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EFFECT OF SUPPLEMENTAL VITAMIN E AND SELENIUM ON PRODUCTIVE AND REPRODUCTIVE PERFORMANCES OF JAPANESE QUAIL BIRDS.

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SUMMARY

A total number of 800 one-day-old Japanese quail chicks were used in this study. The chicks were divided into four equal groups: the first group was fed on a vitamin E and selenium free diet (-E), the second group was fed on a diet containing the NRC recommended allowances of vitamin E and selenium for quail (E), the third group was fed on a diet containing 5 folds of the recommended doses of vitamin E (+E) and finally a group was fed on a diet containing 10 folds of the recommended doses of vitamin E (++E). The results of this work revealed a significant increase in +E and ++E groups and a significant decrease in -E group for body weight gain compared to control group through the twelve weeks of the experimental period. On the contrary mortality rate decreased in +E and ++E groups and increased in -E group compared to the control group. Egg production performance parameters, hatchability fertility and post hatching weight of one and seven-day-old quails showed significant increase in +E and ++E groups and a significant decrease in -E group when they were compared with control group. In this period embryonic mortality and alive inside shell significantly decreased in +E and ++E groups and significantly increased in -E group compared to the control group. Serum levels of T_3 and T_4 hormones were significantly reduced for +E and ++E groups and significantly increased in -E group compared to the control group. The present investigation indicates that the current NRC requirements for quail are not adequate for optimal performance.

Keywords: vitamin E, selenium, quail, productive, reproductive.

INTRODUCTION

Vitamin E is essential for optimum nutrition. By restricting dietary intake and noting deficiency symptoms, investigators have demonstrated this fact in all avian species (Sell 1997). Vitamin E deficiency symptoms develop in various tissues and at various rates. On a tocopherol-free diet chicks show softening of the brain (enchephalomalecia) within 6 weeks. Chickens if they do not succumb to encephalomolacia eventually develop both muscular and reproductive disorders (Hassan *et al.*, 1985). Selenium is also an essential element as its deficiency has been associated with exudative diathesis (geveralized edema due to vascular leakage of serous fluid) in chicks (Nesheim and Scott 1958). It was found that either vitamin E or selenium is affective in preventing exudative diathesis (Combs and Scott 1974). (Scott 1966a) found that the interrelationship between tocopherol metabolism and selenium metabolism are extensive and complex. Growth and viability of chicks improve with vitamin E (Serman *et al.*,1992) and selenium supplementation (Colnago *et al.*, 1984). They also stated that chicks fed 100 IU of vitamin E/kg of diet had increased weight gains and reduced mortality during coccidosis challenge. Kennedy *et al.* (1991) observed that diets supplemented with vitamin E at a concentration of near to 180 mg/kg improved body weight of broilar performance as compared with control diets containing approximately 50 mg/kg. The present evidence (Bruni 1993) suggests that an effective dietary concentration is between 100 and 200 mg/kg. Swain *et al.*, (2000) attributed the increase in body weight gain at 42 day of broiler age to vitamin E supplementation and concluded that combined dietary supplementation levels of viramin E and selenium, 150 IU/kg and 0.1 mg/kg respectively may be required for better health, disease protection and overall growth performance. Vitamin E has been reported to be essential also for normal hatchability (Kling and Soares 1980). Dietary selenium interacts with vitamin E and in some cases, may have a sparing action on vitamin E. A decreased hatchability was found when feeding a selenium-deficient diet (Jensen 1968). Furthermore, Arnold *et al.*, (1974) reported a significant effect of selenium on hatchability. The optimum dietary concentration of vitamin E found by Bollengier *et al.*, (1998) to be affective in maintaining normal egg production was probably between 125 and 500 mg/kg depending on environmental stress upon laying hens. This level was found to be less by Barreto *et al.*, (1997) for broiler breeders (25 mg/kg). Bollengier *et al.*, in 1998 reported that dietary supplementation of 250 mg vitamin E /kg is adequate during chronic heat stress for egg production and egg weight maintenance. Final broilar body weight decreases significantly with low doses of vitamin E (Gai *et al.*, 1997). Higher final body weight at 42 days improved feed conversion efficiency and reduced mortality, increased egg production, hatchability and neonatal chick weight were observed in broilers hatched from eggs injected with vitamin E (Hussain *et al.*, 1998).

The objective of the present investigation is to determine the optimal requirement of vitamin E that will enhance both productive and reproductive traits to the greatest limit in Japanese quail hens.

MATERIALS AND METHODS

Birds and management:

A total number of 800 one-day-old quail chicks were divided into four groups. Each group was given a different dietary treatment as described letter. The birds were kept under similar and standard hygienic, environmental and managerial conditions. All quails of the different groups were floor brooded until they reached 28 days of age. Then birds transferred to multideck batteries. The feed and water were supplied automatically ad libitum to all birds.

Experimental design and procedure:

Birds were assigned equally in number to four experimental groups as follows:

Group	Code	No of birds	Diatary treatment
1	-E	200	NRC(1994) recommended diet + minor possible amount of Vit. E and Se from feed ingredient with no added Vit. E or Se.
2	E	200	NRC (1994) recommended diet + NRC recommended requirement of Vit. E (12 mg/kg for starter or 25 mg/kg for laying) and Se (0.2mg/kg in both diets).
3	+E	200	NRC (1994) recommended diet + 5 folds of recommended dose of Vit. E and recommended dose of Se.
4	++E	200	NRC (1994) recommended diet + 10 folds of the recommended dose of Vit. E and recommended dose of Se.

Normal commercial diets were not used in the present study due to presence of high percent of Vit.E and Se in all ingredients of these rations especially yellow corn and concentrate. Therefore, a special practical diet containing the least possible levels of Vit.E and Se in its ingredients was formulated according to NRC requirements and used as the Vit. E and Se deficient diet (-E). It contained mainly the following ingredients:

a-Sorghum to substitute yellow corn contained very low percent of Vit.E (3.9mg/kg).

b-Soybean which contained very low percent of Vit.E (2 IU/kg.) and Se (0.1 mg/kg.).

In this respect the concentration of Vit. E and Se in starter deficient ration were 2.868 IU/kg and 0.04 mg/kg respectively, and were 3.09 IU/kg and 0.03 mg/kg respectively in laying ration. These minimal amounts do not support reproduction and immunity.

Table 1. Ingredients and Nutrients of the Experimental Diet

Item	Starting diet	Laying diet
Ingredients:		
Sorghum, ground grain (10.5% CP, 4001 Kcal / kg)	52.360	62.000
Soybean meal (44% CP, 2230 Kcal / kg)	42.300	29.100
Sucrose (3896 Kcal / kg)	0.100	0.050
Choline chloride	0.334	1.450
DL-methaionine	0.505	0.194
NaCl	0.500	0.480
$CaCO_3$	1.100	4.540
$CaHPO_4$	1.350	1.350
$MgSO_4$	0.285	0.290
KH_2PO_4	1.100	0.480
Premix†	0.066	0.066
	100.000%	100.000%
Composition by Calculation		
Nutrients:		
Crude protein, CP (%)	24.11	19.31
ME_n (Kcal / kg diet)	3041.11	3030.89

† Prepared in our laboratory and consisted of the following in grams: Vit. A (Ritinol), 0.135; Vit.D3 (cholecalciferol) 0.1875; Vit.K (Menadion Sodium Bisnlfate), 0.45; riboflavin, 0.6; calcium pantothenate, 2.2; niacin (nicotinic acid), 4.2; Pyridoxin HCl, 0.55; folacin (folic acid), 0.1; Biotin (Vit.H), 0.02; Vit.B12 (cyano cobalamine), 0.02; thiamine HCl, 0.35; Manganese (MnSO4) 16.7; Zinc (Zn(O3)), 9.6; iron (Fe2(SO4)2), 28.7; copper (CuSO4). 2.5; iodine (KI), 0.065.

