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NUTRITIONAL AND MANAGEMENT STUDIES ON THE PIGEON:

EFFECT OF DIFFERENT LEVELS OF VITAMINS AND MINERALS PREMIX ON PRODUCTIVE AND REPRODUCTIVE PERFORMANCE.

By

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Abstract: *An experiment was conducted to estimate the effects of inclusion different levels of Vit +Min. premix on productive and reproductive performance of pigeon under Egyptian conditions. A total of 40 pairs of Baladi pigeons (24 months old) were distributed according to their companion mating systems into five dietary treatments. ach treatment contained 8 pairs (4 replicates of 2 pairs each).The dietary Vit +Min. premix levels were 1, 2, 3, 4 and 5g /kg of diet. Diets were formulated in mash form containing 15.64% CP and metabolize energy of 2752 Kcal/kg of diet. Birds were subjected to a daily 14-hours of lighting program through out the experimental period. Feed and water were given ad libitum during the experiment.*

Results obtained are summarized as follow:

1- Live body weight (LBW) and changes in body weight at different ages were significantly affected by increaseing dietary premix level in the diet.

2- Increasing the dietary premix level from 1 to 5 kg/ ton of the diet decreased feed intake of pigeons without or with squabs allover the experimental periods.

3- Dietary premix levels had highly significant effect on daily Vit & Min intakes during the experimental period..

4- Dietary premix level had significant ($P \leq 0.05$) effect on egg cycle. Pigeon fed high 5 kg premix/ton of diet had the shortest egg laying cycle compared with low premix diets.

5- Egg number, egg weight, fertility and hatchability significantly ($P<0.05$) increased as dietary premix levels increased in the diet.

6- Squabs fed diets containing the high level of premix (5 kg/ton of diet) had significantly the highest number of weaned squabs, body weight and weight gain during 28 days of age compared with those fed the Lowe premix level (1 kg /ton of diet).

7- Viability percentage and economical efficiency (EE) of squab increased with increasing premix level in the diet.

It can be concluded that the vitamins and minerals levels of pigeon diets play an important role in metabolism which affects most important reproduction traits. Feeding high vitamins and minerals levels in for of premix at a level of 5 kg/ton of the diet increased both the number and the weight of weaned squabs.

INTRODUCTION

The addition of supplemental vitamins and minerals, most often via drinking water, has become a common practice among pigeon fanciers. During times of stress and heavy demands on birds, there may be a benefit of applying this practice. The pigeon has evolved and adapted over time to the point that it receives most of its nutrient required via the diet.

Fat soluble vitamins (A, D3, E and K) and water soluble (ascorbic acid and B-complex) are necessary for the proper body functions. Trace elements, are generally accepted as they function as parts of hormones, enzymes, or as activators of enzymes. They are required in very small amounts by poultry. Trace elements that may be associated with specific problems in poultry or their dietary supplementation principally include iron, copper, zinc, manganese and selenium. Dietary concentrations of these elements lead to three responses in the bird: low levels are associated with deficiency, higher levels over range where the requirements are met and where body reserves are maintained constant while amounts beyond this result in toxicity which will reduce growth rate in young birds or lower rates of egg production in laying hens. In the body of animals, there are approximately 20 minerals that are essential for maintenance and normal functioning of body. Lack or insufficient amounts of these minerals result in deficiency symptoms leading to reduced performance. Excess amount, on the other hand, may also lead to a reduction in performance and/or toxicity **(Jongbloed et al. 2002)**.

Dietary supplementation of Mn is especially important for poultry because diets based on corn and soybean meal are deficient in Mn unless supplemented with feedstuffs rich in Mn. Corn is very low in Mn (7 ppm) while, soybean meal contains 29 to 43 ppm Mn depending on the method of processing **(NRC, 1994).**

Subsequent research has shown that Mn is vital for growth, egg production and proper development of the chick embryo and is essential in the activation of numerous enzymes **(Underwood, 1977).**

Manganese has also been shown to be an essential nutrient for the laying hen. A deficiency in this nutrient will result in decreased egg production and eggshell thickness **(Leach and Gross, 1983).**

A lot of feed additives have been utilized in order to improve the productive performance of growing and laying quails. Zinc as an essential micronutrient has significant roles in the organism, probably because it is a co-factor of more than 200 enzymes **(Sahin et al. 2005)**. So, the presence of adequate zinc in the higher biological systems is necessary for normal development, maintenance and function of the immune system **(Dardenne and Bach, 1993)**. **Kim et al. (1998)** predicated that zinc as an antioxidant interacts with vitamin E, because vitamin E is impaired in zinc-deficient animals. Also, zinc can occupy iron and copper binding sites on lipids, proteins and DNA and thus exert a direct antioxidant action **(Prasad and Kucuk, 2002).** Another important role for zinc in that it is essential component of both DNA and RNA polymerase enzymes and is vital to the activity of a variety of hormones including glucagon, insulin, growth hormone and the sex hormone. So, normal Zn status is of key importance for the immune function in broiler **(Hengmin et al. 2004).**

