P<0.05$) increased as the ME levels increased from 2600 to 3200 ME Kcal/ kg (Table 5). These results indicated that the feed intake by pigeons without or with squabs were decreased at all period when the energy level increases from 2600 to 3200 ME Kcal/ kg. Also the energy intake increased with the increasing feed intake. In additions the amount of feed intake increased with the increasing the age of squabs. The hatching squabs are given only crop milk from the first day until 4^{th} day, then the parents start to give the squabs rations mixed with the crop milk, while the amount of feed intake by pigeons increased at 14,21 and 28 days. This may be due to the increase of body weight of squabs, and crop size, also the crop milk produced by parent decreases with the increase in age of squabs, so squabs required a large amount of feed with advanced ages. The data indicated that feed, protein and metabolizable energy intake were significantly ($P<0.05$) increased as the ME levels increased from 2600 to 3200 ME Kcal /kg of diet in both cases except metabolizable energy intake in pigeon without squabs. These results agree with that reported by **Scott et al. (1982)** who found that energy levels of the diet appears to be the overwhelmingly important factor

determining the feed intake. However, **Waldie et al. (1991)** indicated that feed intake and protein intake decreased with the increasing of dietary energy levels in the diet, while metabolizable energy intake was not affected. Also, they added that the daily average energy intake was 235 Kcal / pair / day of pigeons not producing squabs. Feed intake of pair of pigeons varied between 106 and 126 g for group fed diets containing either 2650, 2900 or 3150 Kcal/kg respectively. Also, **Plavnik et al. (1997) and Nahashon et al. (2005)** suggested that as dietary energy levels increased birds satisfy their energy needs by decreasing feed intake. Furthermore, **Abd El-Azeem et al., (2007)** indicated that feed, protein and metabolizable energy intake were significantly ($P<0.05$) decreased as the ME levels increased from 2600 to 3200 ME Kcal /kg of diet.

The present results in dictated that a diet containing 3200 kcal/kg diet and 3000 or 2800 kcal/kg diet levels were suggested to be suitable requirements for pigeon at the laying period during the 6 months in production after 180 days of age. Dietary energy level is the main effect in determining the efficiency of feed utilization.

Since birds tend to eat in order to satisfy their energy requirement, the differences in feed intake were probably due to the lower ME.

Age at onset of egg production:

Table (6) showed that the dietary ME levels ((2600, 2800, 3000 and 3200 Kcal ME/kg of diet) had significant ($P\leq0.05$) effect on age at onset of egg production.

The lowest level of dietary ME (2600 Kcal ME/kg of diet) had delayed sexual maturity compared with other dietary ME levels (2800, 3000 and 3200 Kcal ME/kg of diet). While, the young pigeon given (3200 Kcal ME/kg of diet) reached maturity at earlier age followed by diet (3000 Kcal ME/kg of diet). It could be concluded that the ME level seemed to affect remarkably the age at onset of egg production. The pigeons fed on a high level of ME start in laying at earlier age (187 days) than pigeons fed low ME level (198.50 days of age). This result is in agreement with that reported by **Morley (1974)** and **Haynes (1987)** found that the age of mating in pigeons was ranged from 5 to 8 months.

Egg cycle:

Pigeon fed high ME diets (3200 ME Kcal /kg of diet) recorded the short length of the egg cycle compared with those fed low ME diets (2600 ME Kcal /kg of diet) Table 6. The egg cycle recorded 49.12, 50.37, 51.62

and 52.75 days when parent pigeon fed diets containing (3200, 3000, 2800 and 2600 Kcal ME/kg of diet respectively). These results are in agreement with those obtained by **Abed Al-Azeem, (2005)** who found that the interval between two consecutive egg laying (days) were ranged from 45.80 to 54.60 depending on the activity of parents to rear of their squabs. It is notes worthily the length of the egg cycle values of adult pigeons significantly increased due to decreasing dietary ME levels.