‡ Based on NRC (1994) Table of feed composition.

Table 2. Vitamin E was added to the ration as DL alpha tocopherol acetate and selenium as sodium selenate according to the following quantities per kg diet:

Groups	Starter diet		Laying diet	
	Vitamin E (IU/Kg)	Selenium (mg/Kg)	Vitamin E (IU/Kg)	Selenium (mg/Kg)
Deficient (-E)	2.868	0.04	3.09	0.03
Control (E)	14.868	0.204	28.09	0.203
High (+E)	74.34	0.204	140.45	0.203
Very High (++E)	148.68	0.204	280.90	0.203

Note : one IU of vitamin E = 1 mg DL alpha tocopherol acetate

Measurements:

Body weight and mortality:

Growth data were obtained by weighing, individually, the quails at weekly intervals till 12th week of age. At the same period quail mortality was registered weekly.

Production and first generation follow-up:

When the birds reached sexual maturity, they were housed in laying cages in-groups of 20 females and 10 males. Egg production began early in the sixth week of age, eggs were collected and weighed daily and the following parameters were calculated through eight weeks of production from the first day of egg laying.

- Hen day = number of eggs / number of females/number of days x 100
- Average egg weight = total egg weight (gm)/number of eggs
- Total egg weight = egg production (gm)/quail/day.

Fertility, hatchability, embryonic mortality and alive inside shell:

Eggs collected from each group were incubated weekly in a standard automatic incubator to follow the effect of vitamin E and selenium on the reproductive efficiency of the birds. Eggs were candled to determine fertility. The quails hatched at the 16th to the 19th day of incubation period were removed from the hatchery and weighed individually at days 1 and 7 after hatch. Hatchability and embryonic mortality were then calculated.

Blood sampling procedure:

At the 3rd, 6th and 12th weeks of age, 5 females and 5 males representing the average body weight were selected from each treatment, deprived from food and water overnight. Blood sample from each bird was collected and serum separated by centrifugation. Chopra (1972) and Larsen (1972) measured T3 and T4 in quail serum by Radioimmunoassay (RIA) technique based on the method described.

Statistical analysis:

The data were analyzed by ANOVA in one-way classification according to Snedecor and Cochran (1982) followed by Duncan test (1955) to separate LSD between means and by the general linear models (GLM) procedure by SAS (1988).

RESULTS

Body weight:

Body weight changes of unsexed quails from different experimental groups at weekly intervals from 1st till 12th week of age. Intervals are illustrated in Table (3). The analysis of variance indicated that ++E group which received 10 folds of the recommended requirement of vitamin E and selenium (Se) (120 IU/kg diet for Vit. E and 0.2 mg/kg diet for Se) showed highly significant increase in body weight during 1st and 2nd weeks of age when compared to control, while -E group which received neither vitamin E nor Selenium showed highly significant decrease in body weight. On the other hand, +E group which received 5 folds of Vitamin E and Selenium than NRC requirement (60 IU/kgm diet for Vitamin E and 0.2mg/kg diet) surprisingly showed significant decrease in quail body weight than the control in that 1st and 2nd weeks of age. In 3rd week of age +E joined the ++E groups in showing significant increase in body weight gain than control and -E group which continued to show highly significant decrease than the control. It could be noticed from the Table that from the 1st to 12th week of age that -E group was consistent in showing highly significant decrease in body weight, while ++E group showed highly significant increase as compared to the control group. The +E group showed a significant increase than the control group in the 4th week, no significant difference in the 5th and 6th wk and a significant increase in the following weeks thereafter till the 12th wk.

Female body weight:

Table (5) presented the result of the effect of vitamin E level in the diet on female body weight of Japanese quails from the 4th to the 12th week of age. It could be observed that in the 4th and 5th weeks of age that female quails of groups +E and ++E showed highly significant increase than the control and no significant difference between them was found. On the other hand female quails of -E group were significantly less in their body weight than the control. In the 6th, +E and ++E groups were not significantly different than the control, while -E group continued to show significant decrease. In the following weeks, from 7 to 12, ++E, +E and -E groups showed highly significant increase, significant increase and highly significant decrease in their body weight than the control, respectively.

Male body weight:

Results data on the effect of vitamin E and Se on male Japanese quail birds body weight from the 4th to the 12th weeks of age are illustrated in Table (5). It is observed from the Table that at four, seven, eleven and twelve weeks of age that ++E, +E and -E male group showed highly significant increase, significant increase and highly significant decrease in their body weight than the control group (E) respectively. In the 5th and 6th weeks of age there were no significant differences between ++E, +E and control. While -E group contained to significant decrease than control at this age period also. Furthermore, in the 8th, 9th and 10th week of age, there was no significant difference between the control and +E group, while the ++E group showed highly significant increase and -E showed highly significant decrease in quail body weight than control, respectively.

Mortality percentage:

Data concerning total mortality percentage of the different experimental groups at weekly intervals are shown in Table (4). It could be observed that all the mortalities that occurred during the experimental period lied within and under the normal range of quail mortality, except for the -E group, which recorded the highest percent of mortality during all experimental periods. The percent mortality for this deficient group ranged from 1.0% to 9.73% along the twelve examined weeks except for the 9th week which registered 39.77% to record the highest percent during a week in all treatments and caused to elevate the total mortality percent in this group to 46.5% corresponding to 6.0 in control group. On the other hand, weekly mortality percent of +E and ++E ranged from 0.0% to 2.83% and 0.0% to 1.56%, respectively, corresponding to 0.0% to 3.26% in control group along the twelve examined weeks of age, while the total mortality percent of +E and ++E groups was 6.0% and 4.0% respectively corresponding to 6.0 in control group during all twelve weeks under study.

Female mortality percentage:

Female mortality data expressed as percentage of total birds of the different experimental groups at weekly intervals are illustrated in Table (6). It is observed from the Table that weekly mortality percent of -E, E, +E and ++E ranged from 3.45% to 48.15%, 0.0% to 5.41%, 0.0% to 5.17 and 0.0% to 1.84%, respectively. On the other hand, total mortality percent for -E, +E and ++E group was 39.77%, 8.33% and 3.79% corresponding to 10.91% in control group.

Male mortality percentage rate:

Weekly male mortality as age percent of total birds for the different experimental groups is illustrated in Table (6). Data represented in this Table show that weekly male mortality percent for -E group ranged from 3.6% to 42.2%. while in other groups this percent ranged from 0.0% to 2.94%.

Egg Production Performance:

Results of the present investigation show that vitamin E and selenium deficient diets affected the reproductive activity of Japanese quail hens appreciably as indicated by the significant reduction in egg production. The effect was too rapid as one week treatment was quite sufficient to exert a considerable quantity of reduction and continued to decline thereafter until ovipositor came to a complete stop in deficient hens. On the other hand, egg production performance parameters were enhanced in dietary groups receiving additional Vitamin E in their diets over the NRC (1994) requirements.

Egg production parameters:

Data concerning these aspects of egg production were listed in Table (7).