Zinc plays a major role in protein metabolism **(Forbes, 1984),** DNA synthesis **(Lieberman et al. 1963),** carbohydrate metabolism, and basic functions in growth performance **(Mohanna et al. 1999).** Zinc is involved in boosting the immune system to disease outbreaks **(Luecke et al. 1978).**

Selenium (Se) and vitamin E have been shown to play a major role in the development and maintenance of the defense systems. Therefore, adequate dietary levels of Se and vitamin E are important not only to prevent their deficiency signs but also to preserve the organelles responsible for building antibodies and defense mechanisms against diseases and other stresses **(Yu, 1994 and Spears, 1999).**

The role of Se in biological systems has been associated with its antioxidant activity which protects biological systems from oxidative degeneration **(Diplock 1981).**

Cantor et al. (1975) found that Se deficiency induced oxidative diathesis or pancreatic fibrosis. Supplementation of Se to reach the optimum and required level in the diet was efficient in preventing such disorders. On the other hand, **Hoffman et al. (1989)** found that high concentration of Se had an adverse effect on the reproduction, survival and growth of duck.

As far as the researchers are aware, no reports are available on vitamin and mineral requirements of pigeons for or on the effect of dietary levels of minerals and vitamins on productive and reproductive performance of pigeons under Egyptian conditions. Therefore, the present study was conducted to investigate the effect of different dietary levels of vitamins and minerals as a mixture (premix) on the productive and reproductive performance of Balady pigeons.

MATERIALS AND METHODS

The experimental work was carried out at El-Gimmizah Pigeon Production Sector, belonging to, Agricultural Research Center, Ministry of Agriculture; during the period from June, 2008 up to December, 2008. This experiment was designed to estimate the effects of inclusion different levels of premix (vitamin and mineral mixture) on the performance of pigeons and their squabs.

Birds:

A total number of 40 pairs of parent Baladi pigeons (24 months old) was distributed according to companion mating systems in pigeons (sex ratio of pigeons 1:1). At the beginning of experiment pigeons were divided randomly into five equal treatments containing 8 pairs (4 replicates of 2 pairs each) and housed under the same managerial and environmental conditions in brooding battery fitted cages. In each breeding cage, two male and two female pigeons were allowed to form couples on a random basis. In the breeding cages, the pigeons were able to feed their squabs up to the age of 28 days (weaning age). At this age, the squabs were directed for slaughter or transferred to separated battery cages for further rearing and maintained on a daily photoperiod of 14 h.

Experimental diets and feeding system:

Each three kg of the premix used in this experiment contained vit. A, 12000000 IU; vit. D3, 2000000 IU; vit. E, 10 g; vit. K, 2.0 g; vit. B_1, 1 g; vit. B_2, 5 g; vit. B_6, 1.5 g; vit. B_{12}, 10 mg; folic acid, 1 g; biotin, 50 mg; pantothenic acid, 10 g; nicotinic acid, 30 g; choline chloride, 250 g; Mn, 60g; Fe 30 g; Zn, 50 g; Cu, 10g; I, 1 g; Co 100 mg; Se, 100 mg and antioxidants, 10 g, and complete to 3.0 kg by calcium carbonate.

Five experimental diets (D1, D2, D3. D4 and D5) were formulated in mash form to contain 15.64% CP and 2752 kcal ME/kg of each diet and supplemented with five levels of. premix, being 1, 2, 3, 4 and 5 g/kg (These levels are very low as supplement????) in D1, D2, D3. D4 and D5, receptively. The ingredients and calculated chemical composition of the experimental diets are shown in Table (1). However, calculated continents of minerals and vitamins are presented in Table (2). Feed and water were provided to birds ad-libitum.

Experimental procedures:

During the experimental period of 180 days, the following parameters were recorded or calculated: initial body weight, final body weight, change in body weight, daily and total feed intake per pair with or without squab, daily and total intake of Vit +Min. premix per pair with or without squabs, egg cycle, total egg production, egg weight, egg fertility, dead embryos, hatchability, total squabs per pair, live body weight and body weight gain (BWG) of squabs up to 28 days of age, mortality rate of squabs, livability, net return (NR) and economical efficiency (EE) of pigeons.

Statistical analysis:

Data were analyzed using one- way analysis of variance, using **SPSS (1997)** computer program. **Duncan's (1955)** multiple range test was performed to estimate the significant differences among dietary treatments.

RESULTS AND DISCUSSION

Live body weight and change in body weight:

Results in Table (3) show that the initial body weight of the male parent pigeons were fairly higher than those of the female pigeons, with no significant differences among treatments. Final live body weight (LBW) and change in body weight were significantly affected by dietary level of Vit +Min. premix. Pigeons fed the lowest level (1g/kg of diet) had the lowest ($P \leq 0.05$) final body weight compared to those fed the diets containing the other levels. Final body weight of the male was significantly higher than the female pigeons with increasing of Vit. & Min. level in the diet during all periods. The change in body weight was positively affected by increasing dietary level of premix above 3 g/kg diet.