Egg number (EN), Egg weight (WE):

Total egg number produced per pair during the whole experimental period (180 days) were not significantly affected by increasing ME levels in the diet (Table 6). Theses results were in agreement with the finding of **Waldie et al. (1991)** who indicated that egg production of pigeons was not significantly affected by increasing the dietary energy levels in the diet.

However, the results of egg weight showed the highly significantly ($P<0.05$) increased as ME levels increased in the diet. The recorded weight of egg ranged from 14.73 to 16.25g. The results of **Yanni et al. (1969)** indicated that egg weight produced from pigeons was ranged from 17.99 to 20.5 g on average. While, **Abed Al-Azeem, (1998)** indicated that egg weight produced from pigeons was ranged from 13.78 to 17.38g on average when dietary ME levels increased from 2600 to 3200 ME Kcal /kg of diet.

Fertility and hatchability:

Data showed that hatchability of fertile eggs and dead embryo were not significantly affected by increasing the ME levels in the diet (Table 6). While, fertility and hatchability of laid eggs were significantly ($P<0.05$) decreased when ME levels decreased, but infertile eggs was significantly ($P<0.05$) decreased when ME levels increased (Table 6). These observations are in agreement with the results of. **Abd El-Azeem et al., (2007)**. **Waldie et al. (1991)** who indicated that fertility percentage of pigeons was not affected by the energy levels.

Squab production (Exp. 2):

Results indicated that number of squabs produced per treatment was significantly ($P<0.05$) increased by the increase of ME levels in the diet. No significant effect on squab production between dietary energy levels 3200, 3000 and 2800 Kcal ME/kg of diet. But significantly differences were detected when pigeon fed (3200 ME Kcal /kg of diet) as compared with those fed (2600 ME Kcal /kg of diet). Number of squabs at end of 1^{st} week was not affected when pigeon fed (3200 and 3000 ME Kcal /kg of diet).

Also, no significant effect when pigeon fed (3000 and 2800 ME Kcal /kg of diet) and when pigeon fed (2800 and 2600 ME Kcal /kg of diet). Also, significantly differences when pigeon fed (3000 ME Kcal /kg of diet) compared with those fed (2600 ME Kcal /kg of diet) at the end 1st week. Similar results in other periods (number at the end of 2nd, 3rd week and number of weaned squabs) significantly high ME level recorded the highest number of weaned squabs than the low ME level which recorded the lowest number of weaned squabs.

Squab growth during 28 days of age (Exp. 2):

Table (6) shows results of squab's growth from hatching until 28 days (males and females during the experimental period). Significant differences were observed in the body weight of squabs hatched, at 7 days, 14 days, 21 days or weaned squabs which fed different levels of ME. The results indicated that the weights of squabs at hatch were similar among experimental groups and were ranged from 13.38 to 14.12 g.

Results indicated that increasing dietary ME content in the experimental periods significantly increased body weight of squabs, this difference high 23.5% between the diets of the lowest and the highest ME content in the market age. Diet containing less than (2600 ME Kcal /kg of diet) fed to pigeons kept cages resulted in smaller from hatching until 28 days. These result is in agreement with **Abd El-Azeem et al., (2007)** who showed that growth rate of squabs was not significantly affected at hatch and at 3 days of age, while at 7,15, 21 and 28 days of age, growth rate significantly($P<0.05$) increased when dietary energy levels increased from 2600 to 3200(ME Kcal/ kg diet). The **USDA (1960)** indicated that a squab is a young pigeon usually marketed at 25 to 30 days of age just before it is ready to leave the nest. As the weight ranged between 12-24 ounces. **Levi (1954*)*** reported that each day for six or seven days body of squabs seems to double in size. After 26 to 28 days of hatching the squab has reached the peak of its growth for fat, size, and weight. Moreover, **Bokhari (1994)** indicated that squabs grow very rapidly until about 21 days, and then the growth continued at slower rate afterwards. **Essam (1997)** showed that the highest growth rate of squabs was obtained during feeding on the crop milk and the lowest was during seeds feeding.