1- Hen Day:

From the obtained data it was clearly apparent that adding vitamin E and selenium to the laying ration at a level of 125 mg/kg and 0.2 mg/kg, respectively, increased hen/day than the control values from the first week up to eighth week by: 3.72%, 26.7%, 42.99%, 37.55%, 32.83%, 31.52%, 38.09% and 50.89%, respectively. While adding vitamin E and selenium to laying ration with a relatively higher dose of 250 mg/kg of Vitamin E and 0.2 mg/kg selenium increased hen day from 1st week up to 8th week by: 6.33%, 41.49%, 51.15%, 50.22%, 50.09%, 48.58%, 57.57% and 70.64%, respectively. On the other hand, the group which received zero Vitamin E and selenium had a retarded oviposition time as it did not occur until the 3rd week of egg production compared to control, i.e. there was no egg production in 1st and 2nd weeks and the termination of oviposition occurred in sixth week of egg production. Moreover, it showed a marked decrease in egg production as represented by quail day from 3rd to 6th week of egg production by: 20.09%, 24.7%, 5.86% and 23.84%, respectively.

2- Average egg weight:

Average egg weight was estimated as an indicator for egg production performance. Adding vitamin E and selenium increased egg production during the first successive eight weeks of egg production beginning from first day of ovipositor. The values for the average egg weight of the group that received 250 mg/kg Vitamin E and 0.2 selenium increased gradually reaching its maximum value (11.86 gm) at the fourth week of egg production while control group reached its maximum value (11.16 gm) at the eighth week of egg production. On the other hand, the deficient group that received zero Vitamin E and/zero selenium had no egg production data in 1st, 2nd, 7th and 8th weeks of egg production. In this group the average egg weight increased gradually from 3rd week to 5th week of egg production (from 7.98 gm to 10.19 gm) then decreased in 6th weeks to 10.06gm.

3- Egg production in grams/ quail/ day:

When the weight of the egg laid per quail per day parameter was estimated, it showed a highly related response to treatment applied. The group, which received 250 mg/kg Vitamin E, and 0.2-mg/kg selenium in their diet laid a higher weight of eggs/quail/ day. The weight increased during the successive eight weeks from the first time of ovipositor. The values of egg weight/quail/day increased gradually until it reached its highest level at the 8th week of egg production and values were as follow:

1.19 gm, 6.96 gm, 8.9 gm, 10.1 gm, 10.58 gm, 10.84 gm, 11.48 gm and 11.72 gm. These values correspond to 0.46 gm, 2.28 gm, 2.49 gm, 3.6 gm, 4.25 gm, 4.81 gm, 4.29 gm and 3.19 gm in control group during the same period of egg production. On the other hand the group the received zero vitamin E and/zero selenium laid eggs of lower weight/quail/day from the start of oviposition that occurred in this group at a time equivalent to the third week of egg production in control group to the sixth week when oviposition stopped and values were as follow 0.46 gm, 1.01 gm, 3.46 gm and 1.98 gm, respectively.

Hatchability of Fertile Eggs and Hatching Weight:

The effect of dietary vitamin E and selenium on hatchability percent is illustrated in Table (8). Hatchability percent of -E group showed the lowest percent along all experimental periods, at the same time +E group showed higher percent of hatchability than control and ++E showed even a higher increment in hatchability percent from 1st to 8th weeks of egg production. Hatching weight of Japanese quail chicks at day one and day seven-post hatch were illustrated in Table (8). The results showed that chicks hatched from +E and ++E eggs showed a highly significant increase in hatching weights at day 1 and 7 over all other groups, while the group which recived zero vitamin E and zero selenium showed a significant decrease in hatching weight at days 1 and seven. The values of mean in grams of hatching weight are illustrated in Table (9).

Fertility:

The effect of supplementation of dietary Vitamin E and Selenium on fertility percent of males of Japanese quail birds is illustrated in Table (8). It could be noticed that vitamin E and selenium supplementation increase male fertility percent at an age equivalent to the eighth week of female egg production. The group, which received, zero Vitamin E and zero Selenium showed the lowest fertility percent at all experimental periods.

Embryonic mortality:

Effect of vitamin E and selenium on embryonic mortality and alive inside shell (AIS) are illustrated in Table (10). Data of this Table show that embryonic mortality and AIS increased in-group, which received, zero vitamin E and zero selenium. The values were 50.0, 8.96, 42.86 and 41.18 at 3rd, 4th, 5th and 6th weeks of egg production respectively for embryonic mortality and 17.65 in 6th week of egg production for AIS. On the contrary +E and ++E groups showed the lowest percent of embryonic mortality (the percent ranged from 7.86 to 20.0 in ++E group) and for AIS (the percent ranged from 0.0 to 2.42 in +E and ++E groups) in all experimental periods (8 week of egg production).

Thyroid hormones:

1- Triiodothyronine (T_3):

Data concerning triiodothyronine of male and female in serum through different experimental periods are shown in Tables (11), and (12), respectively. It could be noticed that group which received zero vitamin E and zero selenium showed highly significant increase in serum T_3 level compared to any of other group. While groups which received high doses of Vitamin E showed highly significant decrease in all periods except, the twelfth week for males which showed no significant difference between all groups.

2- Tetraiodothyronine (T_4):

Results Tetraiodothyronine (T_4) of male and female in serum through different experimental periods are shown in Tables (11) and (12), respectively. It is very clear to that the group, which received, zero Vitamin E and zero Selenium showed a highly significant increase in T_4 levels through the three experimental periods. The values were 6.24, 6.66 and 3.55 for female T_4 level and 6.36, 9.26 and 7.42 for male T_4 level. These values correspond to the 3rd, 6th and 12th week of age. At the same time groups which received high doses of Vitamin E and Selenium showed significant decrease in T_4 levels. In 3rd, 6th and 12th week of age the values of T_4 concentration were 2.72, 3.86 and 2.22 in female +E group and 2.42, 3.24 and 2.0 for female ++E group respectively. On the other hand groups received high doses of Vitamin E and Selenium of Japanese quail males showed significant decrease in T_4 concentration. The values were 2.92, 5.78 and 4.2 for male +E group and 2.14, 5.34 and 3.49 for male ++E group respectively.

DISCUSSION

Body weight gain was enhanced in dietary groups receiving additional Vitamin E in their diets over the NRC(1994) requirements. The enhanced body weight in the +E and ++E groups could be attributed due to the enhanced resistance to diseases as elicited by the increase in humoral immune response due to Vitamin E supplementation and as reflected by our results on the elevated hemagglutination and inhibition titers to NDV and SRBCs, This increase in body weight gain is in agreement with Heinzerling (1974) who observed a decreased rate of mortality and increased weight gain following an infiction in the chicks supplemented with Vit. E. Moreover, there is evidence that increasing the intake of Vit. E improves the health status and disease resistance of poultry as showed by Sell *et al.*, (1997). These authors found that diets containing 6 to 20 IU of Vit. E supported satisfactory growth, feed efficiency and livability of tom turkeys from one day of age to market age. In another survey, Mcllory *et al*(1993) demonstrated that the results of feeding broiler flocks on high Vit. E containing diet was 8.2% ($P < 0.01$) better in their body weight than that achieved by flocks being fed on normal diets. Our results are inagreement with Abu-Taleb (1999) and Ezzat *et al.*, (2001).

Vitamin E deficiency increased mortality rate in both males and females in the current experiment. Mortality percent decreased in groups receiving additional Vitamin E in their diets and to even higher reduction in those receiving Vit. E at levels over the NRC requirements. This result suggests that vitamin E supplementation may have an immunostimulatory effect, thereby increasing disease resistance and thus decreasing mortality. Several studies have shown that dietary Vitamin E enhances components of the immune system such as antibody production (Reddy *et al.*, 1986), Lymphocyte blastogenic response to lectin (Corwin *et al.*, 1981) and phagocytic activity (Heinzerling 1974). Furthermore, Ezzat *et al.*, (2001), studied the effect of In-vivo injection of Vitamin E on Japanese quails mortality. They achieved the lowest total quail post-hatch mortality due to injection of vitamin E during this incubation interval. It is a well known phenomene that vitamin E is an effective stimulant of immune system in chickens. The passively transferred antibody levels are significantly increased in plasma of young chicks when they were fed high levels of Vitamin E (El-Boushy, 1990). Finally results of the current investigation are in agreement with those of Mcllory *et al*(1993) and Abu-Taleb (1999).