Final live body weight (LBW) of pigeons was not affected significantly by increasing dietary level of Vit. + Min. premix to 5 g/kg). This result is in agreement with **El- Kaiaty et al. (2001),** who suggested that dietary zinc supplementation caused an increase in body weight, growth rate, being the best with the level of 50 ppm zinc/kg diet. It is worthy noting that lack of researches on pigeons makes it possible to use the corresponding data obtained with poultry. In this respect, **Kidd et al. (1994)** postulated that zinc-methionine supplementation increased LBW by 6 %. During 1-6 weeks period they found that feeding diets supplemented with 50 mg Zn from different sources gave insignificantly higher gains than those of the control chicks. This may be indicate that zinc has numerous biological roles including cell division and multiplication **(Rubin, 1972; and Rubin and Koide, 1973)**, . Also, **Abou EL-Wafa et al. (2003)** indicated that using 120 mg Zn/kg significantly increased body weight and body weight gain. **Moreover, Collins and Moran (1999 and Abaza (2002)** found that supplementing the basal diet with the selenium (0.5 ppm) significantly increased body weight

On the other hand, **Moustafa, et al. (2004)** observed that different sources and levels of added Zn (except ZnO) had no effect on live body weight of laying hens. Also, **Roch and Boulianne, (2000) and Kalbfleisch et al. (2000)** found no significant differences in turkey body weight at 3 and 6 weeks age due to feeding vitamin E supplemented diets.

Daily feed intake of the pigeons without or with squabs:

Data indicated that feed intake significantly ($P<0.05$) decreased with increasing the level of Vit. + Min. permit up to 5g/kg diet (Table 4). These results indicated that the high levels of dietary premix had a depressing effect on appetite of birds at all ages or perieds studied. In addition, the amount of feed intake increased with increasing the age of squabs. The hatched squabs received only crop milk from the first until the 4^{th} day of age, then the parents started to give them feed 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. In this concern, **El-Kaiaty et al., (2001)** concluded that, the addition of Zn to the diets of Japanese quails could be utilized as a method for pushing the chicks of Japanese quails toward the best metabolic functions to give the satisfactory productive performance.

In contrast **Abou El-Wafa et al. (2003)** indicated that using 120 mg Zn/kg significantly increased feed intake and improved feed conversion at 21 days of age compared to other experimental levels (60 or 180 mg Zn/kg). Similar trend was observed for feed intake of broilers at 42 days of age. However, feed conversion was improved numerically. Similar results were obtained with adding 100 or 150 ppm Zinc **(EL-Kaiaty et al., 2001)** and 48 or 125 ppm Zinc **(Pimental et al., 1991). Moreng et al. (1992)** reported that the addition of Zn-Met to laying hen diets resulted in no significant difference in feed intake.

Richter et al. (1986) and **Schafer et al., (1985)** found no significant effect on feed intake with different selenium supplementation levels in hens diets.

Daily vitamin and mineral intakes of the pigeons without squabs:

Data indicated that Vit. + Min. intakes of pigeons without squabs significantly ($P<0.05$) increased as the Vit. & Min premix levels increased from 1 to 5 g/kg of diet (Table 5).

The present results indictated that diets containing the highest two levels of premix (4 and 5 g/kg) were suggested to be nutritionaly suitable for pigeon during the laying period (24-30 months of age).

Egg laying cycle:

Pigeon fed the highest dietary level of Vit +Min. premix (5 g/kg of diet) exhibited the shortest egg cycle (incubation and nestling periods) than those fed the lowest level of premix (1 g/kg of diet) as shown in Table (6). The length of egg cycle was 45.62, 46.50, 49.62, 53.50 and 56.62 days when parent pigeons fed diets containing 5, 4, 3, 2 and 1 g/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 ranged from 45.80 to 54.60 days depending on the activity of parents to rear their squabs. The length of egg cycle depend on the activity of parents to rear their squabs and other environmental conditions (light, warmth, and nutrition).

Egg number (EN) and Egg weight (EW):

Table (6) showed that the dietary levels of Vit. + Min. premix ((1, 2, 3, 4 and 5 g/ kg of diet) had significant ($P\leq0.05$) effect on total egg number and egg weight per pair of pigeons during the whole experimental period (6 months). Number and weight of eggs were significantly ($P<0.05$) lower for pigeons fed the diets containins 1, 2 and 3 g Vit +Min. premix /kg of diet, but those fed D4 and D5 (4 and 5 g/ kg) gave significantly greater eggs and heavier eggs than those fed the other diets.