Body weight gain (BWG) during 28 days of age (Exp. 2):

The increasing of growth rate of squabs at these ages may be due to that squabs depend at these periods on crop milk produced from both parents in response to prolactin hormone secretion. The crop milk given for

squabs during first 7 days of age appeared affected by energy levels in the diet because crop milk is a holocrine secretion lipid droplets from within the lining epithelium of the crop, and a gradual increase in size and number of the droplets can be observed in response to prolactin and epithelial cells that are desquamated to disintegrate and become part of the secretion. These results are in agreement with those obtained by **Levi (1974)** who found that growth rate of squabs is very rapid, especially at the first 7 days of age, and the growth peak was at 26 to 28 days of age. **Aggrey and Cheng (1993)** indicated that the maximal weight gain of squabs was observed during 8-14 days of age, while weight gain by the squab between days 21 and 28 days was minimal. In fact, some squabs actually lost weight during this period.

It is clearly noticed that the high ME level (3200 ME Kcal /kg of diet) recorded the highest BWG in all experimental periods compared with other ME levels

Mortality rate:

Mortality rate during the 28 days of age was not significantly affected by the increasing of ME levels in the diet (Table 6).

Livability:

The livability percentage of pigeon squabs was affected by the dietary ME levels (2600, 2800, 3000 and 3200 Kcal ME/kg of diet) when pigeon were fed high ME diets (3200 ME Kcal /kg of diet) had significant effect on livability percentage compared with those fed low ME diets (2600 ME Kcal /kg of diet). While, diets (3000, 2800 and 2600 ME Kcal /kg of diet) had no effect on livability percentage (Table 6). Results indicated that the livability percentage of squab increases with the increasing ME level in the diet.

Net Return (NR) and Economic Efficiency (EE):

The cost of one kg diet decreased with the decrease of dietary energy levels in the diet (Table 7). The NR and EE / pair at the end of the period (180 day) was 5.21, 2.06, 0.10 and -4.51 for groups (3200, 3000, 2800 and 2600 Kcal ME/kg of diet) respectively. Net return recorded the highest values for pigeon fed diets containing 3200 ME Kcal /kg. It is worth while to note that the high ME level recorded more NR and EE than that of other levels.

Therefore, it is evident that comparing ME level in diet on the basic of NR or EE show that (3200 ME Kcal /kg of diet) was the most superior than that of the lower ME level (2600 ME Kcal /kg of diet).From economic point of view it appears that the inclusion of (3200 ME Kcal /kg of diet) or (3000 ME Kcal /kg of diet) in pigeon parents diets is economically

effective. Dietary ME level is considered as one of the major factors that affect the productive performance of pigeon from economical point of view, ME cost is an important item in the total feed cost of poultry feeding.

From the results of this experiment it can be concluded that the metabolizable energy content of pigeon diets plays an important role and effects the most important reproduction traits significantly. Feeding high metabolizable energy diets increases both the number and the weight of weaned squabs. This may be due to the increase of alive squabs in treatment one with the decrease of feed cost.

In conclusion. The highest dietary ME level of pigeon (3200 ME Kcal /kg of diet) gave the best performance compared with other ME levels. The diet containing (2600 ME Kcal /kg of diet) levels were suggested to be suitable requirement and no adverse effects on productive and reproductive performance of Local Baladi squabs and Pigeons under Egyptian conditions

metabolizable energy, Local Baladi squabs, Pigeons, performance

Table (1): Composition and chemical analyses of the basal diets.