On the other hand, -E group registered the highest percent of mortality throughout the twelve experimental weeks under investigation. This detrimental effect for not adding Vitamin E and Selenium to the diet was most prominent on the 9[th] week of age, this is mainly due to blindness of most of the quails that made them not able to reach feed and water. Vitamin A is the major factor for healthy vision, but since there is an apparent relationship between Vitamin E and Vitamin A. As Vitamin E may facilitate the absorption, hepatic storage and utilization of Vit. A (Bauernfeind *et al*., 1974).

Egg production performance was enhanced in dietary groups receiving additional Vitamin E and selenium in their diets over the NRC (1994) requirements. The enhanced egg production that was found in this study may be due to the beneficial effect of Vitamin E and selenium through its intra-membrane antioxidant properties (Tappel, 1972) that protects tissue membranes from lipid peroxidation caused by free radicals. Increased membrane lipid peroxidation induces liver dysfunction and may thus contribute to the reduced hepatic synthesis of vitellogenin (Fowler 1990). Excess of dietary supplementation of Vitamin E may therefore have afforded a degree of protection to the liver and that increased the availability of egg yolk precursors for egg formation by reducing oxidative stress.

Another possible explanation of the increment of egg production performance would involve a direct effect of estradiol. Hepatic synthesis of vitellogenin is under direct estrogenic control. Likewise, estradiol has an effect on circulating calcium through its control of the synthesis of 1, 25-dihydroxy cholecalciferol. the active cholecalciferol metabolite that regulates calcium absorption, circulating calcium and estrogen concentrations are highly correlated in laying hens (Tojo and Huston, 1980). Vitamin E might influence this estradiol-dependent mechanism by exerting a direct effect on estradiol or an indirect effect through maintaining more normal function of cellular processes regulating estradiol.

Hatchability, Embryonic Mortality and Alive Inside Shell:

The effects of dietary factors vitamin E and selenium on the development and viability of avian embryos have been extensively documented. A good nutritional status for the parent birds is crucial to the transfer to the egg of an adequate, balanced supply of nutrients required for normal development of the embryo. The consequences to the embryo may be lethal if the egg contains either inadequate or imbalance levels of Vitamin E and Selenium (Wilson 1997). Normal embryonic growth and development depends on a complete supply of adequate amounts of Vitamin E and Selenium within the egg. The importance of these nutrient supplies to the embryo was emphasized by Romanoff and Romanoff (1972) in verse, nutrition is a corner-stone deficiency or large excess makes embryo diseases prone creates defects and lethal stress.

Results of this study demonstrated that Vitamin E and Selenium supplementation to Japanese quail birds increased hatchability percent of fertile eggs. Analysis of eggs from commercial flocks has indicated that vitamin E and Selenium levels are adequate to support hatchability. The transfer efficiency from diet to egg is very high for vitamin E (Naber 1993). As noted previously, dietary selenium interacts with vitamin E and, in some cases, may have a sparing effect on Vitamin E. Jensen (1968) found decreased hatchability when feeding a selenium-deficient diet. Vitamin E and Selenium have been reported to be essential for normal hatchability, Cantor *et al.* (1974) found that hatchability of eggs produced by hens reviving a practical corn-Soybean meal laying diet (unsupplemented diet) dropped to zero by the 17th week, and was maintained at over 90% of fertile eggs by supplementing the diet with the selenium as sodium. Selenite at a level of 0.1 ppm. Our results are in agreement with that obtained by Abou-Taleb (1999) and Ezzat *et al.* (2001).

Fertility:

Vitamin E is naturally present in the chicken (Blesbois *et al.*, 1993) and turkey sperm Surai and Ionov 1992). The results from the present study on Japanese quail fertility demonstrated that Vit.E at 0 or control level were not adequate for supporting the fertilizing ability and supplementation of higher doses of Vit.E improved fertility and agrees with Donoghue and Donoghue 1997. Vitamin E and Seleniun supplementation produced highly significant increase of fertility percent in +E and ++E groups. While Vitamine E deffeciency causes fertility failure. Males become infertile because sperm become incompetent (Friedrichsen *et al.*, 1980). Functionally, Vitamin E protect both internal and external cellular membranes of the sperm from free radical-induced damage (Tappel, 1970). In studies with chicken spermatozoa, lipid peroxidation, had been associated with the partial or absolute less of fertility (Wishart, 1984) although motility may (Fujihara and Koga, 1984) or may not (Wishart 1984) be affected. Moreover, Cecil and Bakst (1993) reported that one mechanism proposed for cellular degradation is lipid peroxidation within the cell membrane (outer membrane of sperm). Lipids are known to be important structural elements of cell membranes: hence, maintenance of the integrity of lipids in spermatozoal membranes may be the mechanism that protects spermatozoa from the stress associated with Vitamin E and Selenium deficiency.

Results of this study demonstrated that the administration of Vitamin E and Selenium to Japanese quail birds reduced serum level of T_3 and T_4 concentration. These results coincide with the results obtained by Burke and Marks (1984) who reported that T_4 concentrations were higher and body weight were lower in Japanese quail birds between 0 and 4 week of age. Our results are in agreement also with those obtained by Abo-Taleb (1999) and Ezzat *et al* (2001) who reported that Vitamin E injected to Japanese quail eggs reduced the serum level of T_3 and T_4 of hatch quails from first to seven week of age. This leads to production of highly metabolic rate and inturn increement of body weight of that birds. On the other hand, Haddad and Mashely (1990) reported that decreasing circulating thyroid hormone levels are paralleled by decreasing the weight of lymphoid organs, total circulating white blood cells and number of lymphocytes (Erf and Marsh 1987). These results are not consistant with those reported by Bachman and Mashaly (1987) who found that T_3 supplementation reduces relative thymus and spleen weights. Gupta and Kar (1999) reported that administration of the antioxidant vitamin E (5mg/kg body weight on alternate days) to cadmium treated chicknes restored thyroid function by maintaining normal hepatic 5'-monoderodinase and serum thyroid hormone concentrations. In this respect Guo *et al.*, (1999) reported that selenium deficiency in broiler chick diets decreased hepatic glutathione peroxidase and inturn 5'-iodothyronine deiodinase activities significantly compared to control. They also reported that plasma thyronine concentrations were decreased by a concomitant iodine and selenium deficiency. In another study on white karaman lambs. Naziroglue *et al*., (1998) reported that levels of T_3 were slightly increased and both levels of T_4 and the ratio of T_4/T_3 were slightly decreased when vitamin E, selenium and vitamin E with selenium were supplemented in in diets. Engelemann *et al.* (1999) administrated 20,000 mg vitamin E/kg diet to laying hen. They reported that plasma thyroxine was significantly higher in the treatment group of hatched chicks and non-pipped eggs, and plasma triiodothyronine (T_3) was significantly lower in pipped eggs of the treatment group than control group.

REFERENCES

Abu-Talb, A.M.A. (1999). Biochemical evaluation of immunity produced by applying embryo infection technique of Newcastle Vaccination and Vit. E in Japanese quail. Ph.D Thesis, Faculty of Agriculture, Zagazig University at Banha.