In this concern, **Inal et al. (2001)** found that 25 mg Mn/-kg in the diet was sufficient for maximum egg production, egg weight and feed conversion, but for optimal shell quality the requirement of Mn for laying hens was much higher. This may be interpreted based on the requirements for trace minerals which are often fulfilled by concentrations present in conventional feed ingredients **(NRC, 1994). Moustafa, et al. (2004)** reported that sources and levels of added Zn (except ZnO at level 150 mg) significantly improved egg weight and egg number. Also**, Oishi et al. (1987)** found that egg production of the laying hen fed the control and low-Se diets, was 73.3 and 50.7% of the control, respectively**. Hassan (1990)** observed a significant reduction in egg production of White Leghorn hens fed diet deficient in Se (0.03 mg/kg of diet) for 8 weeks starting from 28 weeks old. He added that increasing dietary selenium to the level of 0.6 mg/kg had no adverse effect on hen performance during heat stress period.

Moreover, **Saly et al. (1994)** found that added vitamin E at levels of 20 and 30 mg increased egg weight of Shaver laying hens during the first month of laying. Also, **Oishi et al. (1987)** found that low-Se diets significantly decreased egg weight from 60.8 to 58.5g. Moreover, **Leach and Gross, 1983** reported that manganese deficiency in the laying hens result in decreased egg production. However, these results are in disagreement with those of **Zamani et al., (2005)** who found that manganese level and age had no effect on productive performance. Furthermore, **Maurice and Whisenhut (1980)** reported no significant change in egg number and egg weight when manganese level increased from 25 to 200 mg/kg diet. Finally, **Sazzad et al. (1994)** reported insignificant differences in egg production, egg weight and feed conversion when the supplement of manganese increased from 0 to 80 mg/kg diet.

Fertility and hatchability:

Results in table (6) indicated that Vit. + Min. premix at levels of 4 and 5 g/ kg) significantly ($P<0.05$) achieved superior fertility rates and hatchability percentages, while premix at low levels (1 and 2 g/kg)had inferior means of fertility, total hatchability, hatchability of fertile eggs, dead embryo and infertile eggs. This trend may be associated with improving semen quality of males. In this respect, **Moustafa, et al. (2004)** reported that sources and levels of added Zn (except ZnO at level 150 mg) improved significantly ($P<0.05$) some semen characteristics of cocks. The addition of Zn-Met at levels of 100 or 150 mg/kg, significantly increased fertility percentages. While, both sources of zinc did not affect hatchability percentages.

Also, **Hassan (1990)** reported that the effects of Se deficiency (at 0.03 mg /kg) in the diet of White Leghorn caused a significant reduction in hatchability.

Squab production:

Results in Table (6) indicated that number of squabs produced per treatment significantly ($P<0.05$) increased by increasing. Vit +Min. premix level in the diet. No significant effect was observed on squab production for premix levels of 4 and 5 g/kg diet however significant differences were detected when compared with levels of 1, 2 and 3 g/kg diet.

It is noticed also that number of weaned squabs for pigeons fed the high Vit. & Min.high premix levels (4 and 5 g/kg diet) improved showing highly improvement in number of weaned squabs compared with those fed low Vit. + Min. premix levels (1 and 2 g/kg diet).

Squab growth during 28 days of age:

Data in Table (6) show 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, 14 and 21 days of age or at weaning for squabs fed different levels of Vit. & Min. premix. These results indicated that the weights of squabs at hatch had a significant differences, ranging from 9.65 to 14.53g.

This difference was 33.02% between the diets containg the lowest and the highest Vit. & Min.level of premix at the market age.

The effects of dietary Vit. & Min. premix levels during the experimental period on squab weaning weight of Balady pigeons at 28 days showed were significant. The heaviest weights were significantly $P<0.05$) obtained when pigeon fed the 5 kg/ton. This result is in agreement with **Levi (1954)** who reported that 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.

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

Data showed that body weight gain during 28 days of age was significantly ($P<0.05$) affected by increasing the Vit. + Min. premix level in the diet (Table 6).

The results showed that the weight gain

was higher between 8 to 14 days of age –compared with other periods. While the weight gain between 21 - 28 days of age was very poor, where the pigeon squabs reach to maximum weight gain during first 28 days of age. Results also indicated that as dietary Vit. & Min. premix levels in the all experimental period (28 days) increased, BWG of squabs increased significantly (Table 6).

Similar results were observed by **Hegazy and Adachi (2000)** reported that Zn addition is an important determinant of growth performance of chicks.

It is clearly noticed that the high Vit. + Min. premix levels (4 and 5 g/kg diet) recorded the highest BWG in all experimental periods compared with other Vit. & Min.premix levels**.**

Mortality rate:

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

Livability:

The viability rate of pigeon squabs was affected by the dietary Vit. + Min. premix level. Results indicated that the viability rate of squab increased with the increasing of Vit. & Min.premix level in the diet.