Ingredients (%)	Diet 1 3200kcl	Diet 2 3000kcal	Diet 3 2800kcal	Diet 4 2600kcal
Yellow corn	**68.50**	**70.00**	**67.40**	**59.00**
Soybean meal, 44 %	**22.00**	**21.00**	**19.00**	**17.00**
Wheat bran	**0.00**	**2.60**	**9.50**	**20.00**
Oil	**5.20**	**2.00**	**0.00**	**0.00**
Limestone	**1.40**	**1.50**	**1.50**	**1.90**
Bon meal	**2.30**	**2.30**	**2.00**	**1.50**
Common salt (NaCl)	**0.30**	**0.30**	**0.30**	**0.30**
Vit. & Min. mix.*	**0.30**	**0.30**	**0.30**	**0.30**
Total	**100**	**100**	**100**	**100**
Calculated values:**				
Crude protein, %	**15.11**	**15.18**	**15..11**	**15.12**
ME,Kcal/kg	**3201.36**	**3007.11**	**2805.11**	**2615.61**
Crude fiber,%	**3.183**	**3.42**	**3.981**	**4.798**
Ether Extract,%	**2.813**	**2.966**	**3..121**	**3.200**
Calcium, %	**1.346**	**1.383**	**1.323**	**1.323**
Available phosphorus, AP %	**0.403**	**0.417**	**0.404**	**0.404**
Lysine, %	**0.806**	**0.797**	**0.751**	**0.751**
Methionine,%	**0.280**	**0.281**	**0.276**	**0.268**
Methionine + cysteine %	**0.533**	**0.539**	**0.536**	**0.533**
C/P ratio	**1/212**	**1/198**	**1/186**	**1/173**
Pries / ton	**1924**	**1835**	**1755**	**1709**

*Vit.& Min. mix:. each 1kg diet contains: 10,000 IU Vit. A; 2,000 IU Vit D_3 10 mg Vit. E;1mg Vit. K; 1mg Vit. B1; 5mg Vit. B2; 1,5mg Vit B6; 0.1mg Vit. B12; 0.3mg; Niacin, 10 mg ; Panatothenic acid, 0.5 mg, Biotin; I mg Folic acid;250 mg choline chloride; 60 mg manganese; 30 mg iron; 50 mg zinc; 4 mg copper;0.3 mg iodine; 0.1 mg Seleinium and 0.1mg cobalt.

** Calculated according to NRC (1994).

Table 2: Body weight and body weight gain of the squabs from 28 day to 6month of age (S. EX.)

Variables	Dietary ME levels (Kcal/Kg)				Sig.
	3200	3000	2800	2600	
Initial body weight (gm/birds).					
Males	248.50±0.42a	246.75±1.14a	249.00±0.59a	247.62±0.49a	NS
Females	228.75±0.27b	229.25±0.72b	228.25±0.72b	228.00±0.84b	NS
Mean	238.62±2.62	238.00±2.35	238.50±.2.76	237.81±2.58	NS
Body weight (gm/birds) in 1st month .					
Males	268.50±2.16a	262.75±2.42b	259.00±0.70bc	257.25±0.72c	**
Females	248.50±1.01d	248.25±0.49d	244.75±1.11d	240.50±1.01e	**
Mean	258.50±2.83a	255.50±2.22ab	251..87±1.95ab	248.87±2.24b	*
Body weight (gm/birds) in 2nd month					
Males	277.25±1.31a	270.00±1.36b	265.75±0.55c	268.25±0.77b	**
Females	248.75±0.72d	247.00±0.80d	247.00±0.46d	242.00±0.46e	**
Mean	263.00±3.75	258.50±3.06	256.37±2.44	255.12±3.41	NS
Body weight (gm/birds) in 3rd month					
Males	291.00±1.41a	283.25±1.26b	281.00±1.48bc	279.00±0.70c	**
Females	260.00±0.71d	254.75±0.72e	254.50±0.68e	248.50±0.62f	**
Mean	275.50±4.07	269.00±3.75	267.75±3. 51	263.75±3.96	NS
Body weight (gm/birds) in 4th month					
Males	301.00±0.59a	295.25±0.86b	290.50±1.26c	287.00±1.41d	**
Females	272.00±1.91e	257.50±0.18f	256.00±0.59f	248.50±0.62g	**
Mean	286.50±3.86a	276.37±4.89ab	273.25±4.50ab	269.25±4.64b	*
Body weight (gm/birds) in 5th month					
Males	322.00±0.96a	316.25±1.23b	304.25±0.72c	294.00±1.98d	**
Females	280.75±0.81e	273.75±0.40f	261.25±1.14g	255.25±1.31h	**
Mean	301.37±5.36a	295.00±5.52ab	282.75±5.58bc	274.62±5.64c	*
Body weight (gm/birds) in 6th month					
Males	332.00±0.84a	319.25±1.47b	312.75±1.17c	310.50±1.35c	**
Females	297.50±0.42d	291.75±0.67e	273.25±0.41f	269.00±0.71g	**
Mean	314.75±4.48a	305.50±3.63ab	293.00±5.13bc	289.75±5.41c	**
Changes in body weight(gm).					
Males	83.50±1.01a	72.50±2.35b	63.75±1.26b	62.87±1.17c	**
Females	68.75±1.38b	62.50±1.21c	45.00±1.16d	41.00±1.03e	**
Mean	76.12±2.07a	67.50±1.81b	54.37±2.55c	51.93±2.92c	*