Arnold, R.L.; O.E. Olson and C.W. Carlson (1974). Tissue selenium content and serum tocopherals as influenced by dietary type, selenium and Vitamin E. Poult. Sci. 53:2185.

Bachman, S.E. and M.M. Mashaly (1987). Relationship between circulating thyroid hormones and Cell-Mediated in immature male chickens. Dev. Comp. Immunol. 11: 203.

Barreto, S.L.T.; S.M. Hossain; G.B. Mourao (1997). Effect of dietary vitamin E on productive and reproductive performance of broiler breeders. Arquivo Brasileiro de Medicina Veterinaria e Zootecnia. 49:453.

Bauernfeind, J.C.; H. Newmark and M. Brin (1974). Vitamin A and E nutrition via intramuscular or oral route. Am. J. Clin. Nutr. 27: 234.

Blesbois, E.; I. Grasseau; and J.C. Blum (1993). Effects of Vitamin E on fowl sevaen storage at 4C. Theriogenology 39: 771.

Bollengier-Lee, S.; M.A. Mitchell; D.B. Utomo; P.E.V. Williams and C.C. Whitehead (1998). Influence of high dietary vitamin E supplementation on egg production and plasma characteristics in hens subjected to heat stress. British Poultry Science 39:106.

Bruni, M. (1993). Vitamin E and meat quality. Rivista di Avicolture, 62:15.

Burke, W.H. and H.L. Marks (1984). Growth hormonal thyroxin, and triiodothyronine levels of Japanese quail selected for four-week body weight. Poult. Sci., 63: 207.

Cantor, A. H.; M. L. Scott and T. Noguchi (1974). Biological availability of selenium in foodstuffs and selenium compounds for prevention of oxidative diathesis in chicks. J. Nutr. 105: 96.

Cecil, H.C. and M.R. Bakst (1993). In vitro lipid peroxidation of turkey spermatozoa. Poultry Science 72: 1370.

Chopra, J. (1972). A radioimmunoassay for measurement of thyroxine in unextracted sera. J. Clin. Endocrin. 34: 938.

Colango, G.L.; L.S. Jensen and P.L. Long (1984). Effect of selenium and Vit.E on the development of immunity to coccidosis in chickens. Poult. Sci. 63(6): 1136.

Combs, G.F., Jr. and M.L. Scott (1974). Dietary requirements of vitamin E and selenium measured at the cellular level in the chick. J. Nutr, 104:1292

Corwin, L.M.; R.K. Gordon and J. Shloss (1981). Studies of the mode of action of Vitamin E in Stimulating T-cell mirogenesis. Scand. J. Jmunol., 14: 565.

Donoghue, A.M. and D.J. Donoghue (1997). Effects of water- and lipid-soluble antioxidants on turkey sperm viability, membrane integrity, and motility during lipid storage. Poultry Science 76: 1440.

Elaroussi, M.A. (1998). Unpublished results.

El-Boushy, A.R. (1990). Role of Vit. E on immune response. Poult. Sci. 6, No. 2, 29.

Engelmann, D.; I. Halle; G. Flachowsky; H.P. Dallmann; R. Schuber; G. Flachowsky; R. Bitsch and G. Jahreis (1999). Effect of high vitamin E intake in laying hens on thyroid hormones in the plasma of chicken embryos. Vitamin und Zusatzstoffe in der Ernahrung von Mensch and Tier: 7. Symposium Jena Thuringen, Germany, 22. und 23. September, pp. 160.

Erf, G.F. and J.A. Marsh (1987). Triiodothytonine effects mitogen responsiveness in sex-linked dwarf and cornell K strain chickens. Dev. Comp. Immunol. 11: 395.

Ezzat, I.E.; F.F. Ali; M.K. Shabana and A.M. Abo-Talab (2001). In Ovo Technology and New Castle disease resistance in Japanese quail birds. Arab Journal of Nuclear Sciences and Applications, 34(2) 301.

Fowler, N.G. (1990). Nutritional disease, in: Jordan, F.T.W. (Ed.) Poultry Disease, 3rd end pp. 229-301 (London, Biolliere Tindall).

Friedrichsen, J.V.; G.H. Arscott and D.L. Wills (1980). Improvement in fertility of white leghorn males by Vitamin E following a prolonged deficiency. Nutr. Rep. Int. 22: 41.

Fujihara, N., and O. Koga (1984). Preventation of the production of lipid peroxide in rooster spermatozoa. Anim. Reprod. Sci., 7: 385.

Gai-Z.T.; Toled, G.S.P.; Costa, P.T.C.; Lopes, J.M.; Visentini, P.R. and Kloeckner, P.E. (1997). Effect of the amounts of retinol, Vit. E, Pyridoxine, folic acid and biotin on performance of broiler chickens from 1 to 42 days old. Revista da Sociedade Brosilairo de Zootecnia. 26: 2, 304.

Guo, Y.M.; Z.W. Li, Y.P. Zhou (1999). Nutritional interrelationships between selenium and iodin in broiler chicks. Journal of China Agriculture University, 4:1, 97.

Gupta, P. and A. Kar (1999). Cadmium induced thyroid dysfunction in chicken: hepatic type I iodothyronin 5'-monodeiodonose activity and role of lipid peroxidation.

Haddad, E.E. and M.M. Mashaly (1990). Effect of thyrotropin releasing hormone, Triiodothyronine and chicken growth hormone on plasma concentrations of thyroxine, triiodothyronine, growth hormone, and growth of lymphoid organs and leukocyte populations in immature male chickens. Poult. Sci., 69: 1094.

Hassan, S.; L. Jonsson and J. Hakkarainen (1985). Morphological studies on nutritional encopholoualacia in chicks, with reference to mineralized deposits in the cerebellum. Zentralbl Veterinaermed. Reihe A 32: 662

Heinzerling, R.H. (1974). The effect of vitamin E on immunity Doctoral Thesis, Colorado.

Hossain, S.M.; S.L. Barreto; A.G. Bertechini; A.M. Rois and C.G. Silva (1998). Influence of dietary Vitamin E level on egg production of broiler breeders, and on the growth and immune response of progeny in comparison with the progeny from eggs injected with Vitamin E. Animal Feed Science and Technology 73:307.

Jensen, L.S. (1968). Selenium deficiency and impaired reproduction in Japanese quail. Proc. Soc. Exp. Biol. Med., 128: 970.

Kennedy, D.G.; D.A. Rice; D.W. Bruce; E.A. Goodall; S.G. McIlroy (1991). Economic effects of increased vitamin E supplementation of broiler diets on commercial broiler production. British Poult. Sci. 33: 1015.

Kling, L.J. and J.H. Soares, Jr., (1980). Vitamin E deficiency in the Japanese quail. Poultry Science 59: 2352.

Larsen, P.R. (1972). Direct immunoassay of triiodothyronino in human serum. J. Clin. Invest. 51: 1939.

McIlroy, S.G; E.A. Goodall; D.A. Rice; M.S. McNulty and D.G. Kennedy (1993). Improved performance in commercial broiler flocks with subchinical infectious bursal disease when fed diets containing increased concentrations of vitamin E. Avian Pathology 22:81.

Naber, E.C. (1993). Modifying vitamin composition of eggs: Review. J. Appl. Poult. Res. 2: 385.

Naber, E.C. and M.W. Squires (1993). Vitamin profiles of eggs as indicators of nutritional status in the laying hen: diet to egg transfere and commercial flock survey. Poultry Science 72: 1046.

Nesheim, M.C. and M.L. Scott (1958). Studies on the nutritive effects of selenium for chicks. J. Nutr. 65: 601.