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

The cost of one kg diet decreased with the decrease of premix level in the diet (Table7). Net return/pair at the end of experiment were 14.499, 10.222, -2.039,-17.527 and -24.265 L.E for (5, 4, 3, 2 and 1 kg/ton of diet) respectively. Net return recorded the highest values for D5 (5 Kg/ton of diet). It is worthy noting that the 5 kg/ton of diet recorded more NR and EE than that of other treatments. While 1 kg/ton of diet recorded the lowest values of NR and EE.

Therefore, it is evident that comparing levels of NR or EE show that the high level (5 Kg/ton of diet) was the most superior than that of the 1, 2 or 3 kg/ton of diet. From the economical point of view, it appears that the 5 kg/ton or 4 kg/ton of diet in pigeon parents' diets is economically effective.

From the results of this experiment, it can be concluded that the vitamins and minerals levels of pigeon diets plays an important role of metabolism which affects on the most important reproduction traits significantly.

Table (1): Composition and calculated analyses of the experimental diets.

Ingredients (%)	Dietary levels of Vitamins and Minerals premix (g/ Kg)				
	Diet 1 (1g/ Kg)	Diet 2 (2g/ Kg)	Diet 3 (3g/ Kg)	Diet 4 (4g/ Kg)	Diet 4 **(5g/ Kg)**
Yellow corn	64.00	64.00	64.00	64.00	64.00
Soybean meal, 44 %CP	20.00	20.00	20.00	20.00	20.00
Wheat bran	12.00	12.00	11.90	11.80	11.70
Limestone	1.60	1.50	1.50	1.50	1.50
Bone meal	2.00	2.00	2.00	2.00	2.00
Common salt (NaCl)	0.30	0.30	0.30	0.30	0.30
Vit. & Min. mix.*	0.10	0.20	0.30	0.40	0.50
Total	100	100	100	100	100
Calculated values:**					
Crude protein, %	15.66	15.66	15.65	15.63	15.62
ME, kcal/kg	2754	2754	2753	2751	2750
Crude fiber,%	4.25	4.25	4.24	4.22	4.21
Ether Extract,%	3.24	3.24	3.23	3.23	3.23
Calcium, %	1.231	1.195	1.194	1.194	1.194
Non-phytate phosphorus, %	0.401	0.401	0.401	0.401	0.401
Lysine, %	0.821	0.821	0.820	0.819	0.819
Methionine,%	0.288	0.288	0.287	0.287	0.287
Methionine + cysteine %	0.566	0.566	0.565	0.565	0.564
Cost/kg diet (LE)	1.433	1.440	1.446	1.452	1.458

*Vit.& Min. mix:. each 3kg contains: vit. A, 12000000 IU; vit. D3, 2000000 IU; vit. E, 10 g; vit. K, 2.0 g; vit. B1, 1 g; vit. B2, 5 g; vit. B6, 1.5 g; vit. B12, 10 mg; folic acid, 1 g; biotin, 50 mg; pantothenic acid, 10 g; nicotinic acid, 30 g; choline chloride, 250 g; Mn, 60g; Fe 30, g; Zn, 50 g; Cu, 10g; I, 1 g; Co 100 mg; Se, 100 mg and anti-oxidant, 10 g, and complete to 3.0 kg by calcium carbonate

** Calculated according to NRC (1994).

pigeons Vitamins, minerals, productive and reproductive performance.

Table 2: Calculated contents of Vitamins and minerals per kg of the experimental diets.

Items	Dietary levels of Vitamins and Minerals premix (g/ Kg)				
	(1g/ Kg)	**(2g/ Kg)**	**(3g/ Kg)**	**(4g/ Kg)**	**(5g/ Kg)**
Vitamins:					
A (IU)	4000	8000	12000	16000	20000
D3 (IU)	666.666	1333.332	1999.998	2666.664	3333.333
E (mg)	3.333	6.666	9.999	13.332	16.665
K3 (mg)	0.667	1.334	2.001	2.668	3.335
B1 (mg)	0.333	0.666	0.999	1.332	1.665
B2 (mg)	1.667	3.334	5.001	6.668	8.335
B6 (mg)	0.500	1.000	1.500	2.000	2.500
B12 (mg)	3.333	6.666	9.999	13.332	16.665
Choline (mg)	83.333	166.666	249.999	333.332	416.665
Biotin (mg)	16.667	33.334	50.001	66.668	83.335
Folic acid (mg)	0.333	0.666	0.999	1.332	1.665
Nicotinic cid (mg)	10.000	20.000	30.000	40.000	50.000
Pantothenic acid (mg)	3.333	6.666	9.999	13.332	16.665
Minerals:					
Zinc (mg)	16.667	33.334	50.001	66.668	83.335
Copper (mg)	3.333	6.666	9.999	13.332	16.665
Iron (mg)	10.000	20.000	30.000	40.000	50.000
Cobalt (mg)	0.033	0.066	0.099	0.133	0.166
Selenium (mg)	0.033	0.066	0.099	0.133	0.166
Iodine (mg)	0.333	0.666	0.999	1.332	1.665
Manganese (mg)	20.000	40.000	60.000	80.000	100.000