a-d Means with different letters within the same column are significantly different at P≤0.05

metabolizable energy, Local Baladi squabs, Pigeons, performance

Table 3: Daily feed and protein intake of the squabs and young pigeon (S. EX.)

Variables	Dietary ME levels (Kcal/Kg)				Sig.
	3200	3000	2800	2600	
Daily feed intake of pairs (gm/day).					
1st month	20.25±0.84	20.25±0.77	20.40±0.69	22.31±0.56	NS
2nd month	22.18±0.86c	24.67±0.79b	25.61±0.72b	28.17±0.58a	**
3rd month	27.14±0.91c	30.18±0.71b	31.13±0.68b	35.43±0.66a	**
4th month	29.21±0.72c	32.88±0.81b	34.59±0.69ab	36.14±0.97a	**
5th month	38.19±0.56c	40.37±0.59b	42.04±0.96b	46.82±0.81a	**
6th month.	49.83±0.55d	53.11±0.77c	55.49±0.66b	57.82±0.83a	**
Total feed intake of pairs (gm) during 6th month	5604.67±71.16d	6044.6±42.76c	6277.98±62.48b	6801.18±55.99a	**
Daily ME intake of pairs (kcal /day)					
1st month	64.82±2.70a	60.75±2.31ab	57.12±1.94b	58.02±1.45b	*
2nd month	70.97±2.75	74.03±71.69	71.69±2.02	5.17±0.12a	NS
3rd month	86.87±2.93	90.56±2.12	87..16±1.93	92.12±1.73	NS
4th month	93.48±2.31	98.65±2.44	96.85±1.94	93.96±2.53	NS
5th month	122.20±1.80	121.11±1.77	117.71±2.69	121.74±2.09	NS
6th month.	158.21±2.05a	158.06±3.00a	154.03±2.57ab	150.33±2.17b	*
Total ME intake of pairs (kcal) during 6thmonth	17897.22±238.86	18095.50±143.87	17537.62±180.70	17683.09±145.59	NS

a-d Means with different letters within the same column are significantly different at P≤0.05

Table 4: Body weight and changes in body weight of the adult pigeons (P. EX.)

Variables	Dietary ME levels (Kcal/Kg)				Sig.
	3200	3000	2800	2600	
Initial body weight (gm/birds).					
Males	339.73±0.44	339.06±0.43	338.29±0.70	337.90±0.90	NS
Females	302.75±0.54	300.63±0.51	301.79±1.69	300.77±0.84	NS
Mean	321.24±4.78	319.84±4.97	320.04±4.79	319.33±4.82	NS
Final body eight (gm/birds).					
Males	351.37±0.53a	349.32±0.47ab	348.48±0.70b	345.78±1.14c	**
Females	324.53±0.34d	322.81±0.34d	322.70±1.41d	320.03±0.55e	**
Mean	337.95±3.47	336.06±3.43	335.59±3.39	332.91±3.37	NS
Changes in body weight(gm)					
Males	11.64±0.51a	10.25±0.11a	10.18±0.68ab	7.88±1.18b	*
Females	21.78±0.56c	22.18±0.29c	20.90±0.50c	19.26±0.98d	*
Mean	16.71±1.36	16.21±1.54	15.54±1.44	13.57±1.64	NS

a-d Means with different letters within the same column are significantly different at P≤0.05