NRC. (1994). Nutrient Requirements of Poultry. Ninth Revised Edition: National Academy Press— Washington, D.C.

Reddy, P.G.; Morril Minocha; H.C. Morril; A.D. Dayton and R.A. Frey (1986). Effect of supplemental vitamin E on the immune system of Calves. Journal of Dairy Science 69: 164.

Romanoff, A.L. and A.J. Romanoff (1972). Pathogenesis of the Avian Embryo. Wiley Interscience, New York, N.Y.

SAS. (1988). SAS / STAT User's Guide, Release 6.03 Edition. SAS Institute Inc., Cary, NC, USA.

Scott, M.L. (1966). Studies on the interrelationship of selenium, vitamin E and sulfer amino acids in a nutritional myopathy of the chick. Ann. N.Y. Acad. Sci. 138: 82.

Sell, J.L.; M.F. Soto-Salanova; P. Palo; M. Jeffrey (1997). Influence of supplementing corn-soybean meal diets with vitamin E on performance and selected physiological traits of male turkeys. Poultry Science 76:1405.

Serman, V.; U. Mas; H. Mazaja and Z. Mikulic (1992). 1- Immune response as a marker of needs for vitamin E in chicken. 2- The influence of vitamin E on fattening chicks productivity. Krimva, 34: 65.

Surai, P.F. and I.A. Iovon (1992). Vitamin E in fowl sperm. pages, 535-537 in: Proceedings 12th International congress Animal Production. Vol.1 The Hague, the Netherlands.

Swain, B.K.; T.S. Johri and S. Majumdar (2000). Effect of different combinations on the performance and immune response of broilers. British Poultry Science 41: 287.

Tappel, A.L. (1970). Biological antioxidantprotection against lipid peroxide damage. American Journal of Clinical Nutrition 23: 1137.

Tapple, A.L. (1972). Vitamin E as the biological lipid antioxidant. Vitam. Horm. 20: 493.

Tojio, H. and T.M. Huston (1980). Effect of environmental temperature on the concentration of serum estradiol, progresteron and Calcium in maturing female domestic fowl. Poultry Science 59: 2797.

Wilson, H.R. (1997). Effect of maternal nutrition on hatchability. Poultry Science 76: 134.

Wishart, G. (1984). Effect of lipid peroxide formation in fowl semen on sperm motility, ATP content and fertilizing ability. Journal of Reproduction Fertility 71:113.

Table 3. Effect of Vitamin E and Selenium supplementation on body weight changes (Mean in Grams) ±SE of unsexed Japanese quail birds.

group	-E	E	+E	++E
Hatching wt.	8.53±0.02	8.50±0.03	8.59±0.03	8.54±0.03
Age in Wk				
1th wk	24.71±0.19 ^{d}	27.75±0.12 ^{b}	26.85±0.15 ^{C}	28.42±0.15 ^{a}
2nd wk	53.77±0.49 ^{d}	64.08±0.47 ^{b}	62.67±0.37 ^{C}	69.19±0.37 ^{a}
3rd wk	88.16±1.16 ^{d}	106.6±0.96 ^{C}	110.79±1.04 ^{b}	116.26±0.85 ^{a}
4th wk	116.29±2.15^{C}	141.91±1.38^{b}	150.53±1.33 ^{a}	151.83±1.51 ^{a}
5th wk	152.95±2.29^{C}	181.93±1.76^{b}	184.17±1.62 ^{b}	188.43±1.35 ^{a}
6th wk	179.34±2.16^{C}	201.18±1.82^{b}	202.80±1.91 ^{b}	206.54±1.86 ^{a}
7th wk	191.15±2.81^{d}	211.87±2.83^{C}	221.85±2.63 ^{b}	232.04±2.88 ^{a}
8th wk	184.35±3.44^{d}	218.39±3.02^{C}	225.83±3.12 ^{b}	243.99±3.31 ^{a}
9th wk	184.23±3.17^{C}	225.00±3.55^{bc}	228.99±3.79 ^{b}	257.03±3.48 ^{a}
10th wk	191.75±2.50^{C}	225.61±3.36^{bc}	230.01±3.40 ^{b}	250.64±4.01 ^{a}
11th wk	186.80±2.67^{d}	216.57±4.19^{C}	228.57±3.79 ^{b}	251.00±3.79 ^{a}
12th wk	198.52±3.07^{d}	217.59±4.24^{C}	230.98±4.63 ^{b}	254.38±4.33 ^{a}

Values in the same raw with different superscript differ significantly ($P < 0.05$).

Table 4. Effect of Vitamin E and Selenium supplementation on mortality percentage of Japanese quails birds.

Groups	Total mortality, %				Total Comulative mortality, %			
Weeks	-E	E	+E	++E	-E	E	+E	++E
1st	1.00	0.0	0.50	0.0	1.0	0.0	0.5	0.0
2nd	2.02	0.0	0.51	0.0	3.0	0.0	1.0	0.0
3rd	3.61	1.55	1.03	1.54	6.5	1.5	2.0	1.5
4th	3.83	0.0	0.0	0.56	10.0	1.5	2.0	2.0
5th	6.08	0.0	0.78	0.0	14.5	1.5	2.5	2.0
6th	1.44	0.0	2.42	0.71	15.5	1.5	4.0	2.5
7th	5.34	0.0	0.0	0.83	19.0	1.5	4.0	3.0
8th	9.38	2.0	0.92	1.09	23.5	2.5	4.5	3.5
9th	39.77	3.26	2.83	1.19	41.0	4.0	6.0	4.0
10th	9.43	2.66	0.0	1.56	43.5	5.0	6.0	4.0
11th	4.16	1.41	0.0	0.0	44.5	5.5	6.0	4.0
12th	9.09	1.49	0.0	0.0	46.5	6.0	6.0	4.0

Table 5. Effect of Vitamin E and Selenium supplementation on body weight changes (Mean in grams ±SE) of male and female Japanese quail birds

Groups	Male				Female			
Age in Weeks	-E	E	+E	++E	-E	E	+E	++E
4th wk	120.±2.5^{d}	141.4±1.5^{C}	147.4±1.9^{b}	151.0±1.5^{a}	118.9±3.8^{C}	142.6±2.5^{b}	154.0±1.8^{a}	154.2±1.8^{a}
5th wk	153.3±2.9^{b}	178.8±1.9^{a}	177.6±2.1^{a}	181.0±1.9^{a}	152.4±3.7^{C}	186.4±3.3^{b}	191.6±2.1^{a}	194.2±1.6^{a}
6th wk	175.2±2.7^{b}	193.8±1.6^{a}	193.0±2.6^{a}	194.5±2.1^{a}	185.9±3.4^{b}	212.9±3.1^{a}	214.9±2.8^{a}	215.2±2.3^{a}
7th wk	181.9±2.9^{d}	201.0±2.1^{C}	205.7±2.6^{b}	211.7±2.9^{a}	205.2±5.1^{d}	230.3±5.6^{C}	240.2±3.5^{b}	247.0±3.2^{a}
8th wk	180.4±3.7^{C}	204.8±3.2^{b}	206.0±2.9^{b}	219.5±3.6^{a}	193.2±6.9^{d}	238.6±4.0^{C}	248.9±3.7^{b}	260.6±3.5^{a}
9th wk	180.9±2.9^{C}	211.1±2.7^{b}	207.7±3.4^{b}	234.1±4.5^{a}	199.2±10.5^{C}	247.4±6.2^{bc}	253.7±5.0^{b}	268.2±3.6^{a}
10th wk	188.8±2.3^{C}	214.3±2.9^{b}	210.5±2.7^{b}	226.2±4.6^{a}	206.6±8.1^{d}	244.0±5.9^{C}	253.3±4.5^{b}	262.3±4.5^{a}
11th wk	186.4±2.8^{d}	201.2±3.6^{C}	211.8±3.1^{b}	231.2±4.6^{a}	188.9±7.8^{C}	242.4±6.9^{bc}	250.9±5.9^{b}	261.3±4.7^{a}
12th wk	196.2±2.8^{d}	206.2±4.5^{C}	215.5±3.9^{b}	235.1±3.9^{a}	212.8±13.3^{d}	227.9±15.5^{C}	252.00±8.09^{b}	263.1±5.4^{a}

Values in the same raw with different superscript differ significantly ($P < 0.05$).