Table 3: Effects of different levels of vitamins and minerals premix on body weight and change in body weight of the pigeons

Items	Dietary levels of Vitamins and Minerals premix (g/ Kg)					±SE.
	(1g/ Kg)	(2g/ Kg)	(3g/ Kg)	(4g/ Kg)	(5g/ Kg)	
Initial body weight (g/bird).						
Males	330.53±2.69	329.69±2.76	325.16±1.76	326.65±1.61	326.70±1.97	NS
Females	275.26±1.91	276.38±1.04	279.29±0.74	278.29±0.58	279.38±2.25	NS
Mean	302.80±10.52	303.03±10.16	303.23±8.71	302.47±9.17	303.04±9.05	NS
Final body weight (g/bird).						
Males	324.14±1.40c	330.83±3.06ab	325.85±1.66bc	330.24±1.36a	331.75±1.41a	**
Females	265.46±1.24c	266.75±1.27c	279.16±0.59ab	281.17±1.11ab	285.03±1.77a	**
Mean	294.80±11.12d	298.79±12.20c	302.51±8.86b	305.71±9.30ab	308.39±8.89a	**
Changes in body weight(g).						
Males	-6.21±1.58d	1.14±0.75abc	0.68±0.19bc	3.59±0.75abc	5.05±0.66ab	*
Females	-9.79±1.04d	-9.62±1.09d	-0.13±0.23c	2.88±0.53abc	5.65±0.58a	*
Mean	-8.00±-1.11d	-4.24±2.27c	0.27±0.20b	3.23±0.44a	5.35±0.42a	**

a-f Means with different letters within the same row are significantly different at $P \leq 0.05$
** = $P < 0.01$, * = $P < 0.05$ and NS = Not significant

Table 4: Effects of different levels of vitamins and minerals on total and daily feed intake of the pigeon

Items	Dietary levels 0f Vitamins and Minerals (g/ Kg)					±SE.
	(1g/ Kg)	(2g/ Kg)	(3g/ Kg)	(4g/ Kg)	(5g/ Kg)	
Daily feed intake of pairs (g/day).						
Without squabs	115.75±1.16a	111.25±1.33b	103.00±1..67c	98.50±0.82d	97.37±086d	**
With squabs at 7 days	128.87±0.85a	121.00±1.48b	111.12±1.07c	108.50±1.50cd	106.12±1.98d	**
With squabs at 14 days	139.50±1.74a	131.62±0.94b	125.00±0.96c	120.87±1.87d	113.12±1.34e	**
With squabs at 21 days	153..12±1.40a	143.62±1.36b	134.13±0.63c	132.87±1.50c	122.87±088d	**
With squabs at 28 days	164.75±0.83a	153.75±0.84b	147.37±0.81c	144.50±1.56c	133.500.87d	**
Total feed intake of pairs (g) Without squab during 28 days						
	3241.00±32.51a	3115.00±37.32b	2884.00±47.03c	2758.00±2306d	2726.50±24.21d	**
Total feed intake of pairs (g) With squab during 28 days						
	4103.75±24.16a	3850.00±23.36b	3623.37±18.37c	3547.25±34.61d	3329..37±19.57e	**
Total feed intake of pairs (kg) without squab during 180 day						
	20.835±0.209a	20.025±0.239b	18.540±0.302c	17.730±0.148d	17.527±0.155e	**
Total feed intake of pairs (kg) With squab during 180 day						
	23.577±0.111a	22.502±0.160b	21.220±0.152c	20.781±0.159d	19.905±0.128e	**

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

Table 5: Effects of different levels of vitamins and minerals premix on daily intakes of vitamins and minerals of the pigeon

Items	Dietary levels of Vitamins and Minerals premix (g/ Kg)					±SE.
	(1g/ Kg)	(2g/ Kg)	(3g/ Kg)	(4g/ Kg)	(5g/ Kg)	
Vitamins:						
A (IU)	463.000e	890.000d	1236.000c	1576.000b	1947500a	83/059
D3 (IU)	77.166e	148.333d	205.999c	262.666b	324.583a	13.843
E (mg)	0.385e	0.741d	1.029c	1.313b	1.622a	0.069
K3 (mg)	0.077e	0.148d	0.206c	0.262b	0.324a	0.013
B1 (mg)	0.038e	0.074d	0.102c	0.131b	0.162a	0.006
B2 (mg)	0.193e	0.370d	0.515c	0.656b	0.811a	0.034
B6 (mg)	0.058e	0.111d	0.154c	0.197b	0.243a	0.011
B12 (mg)	0.385e	0.741d	1.029c	1.313b	1.622a	0.069
Cholin (mg)	9.645e	18.541d	25.749c	32.833b	40.572a	1.730
Biotin (mg)	1.929e	3.708d	5.150c	6.566b	8.114a	0.346
Folic acid (mg)	0.038e	0.074d	0.102c	0.131b	0.162a	0.006
Nicotinic cid (mg)	1.157e	2.225d	3.090c	3.940b	4.868a	0.207
Pantothenic acid (mg)	0.385e	0.741d	1.029c	1.313b	1.622a	0069
Minerals:						
Zinc (mg)	1.929e	3.708d	5.150c	6.566b	8.114a	0.346
Copper (mg)	0.385e	0.741d	1.029c	1.313b	1.622a	0.069
Iron (mg)	1.157e	2.225d	3.090c	3.940b	4.868a	0.207
Cobalt (mg)	0.003e	0.007d	0.010c	0.013b	0.016a	0.006
Selenium (mg)	0.003e	0.007d	0.010c	0.013b	0.016a	0.006
Iodine (mg)	0.038e	0.074d	0.102c	0.131b	0.162a	0.006
Manganese (mg)	2.315e	4.450d	6.180c	7.880b	9.737a	0.415