** = P < 0.01, * = P < 0.05 and NS = Not significant

metabolizable energy, Local Baladi squabs, Pigeons, performance

Table 5: Daily feed and protein intake of the adult pigeons without or with squabs

Variables	Dietary ME levels (Kcal/Kg)				Sig.
	3200	**3000**	**2800**	**2600**	
Daily feed intake of pairs (gm/day).					
Without squabs	89.00±11.06d	95.62±0. 75c	101.62±1.87b	111.62±1.80a	**
With squabs at 7 days	102.87±2.18c	105.25±0.99c	109.87±1.15b	118.25±0.64a	**
With squabs at 14 days	110.87±0.78d	117.12±0.81c	121.12±1.78b	130.50±0.82a	**
With squabs at 21 days	122.12±0.81d	129.12±1.38c	133.25±0.86b	142.37±1.06a	**
With squabs at 28 days	133.12±0.91d	139.50±0.91c	144.37±1.05b	152.75±0.53a	**
Total feed intake of pairs (gm) Without squab during 28 days	2492..00±29.93d	2677.50±21.12c	2845.50±52.63b	3125.50±50.46a	**
Total feed intake of pairs (gm) With squab during 28 days	5775.00±40.83d	6114.50±39.33c	6405.87±62.76b	6932.62±61.65a	**
Total feed intake of pairs (kg) With or without squab during 180 day	18.947±0.167d	19.907±0.135c	20.742±0.276b	22.402±0.265a	**
Daily ME intake of pairs (kcal day)					
Without squabs	284.80±3.42	286.87±2.26	284.55±5.26	290.22±4.68	NS
With squabs at 7 days	329.20±6.98a	315.75±2.98b	307.65±3.23b	307..45±1.68b	*
With squabs at 14 days	354.80±2.52a	351.37±2.43a	339.15±2.21b	339.30±2.14b	*
With squabs at 21 days	390.80±2.59a	387.37±4.14a	373..10±2.41b	370.17±2.77b	*
With squabs at 28 days	426.00±2.93a	418.50±2.72b	404.25±2.94c	397..15±1.36c	**
Total ME intake of pairs (kcal) Without squab during 28 days	7974.40±95.78	8032.50±63.37	7967.40±147.37	8126.30±131.19	NS
Total ME intake of pairs (kcal) With squabs during 28 day	18480.00±130.68a	18343.50±117.99a	17936.45±175.75ab	17024.83±1160.29b	**
Total ME intake of pairs (kcal) With or without squab during 180 day	60630.41±534.45a	59721.00±450.11a b	58077.60±774.86b	58245.20±691.32b	*

a-d Means with different letters within the same column are significantly different at P≤0.05
** = P < 0.01, * = P < 0.05 and NS = Not significant

Table 6: Squabs and pigeon performance production.