Table 6. Effect of Vitamin E and Selenium supplementation on male and female mortality percentage of Japanese quail birds.

Wk	Female								Male							
	Mortality percent				Comulative mortality percent				Mortality percent				Comulative mortality percent			
	-E	E	+E	++E	-E	E	+E	++E	-E	E	+E	++E	-E	E	+E	++E
4th	3.61	0.0	0.0	0.0	3.6	0.0	0.0	0.0	4.0	0.0	0.0	1.12	4.0	0.0	0.0	1.1
5th	6.36	0.0	0.0	0.0	8.4	0.0	0.0	0.0	5.75	0.0	0.78	0.0	9.0	0.0	1.2	1.1
6th	3.45	0.0	5.17	1.27	10.8	0.0	4.3	1.25	0.0	0.0	0.0	0.0	9.0	0.0	1.2	1.1
7th	5.88	0.0	0.0	1.35	14.5	0.0	4.3	2.5	5.0	0.0	0.0	0.0	13.0	0.0	1.2	1.1
8th	17.65	2.70	0.0	1.84	21.7	1.4	4.3	3.75	4.84	1.59	1.72	0.0	16.0	1.25	2.4	1.1
9th	48.15	5.41	4.08	0.0	37.3	4.2	7.1	3.75	36.07	1.82	1.75	2.94	38.0	2.5	3.6	2.2
10th	20.0	3.45	0.0	0.0	39.8	9.9	7.1	3.75	6.98	2.17	0.0	0.0	41.0	3.75	3.6	2.2
11th	0.0	1.45	0.0	0.0	39.8	5.6	7.1	3.75	5.0	0.0	0.0	0.0	43.0	3.75	3.6	2.2
12th	25.0	4.0	0.0	0.0	42.2	8.5	7.1	3.75	5.56	0.0	0.0	0.0	45.0	3.75	3.6	2.2
Total	39.77	10.91	8.33	3.79					45.0	4.23	4.41	2.25				

Table 7. Effect of Vitamin E and Selenium supplementation on egg production performance parameters of Japanese quail birds.

weeks	Hen day				Average egg wt				Egg production in gm/q/d.			
	-E	E	+E	++E	-E	E	+E	++E	-E	E	+E	++E
1st wk	--	5.54	9.26	11.87	--	8.30	9.70	10.25	--	0.46	0.89	1.19
2nd wk	--	24.32	51.02	65.81	--	9.35	10.42	10.57	--	2.28	5.31	6.96
3rd wk	5.80	25.89	68.88	77.04	7.98	9.60	10.96	11.56	0.46	2.49	7.55	8.90
4th wk	10.28	34.98	72.53	85.20	9.80	10.30	11.60	11.86	1.01	3.60	8.41	10.10
5th wk	33.93	39.79	72.62	89.88	10.19	10.68	11.31	11.77	3.46	4.25	8.21	10.58
6th wk	19.64	43.48	75.00	92.06	10.06	11.06	11.32	11.83	1.98	4.81	8.49	10.84
7th wk	--	40.48	78.57	98.05	--	10.61	10.74	11.71	--	4.29	8.44	11.48
8th wk	--	28.57	79.46	99.21	--	11.16	9.76	11.81	--	3.19	7.75	11.72

Table 8. Effect of Vitamin E and Selenium supplementation on hatchability percent of fertile eggs and fertility percent of eggs set.

Weeks	hatchability percent of fertile eggs				Fertility percent of egg set.			
	-E	E	+E	++E	-E	E	+E	++E
1th wk	0.0	33.33	55.55	57.14	--	30.0	42.86	46.67
2nd wk	0.0	47.06	73.20	82.02	--	64.41	66.36	78.07
3rd wk	50.0	53.66	73.91	84.72	23.53	64.06	84.66	84.21
4th wk	60.53	78.41	94.20	94.29	34.78	72.46	93.85	93.94
5th wk	57.14	63.27	84.85	87.16	36.84	78.46	96.19	96.46
6th wk	0.0	48.78	87.00	92.05	44.18	80.19	89.47	93.83
7th wk	0.0	51.52	86.67	99.08	--	81.13	90.48	94.49
8th wk	0.0	66.66	87.50	91.67	--	75.00	88.0	94.29

Table 9. Effect of Vitamin E and Selenium supplementation on hatching weight (mean/gm ± SE) of Japanese quail chicks.

Weeks	1 day old chicks				7 day old chicks			
	-E	E	+E	++E	-E	E	+E	++E
1th wk	--	6.4	6.82 ± 0.01	6.93 ± 0.01	--	--	13.63± 0.31	14.80± 0.032
2nd wk	--	^{a} 7.59 ± 0.19	^{b} 7.19 ± 0.12	^{A} 7.85 ± 0.013	--	^{b} 14.22± 0.09	^{a} 15.67± 0.06	^{a} 15.69± 0.33
3rd wk	^{d} 61.0 ± 0.06	^{c} 6.66 ± 0.08	^{b} 7.31 ± 0.07	^{A} 7.74 ± 0.05	^{d} 14.12	^{c} 14.93± 0.39	^{b} 17.07± 0.22	^{a} 18.26± 0.26
4th wk	^{d} 6.86 ± 0.11	^{c} 7.72 ± 0.09	^{b} 8.30 ± 0.04	^{a} 8.70 ± 1.05	^{c} 14.11± 0.07	^{b} 18.07± 0.05	^{b} 18.71± 0.25	^{a} 21.96± 0.49
5th wk	^{d} 6.95± 0.06	^{c} 7.86 ± 0.05	^{b} 8.12 ± 0.04	^{a} 8.56 ± 0.05	14.21	^{c} 19.77± 0.43	^{b} 22.40± 0.44	^{a} 24.62± 0.29
6th wk	--	^{c} 7.39 ± 0.03	^{b} 8.02 ± 0.04	^{a} 8.42 ± 0.03	--	^{c} 19.11± 0.57	^{b} 23.83± 0.14	^{a} 24.34± 0.09
7th wk	--	^{c} 7.37 ± 0.02	^{b} 7.94 ± 0.51	^{a} 8.42 ± 0.06	--	^{a} 19.72± 0.14	^{b} 23.74± 0.29	^{a} 25.21± 0.31
8th wk	--	^{c} 7.4 ± 0.012	^{b} 7.95 ± 0.05	^{a} 8.39 ± 0.03	--	^{c} 19.63± 0.38	^{b} 23.40± 0.25	^{a} 25.48± 0.29

Table 10. Effect of Vitamin E and Selenium supplementation on embryonic mortality percent and alive inside shell percent of Japanese quail birds.