a-e Means with different letters within the same row are significantly different at $P \leq 0.05$
** = $P < 0.01$, * = $P < 0.05$ and NS = Not significant

Table 6: Effects of different levels of vitamins and minerals premix on reproductive performance of pigeons

Items	Dietary levels of Vitamins and Minerals premix (g/ Kg)					±SE.
	(1g/ Kg)	(2g/ Kg)	(3g/ Kg)	(4g/ Kg)	(5g/ Kg)	
Egg cycle (day)	56.62±0.26a	53.50±0.37b	49.62±0..37c	46.50±0.42d	45.62±0.41d	**
Egg number	4.12±0.29c	4.25±0.16c	5.50±0.26b	6.62±0.18a	6.87±0.12a	**
Egg weight(g)	12.07±0.15d	12.62±0.21c	13.36±0.20b	15.50±0.16a	15.41±0.21a	**
Total fertility %	72.29±2.51c	85.62±4.27b	86.66±2.95b	96.42±2.33a	98.42±1.78a	**
Total hatchability %	46.45±6.23c	55.62±5.70b	75.21±2.66b	88.98±3.62a	92..85±2.69a	**
Hatchability in fertile eggs%	64.58±5.58b	64.85±4.39b	87.29±3.80a	92.26±2.94a	94.64±2.61a	**
Infertile egg%	39.58±5.16a	18.75±5.62b	16.25±3.62b	4.16±1.72c	2.08±0.82c	*
Dead embryos%	6.58a±35.41	35.42±4.39a	12.70±3.80b	7.73±2.94b	5.35±2.61b	*
Squab production (squabs number)						
Hatch number	2.00±0.37c	2.37±0.26c	4.12±0.22b	5.87±0.23a	6.37±0.18a	**
Number in7 days	2.00±0.37c	2.25±0.25c	3.87±0.29b	5.62±0.18a	6.25±0.16a	**
Number in 14 days	1.87±039c	2.12±0.22c	3.37±0.18b	5.37±0.17a	5.87±0.12a	**
Number in 21 days	1.62±0.46c	2.00±0.26c	3.37±0.18b	5.00±0.26a	5.50±0.19a	**
Weaning number	1.12±0.35c	1.75±0.25c	3.37±0.18b	4.75±0.25a	5.12±0.12a	**
Squabs growth at 28 days of age (g)						
Hatch weight(g)	9.65±0.17c	11.76±0.26b	12.13±0.11b	14.08±0.08a	14.53±0.14a	**
Weight in 7 days(g)	56.96±2.40d	64.88±0.50c	69.09±1.11b	80.31±1.04a	84.16±0.88a	**
Weight in 14 days(g)	133.22±1.59e	145.41±1.10d	149.85±0.45c	164.32±1.01b	167.49±1.00a	**
Weight in 21 days(g)	198.54±3.41d	216.88±2.52c	228.53±1.33b	236.21±1.16a	239.61±1.57a	**
Weaning weight(g)	226.62±3.04e	242.11±1.24d	277.46±1.80c	294.99±1.32b	301.45±0.80a	**
Body Weight Gain in squabs (BWG)						
Gain 1-7 day (g)	47.31±2.30d	53.12±0.67c	56.96±1.09b	66.23±1.06a	69.63±0.83a	**
Gain 8-14 day (g)	76.25±3.08b	80.53±0.66ab	80.76±0.76ab	84.01±1.16a	83.32±1.23a	*
Gain 15-21 day (g)	65.32±4.49b	71.46±2.80ab	78.68±1.55a	71.88±1.22ab	72.12±1.31ab	*
Gain21-28 day (g)	28.07±3.52c	25.23±2.82c	48.92±1.21b	58.78±1.75a	61.83±1.76a	**
Total gain 1-28 day (g)	216.96±2.95e	230.35±1.24d	265.33±1.77c	280.91±1.32b	286.92±0.83a	**
Mortality rate%++	0.87±0.22	0.62±0.18	0.75±0.16	1.12±0.29	1.25±016	NS
Livability%+++	25.41±5.06c	40.62±4.09b	61.87±3.07a	71.72±3.25a	74.70±2.15a	**

a-e Means with different letters within the same row are significantly different at $P \leq 0.05$