Variables	Dietary ME levels (Kcal/Kg)				Sig.
	3200	3000	2800	2600	
Age at onset of egg production (day)	187.37±0.56d	191.25±0.52c	194.25±0.64b	198.50±0.42a	**
Egg cycle (day)	49.12±0.0.29d	50.37±0.26c	51.62±0..37b	52.75±0.41a	**
Egg number	7.87±0.12	7.75±0.16	7.50±0.18	7.37±0.18	NS
Egg weight(gm)	16.58±0.04a	15.68±0.11b	14.92±0.15c	13.80±0.16d	**
Total fertility	98.43±1.56a	96.87±2.04ab	93.30±2.54ab	90.17±3.20b	*
Total hatchability	95.31±2.28a	91.96±3.34ab	91.51±2.49ab	83.70±4.52b	*
Hatchability in fertile eggs	96.87±2.04	94.86±2.51	98.21±1.78	92.55±2.82	NS
Infertile egg	1.56±0.56b	3.12±2.04ab	6.69±2.54ab	9.82±3.20a	*
Dead embryos	3.12±2.04	5.13±2.51	1.78±0.78	3.86±2.54	NS
Squab production (squabs number)					
Hatch number	7.50±0.18a	7.12±0.29ab	6.87±0.29ab	6.37±0.26b	*
Number in7 days	7.12±0.22a	6.75±0.25ab	6.50±0.26a b	6.00±0.26b	*
Number in 14 days	6.62±0.18a	6.25±0.31ab	6.12±0.22ab	5.50±0.32b	*
Number in 21 days	6.50±0.19a	6.12±0.35ab	5.87±029ab	5.25±0.25b	*
Weaning number	6.50±0.18a	6.00±0.26ab	5.62±0.37ab	5.12±0.39b	*
Squabs growth at 28 days of age (gm)					
Hatch weight(gm)	14.12±0.08a	13.60±0.12ab	13.76±0.07b	13.38±0.24b	*
Weight in 7 days(gm)	81.11±0.88a	76.77±0.55b	74.24±1.74b	67.92±1.20c	**
Weight in 14 days(gm)	166.76±1.01a	155.95±1.40b	151.64±1.53c	143.85±1.11d	**
Weight in 21 days(gm)	236.39±0.97a	221.90±0.58b	214.73±1.25c	201.31±1.19d	**
Weaning weight(gm)	302.24±1.29a	276.84±2.19b	267.42±1.16c	244.71±1.38d	**
Body Weight Gain in squabs (BWG)					
Gain 1-7 day (gm)	66.98±0.92a	63.16±0.55b	60.48±1.73b	54.54±1.12c	**
Gain 8-14 day (gm)	85.65±0.69a	79.18±1.09b	77.40±2.44b	75.93±1.93b	*
Gain 15-21 day (gm)	69.63±1.12a	65.95±1.41b	63.08±0.62b	57.46±0.52c	*
Gain21-28 day (gm)	54.85±0.93a	43.94±2.72b	41.69±1.08b	32.39±2.32c	**
Total gain 1-28 day (gm)	288.12±1.32a	263.24±2.08b	253.66±1.19c	231.33±1.29d	**
Mortality rate%++	12.94±3.35	14.73±5.12	20.83±5.72	20.05±4.56	NS
Livability%+++	82.58±2.23a	77.45±3.12ab	72.09±4.78ab	66.51±4.70b	*

a-d Means with different letters within the same column are significantly different at P≤0.05

+RGR=((W2-W1)/0.5(W2+W1))*100 Where: W1= initial body weight W2 = LBW at end of periods

++ Mortality rate = {(No. of squabs at hatch day - No. of squabs at 28 day)/ No. of squabs at hatch day} x100

+++ Livability = (No. of squabs at 28 day / No. of egg hatching) x100

** = P < 0.01, * = P < 0.05 and NS = Not significant

Table 7: Economic Efficiency of pigeon fed on different ME levels.