W.K	Embryonic mortality %				Alive inside shell			
	-E	E	+E	++E	-E	E	+E	++E
1th wk	--	20.0	19.05	20.0	--	0.0	0.0	0.0
2nd wk	--	30.51	17.76	14.04	--	0.0	0.0	0.0
3rd wk	50.00	29.69	34.36	12.86	--	--	1.23	1.17
4th wk	8.96	23.19	37.69	13.94	--	1.45	1.54	2.42
5th wk	42.86	36.73	15.15	12.39	--	3.08	1.90	0.0
6th wk	41.18	40.57	14.71	8.02	17.65	2.83	1.75	0.62
7th wk	--	41.51	13.09	9.45	--	3.77	1.19	1.57
8th wk	--	16.67	11.0	7.86	--	0.0	0.0	0.0

Table 11. Means* ± SEM of T_3 and T_4 of 3 week-old quails raised under four levels of Vitamin E and selenium.

Trait	Sex	Treatment ** E1 (0 mg; 0 mg)	E2 (25 mg; 0.2 mg)	E3 (125 mg; 0.2 mg)	E4 (250 mg; 0.2 mg)	Overall Mean
Triiodothyronine T_3 (ng/dl)	Female	486.00 ± 21.35^{au}	342.00 ± 22.00^{bu}	254.00 ± 15.03^{cu}	238.00 ± 14.97^{cu}	330.00^{u}
	Male	426.00 ± 19.65^{av}	384.00 ± 12.08^{av}	248.00 ± 19.94^{bu}	244.00 ± 13.27^{bu}	325.50^{u}
	overall mean	456.00^{a}	363.00^{b}	251.00^{c}	241.00^{c}	
Tyroxin, T_4 (ng/ml)	Female	6.24±0.33	4.34±0.23	2.72±0.45	2.42±0.28	3.930^{u}
	Male	6.36±0.36	5.14±0.46	2.92±0.22	2.14±0.16	4.140^{u}
	overall mean	6.30^{a}	4.74^{b}	2.82^{c}	2.28^{c}	

* Based on five quails taken at random from each Treatment x Sex (TxS) subclass.
Whenever the interaction term TxS was significant, TxS subclass means were compared columnwize and rowwize.
** Ei (α-tocopheryle acetate; selenium) per kg diet, I = 1, 2, 3, 4. ; E2 was the dose recommended by NRC, 1994 for quails up to 3 week-old.
a,b,c,d Values in the same row with different superscript differ significantly ($P < 0.05$).
u,v Values in the same column (within the same trait) with different superscript differe significantly ($P < 0.05$).

Table 12. Means* ± SEM of T_3 and T_4 of 6 and 12 week-old female and male quails raisd under four levels of Vitamin E and selenium.

Trait	Sex	Age	Treatment ** E1 (0 mg; 0 mg)	E2 (25 mg; 0.2 mg)	E3 (125 mg; 0.2 mg)	E4 (250 mg; 0.2 mg)
Triiodothyronine, T_3 (ng/dl)	Female	6	446.00±23.8 ^{au}	300.00±22.1 ^{bv}	262.00±19.3 ^{cv}	210.00±11.4 ^{dw}
		12	424.00±19.6 ^{au}	290.00±21.6 ^{bv}	102.00±5.8 ^{cw}	97.00±4.6 ^{dx}
	Male	6	300.00±22.4 ^{dv}	369.00±26.8 ^{cu}	390.00±21.2 ^{bu}	476.00±16.3 ^{au}
		12	146.00±12.1 ^{dw}	224.00±10.8 ^{cw}	355.00±17.7 ^{au}	290.00±10.0 ^{bv}
Tyroxin, T_4 (ng/ml)	Female	6	6.66±0.52 ^{aw}	5.40±0.35 ^{bv}	3.86±0.22 ^{cw}	3.24±0.24 ^{cv}
		12	3.55±0.30 ^{ax}	3.04±0.32 ^{abw}	2.22±0.22 ^{bx}	2.00±0.11 ^{bw}
	Male	6	9.26±0.27 ^{au}	7.18±0.19 ^{bu}	5.78±0.23 ^{cu}	5.34±0.13 ^{cu}
		12	7.42 ±0.37 ^{av}	6.40±0.20 ^{bv}	4.20 ±0.42 ^{cv}	3.49±0.21 ^{dv}

* Based on five quails taken at random from each Treatment x Sex x age (T x S x A) subclass.
Whenever the interaction term TxS was significant, TxS subclass means were compared columnwize and rowwize.

** Ei (α-tocopheryle acetate; selenium) per kg diet, I = 1, 2, 3, 4. ; E2 was the dose recommended by NRC, 1994 for quails up to 3 week-old.

a,b,c,d Values in the same row with different superscript differ significantly ($P < 0.05$).

u,v Values in the same column (within the same trait) with different superscript differe significantly ($P < 0.05$).

تأثير إضافة فيتامين هـ والسيلينيوم للعليقة على الكفاءة الإنتاجية والتناسلية لطيور السمان الياباني.

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١- قسم التطبيقات البيولوجية - مركز البحوث النووية - هيئة الطاقة الذرية - مصر.
٢- قسم علم الحيوان - كلية العلوم - جامعة عين شمس - مصر.
٣- قسم الإنتاج الحيواني - كلية الزراعة - جامعة عين شمس - مصر.

أستخدم فى هذه الدراسة ٨٠٠ طائر سمان ياباني عمرها يوم واحد وقد قسمت الطيور إلى أربعة مجموعات متساوية كل مجموعة تحتوى على ٢٠٠ طائر. المجموعة الأولى غذيت علي عليقه لم يضا ف اليها فيتا مين هـ وكذلك السيلينيوم (E-). المجموعة الثانية (E) أضيف العليقة المغذاه فيتا مين هـ بالجرعة الموصى بها للسمان تبعاً للجنة تغذية الدواجن المنبثقة عن مجلس الابحاث القومية بالولايات المتحدة (NRC). المجوعة الثالثة (E+) أضيف للعليقة خمسة أضعاف الجرعة الموصى بها من فيتامين هـ. أما المجموعة الرابعة (E++) فقد أضيف للعليقة عشرة أضعاف الجرعة الموصى بها للسمان من فيتامين هـ.

وقد تم دراسة تأثير فيتامين هـ ، السيلينيوم على :

- وزن الجسم ونسبة النفوق فى الذكور والإناث كل على حده وكذلك الوزن الكلى للمجموعة وذلك فى اليوم الأول من العمر وحتى الأسبوع الثانى عشر.
- إنتاج البيض - نسبة الفقس – نسبة الإخصاب - وزن الكتاكيت ألفا قسه (عند عمر يوم وعند عمر أسبوع) وذلك لمدة ٨ أسابيع بعد وضع أول بيضه. وفى هذه الفترة أيضاً تم قياس نسبة النفوق الجنينى وما وجد حياً داخل البيض أثناء التفريخ.
- أيضاً تم تقدير مستوى هرمون الغدة الدرقية فى دم الطيور عند ٣، ٦، ١٢ أسبوع من عمر الطيور.

تتلخص نتائج هذا البحث فى زيادة معنوية فى وزن الجسم وإنتاج البيض فى الطيور وإنخفاض نسبة النفوق. كذلك زيادة نسبة الفقس ووزن الكتاكيت الفاقسة ونسبة الخصوبة وإنخفاض فى النفوق الجنينى وما وجد حياً داخل البيض كما أشارت النتائج أيضاً إلى إنخفاض مستوى هرمون الغدة الدرقية فى دم الطيور وذلك فى المجموعات المضاف لها الفيتامين بجرعات عالية.

وتشير نتائج البحث مجتمعة إلى أن فيتامين هـ، السيلينيوم لهما أهمية إنتاجية كبيرة وأن الجرعة الموصى بها من فيتامين هـ غير كافية للحصول على أعلى كفاءة إنتاجية نموذجية.