++ 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: Effects of different levels of vitamins and minerals premix on economic efficiency of pigeons production

Items	Dietary levels of Vitamins and Minerals premix (g/ Kg)				
	(1g/ Kg)	(2g/ Kg)	(3g/ Kg)	(4g/ Kg)	(5g/ Kg)
Feed intake of pairs (kg) during 180 day)	**23.577**	**22.502**	**21.220**	**20.781**	**19.905**
Cost of feeding (L.E)=TFI x cost/kg diet	**33.785**	**32.402**	**30.684**	**30.153**	**29.021**
Number of squabs /pair	**1.12**	**1.75**	**3.37**	**4.75**	**5.12**
Sale price/ of squabs (L.E)	**9.520**	**14.875**	**28.645**	**40.375**	**43.520**
Net return*(L.E)	**-24.265**	**-17.527**	**-2.039**	**10.222**	**14.499**
Economical efficiency (%)**	**-71.821**	**-54.092**	**-6.645**	**33.900**	**49.960**

During this study the sale price per squab was 8.5 L.E
* Net return = Price of squabs of pair during 180 day - Price of feed cost during 180 day
** Economical efficiency = (Net return / Price of feed cost during 180 day)X100

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الملخص العربي

دراسات غذائية ورعائية على الحمام

تأثير المستويات المختلفة من مخلوط الفيتامينات و الأملاح المعدنية على معدل الآداء النتاجى والتناسلى

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اجريت هذة التجربة لتقدير الاحتياجات الغذائية من الفيتامينات و الأملاح المعدنية ومدى تاثيرها على الصفات الانتاجية والتناسلية فى الحمام البلدى تحت الظروف المصرية . تم عمل التجربة خلال فترة الانتاج حيث قسم عدد 40 زوج حمام بالغ عمر24 شهر الى 5 معاملات بكل معاملة 8 أزواج قسمت المعاملة الى 4مكررات بكل مكرر زوجين (النسبة الجنسية 1:1) قسمت المعاملات وفقا لمستويات الفيتامينات و الأملاح المعدنية حيث كانت 5,4,3,2,1 كجم مخلوط من الفيتامينات و الأملاح المعدنية لكل طن عليقة وتحتوى العلائق على 15.6% بروتين خام و2750 كيلوكالورى/كجم عليقة وتتعرض الطيور إلى 14 ساعة ضوء خلال اليوم ويتم تقديم العلائق والماء بصورة حرة حتى الشبع.

وكانت اهم النتائج كما يلى :

1- وجد تاثيرا معنويا موجبا على كل من وزن الجسم الحى والتغير فى وزن الجسم بزيادة مستوى الفيتامينات و الأملاح المعدنية فى العليقة خلال التجربة .

2- انخفضت كمية الغذاء المتناول لآباء الحمام مع او بدون الزغاليل معنويا بزيادة مستوى الفيتامينات و الأملاح المعدنية فى العليقة من 1 الى 5 كجم/ طن عليقة خلال مدة التجربة.

3- بزيادة مستوى الفيتامينات والأملاح المعدنية فى العليقة يزيد معنويا المتناول منها يوميا خلال مدة التجربة

4- تاثرت معنويا طول دورة البيض بزيادة مستوى الفيتامينات والأملاح المعدنية فى العلائق حيث سجلت 5 كجم/ طن عليقة اقصر فترة زمنية لدورة انتاج البيض.

5- بزيادة مستوى الفيتامينات والأملاح المعدنية فى العلائق زاد معنويا عدد البيض الناتج ووزن البيض ونسبة الخصوبة ونسبة الفقس.

6- بزيادة مستوى الفيتامينات والأملاح المعدنية فى العلائق زاد معنويا عدد الزغاليل الناتجة وكذلك وزن الجسم للزغاليل خلال28 يوم حيث سجلت5 كجم/ طن عليقة اعلى القياسات خلال فترات التجربة.

7- تزيد الحيوية للزغاليل بزيادة مستوى الفيتامينات والأملاح المعدنية فى العلائق كما ترتفع الكفاءة الأقتصادية.

نستخلص من هذة الدراسة ان الفيتامينات والأملاح المعدنية فى علائق الحمام تلعب دورا مهم فى عملية التمثيل الغذائى للمواد الغذائية وتأثيرها المعنوى على الاداء الإنتاجى للحمام و ان التغذية على مستوى 5 كجم/ طن عليقة فى علائق الجمام كان الافضل للحصول على اعلى اداء انتاجى واقتصادى مقارنة بالمستويات الأخرى وان كان مستوى 4 كجم/ طن كيلوكالورى/كجم عليقة يغطى الاحتياجات الغذائية للحمام دون اى تاثير عكسى على الآداء الانتاجى والتناسلى للحمام البلدى المصرى تحت الظروف المصرية.