Items	**Dietary ME levels (Kcal/Kg)**			
	3200	**3000**	**2800**	**2600**
Feed intake of pairs (kg) during 180 day)	18.947	19.907	20.742	22.402
Price of ton (LE)	1799	1705	1621	1573
Price of feed cost during 180 day	34.08	33.94	33.62	35.23
Number of squabs /pair	6.50	6.00	5.62	5.12
Price of squab one bird (LE)	6	6	6	6
Total Price of squabs/ pair (LE)	39.30	36.00	33.72	30.72
Net return*	5.21	2.06	0.10	-4.51
Economic efficiency (%)**	15.30	6.06	0.29	-12.80

* Net return = Price of squabs of pair - Price of feed cost

** Economic efficiency = Net return / Price of feed cost

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الملخص العربي

دراسات غذائية ورعائية على الحمام تقدير الاحتياجات الغذائية من الطاقة الممثلة

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اجريت هذة التجربة لتقدير الاحتياجات الغذائية من الطاقة الممثلة ومدى تاثيرها على الصفات الانتاجية والتناسلية فى الحمام البلدى تحت الظروف المصرية . تم عمل تجربتين، التجربة الأولى (فترة النمو) استخدم فيها عدد 48 زوج حمام زغاليل من عمر 28 يوم الى العمر عند وضع أول بيضة قسمت الى أربع معاملات بكل معاملة 12 زوج زغاليل ، قسمت المعاملة الى 3 مكررات بكل مكرر 4 أزواج زغاليل. بينما التجربة الثانية (فترة الانتاج) استخدم فيها الحمام البالغ من التجربة الأولى حيث قسم عدد 32 زوج حمام بالغ عمر 6 شهور الى 4 معاملات بكل معاملة 8 أزواج قسمت المعاملة الى 4مكررات بكل مكرر زوجين (النسبة الجنسية 1:1) قسمت المعاملات وفقا لمستويات الطاقة 2600 و 2800 و 3000 و 3200 كيلوكالورى/كجم عليقة فى كلا التجربتين وتحتوى العلائق على 15.5% بروتين حام كما تحتوى العلائق على الاملاح المعدنية والفيتامينات وتتعرض الطيور الى 14 ساعة ضوء خلال اليوم ويتم تقديم العلائق والماء بصورة حرة حتى الشبع.

وكانت اهم النتائج كما يلى :

1- التجربة الأولى (مرحلة النمو): تاثيرا معنويا موجب على كل من وزن الجسم الحى ووزن الجسم المكتسب بمستوى الطاقة فى العليقة خلال فترات التجربة المختلفة

2- كمية الغذاء المتناول لآباء الحمام مع او بدون الزغاليل يقل معنويا بزيادة مستوى الطاقة فى العليقة من 2600 الى 3200 كيلوكالورى/كجم عليقة خلال مدة التجربة بينما تزيد كمية الطاقة المتناولة بزيادة الغذاء الماكول معنويا عدا التغذية بدون الزغاليل.

3- تاثر معنويا العمر عند اول بيضة وكذلك طول دورة البيض بزيادة مستوى الطاقة فى العلائق حيث سجلت العليقة 3200 كيلوكالورى/كجم عليقة اصعرعمر عند اول بيضة وكذلك اقصر طول لدورة البيض.

4- بزيادة مستوى الطاقة فى العلائق ذاد معنويا وزن البيض و نسبة الحصوبة ونسبة الفقس (أى ترتفع نسبة الخصوبة).

5- بزيادة مستوى الطاقة فى العلائق زاد معنويا عدد الزغاليل الناتجة وكذلك وزن الجسم للزغاليل عند عمر الفقس و7 و14 و21و 28 يوم حيث سجلت العليقة 3200 كيلوكالورى/كجم عليقة اعلى وزن خلال فترات التجربة.

6- تزيد الحيوية للزغاليل بزيادة مستوى الطاقة فى العلائق كما ترتفع الكفاءة الأقتصادية مع المستوى الأعلى للطاقة.

نستخلص من هذة الدراسة ان مستوى العليقة 3200 كيلوكالورى/كجم عليقة فى علائق الجمام كان الافضل على اعلى اداء انتاجى مقارنة بالمستويات الأخرى من المستويات الأخرى وان كان مستوى 2600 كيلوكالورى/كجم عليقة يغطى الاحتياجات الغذائية للحمام دون اى تاثير عكسى على الآداء الانتاجى والتناسلى للحمام البلدى المصرى تحت الظروف المصرية.