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EFFECT OF CERTAIN DIETARY VITAMINS SUPPLEMENTATION ON SOME PRODUCTIVE, REPRODUCTIVE AND HATCHING PERFORMANCE OF JAPANESE QUAIL UNDER EGYPTIAN SUMMER CONDITIONS

Mohamed M. El-Mekawy*, A.A. Askar, Zenat A. Ibrahim and M.M. Soliman

Poult. Dept., Fac. Agric., Zagazig Univ., Egypt

ABSTRACT

This work was conducted to study the effect of dietary supplementation of vitamins A, E, C, B_6 and B_{12} on some productive and reproductive traits of mature Japanese quails during hot summer season under Egyptian environmental conditions. A total number of 180 Japanese quail breeders (126 females and 54 males), 8 weeks old with nearly equal body weight (215 to 250 g) were randomly divided into six treatment groups (21 females and 9 males in each group). Birds in the first experimental group received the basal diet (without supplementation) used as control, while birds in 2^{nd}, 3^{rd}, 4^{th}, 5^{th} and 6^{th} groups, were received the basal diet supplemented with one of the following vitamins, A (5 mg /kg diet), E (150 mg /kg diet), C (250 mg /kg diet), B_6 (3 mg /kg diet) or B_{12} (2 mg /kg diet), respectively. Egg production, egg quality, semen characteristics as well as hatchability (%) and hatched chick performance were determined. Results indicated that the addition of vitamin C or B_6 in the diets of Japanese quail layers, significantly ($P \leq 0.01$) improved egg number and feed conversion ratio (FCR) comparatively with those unsupplemented treatments, while egg mass values were improved significantly ($P \leq 0.05$) in layers fed diet supplemented with vitamin E, C, or B_6 when compared with layers fed basal diet. The highest egg length value was obtained for hens fed diets supplemented with 150 mg vitam. E /kg diet, while the lowest value was obtained with those fed diets supplemented with 3 mg vitam. B_6 /kg diet when compared with control. Birds fed diet supplemented with 150 mg vitam. E/kg diet recorded the lowest value of egg shape index comparatively with the control and other treatment groups. Japanese quail layers given B_6 or B_{12} had significantly ($P \leq 0.01$) higher hatchablility values than those unsupplemented with vitamins. Semen characteristics studied [mass motility (%), individual motility (%) and dead sperm (%)] were significantly ($P \leq 0.01$) improved male Japanese quail fed diets supplemented with A, E, C and B_6 in comparison with these supplemented with vitam. B_{12} and the control group. It could be concluded that supplementing quail breeder diet with vitamins B_6, E and C, improved the productive performance, while vitam. B_6 gave the higher hatchability percentage. The best semen characteristics were obtained by vitam. E supplementation.

Key words: Vitamins, productive, performance, reproductive, semen, hatchability, quail.

INTRODUCTION

An important economical goal of the poultry industry is to increase the productivity. However, the productivity of this industry is threatened by climatic and physical stress (Dreiling *et al.*, 1991). High temperature in poultry house reduced feed intake, body weight and feed efficiency. Furthermore, high ambient temperature causes the release of corticosterone and catecholmines. Corticoid steriods depress immune system function, reduce serum protein concentrations and increase blood glucose concentrations which have damaging effect on poultry performance by decreasing body weight

***Corresponding author: Tel. :** +201000266654
E-mail address: mmfahmy_elmekkay@yahoo.com

gain and egg production. Therefore, maximum production requires the elimination of the deleterious impacts of environmental stressors (Dreiling *et al.,* 1991; Bollengier *et al.,* 1998).

There are numerous methods to alleviate the negative effects of high environmental temperature on performance of poultry. Due to the fact that, it is expensive to cool animal buildings, such methods are focused mostly on dietary manipulation, critical essential amino acids (Yanming and Baker, 1993), minerals and vitamins (Moreng, 1980), feed additives and growth promoters (Teeter, 1995).

Essential functions of vitam. A in growth, visual development and reproductive physiology are well established in poultry, as well as in other animals. Several workers revealed a beneficial effect of vitam. A supplementation on egg production and egg shell strength in stressed laying hens as a result of many important functions of vitam. A in the body including vision, differentiation of epithelial cells and reproduction (McDowell, 1989; Sahin *et al*., 2001; Lin *et al*., 2002).

Vitamin E is an excellent biological chain breaking antioxidant that protects cells and tissue from lipoperoxidative damage induced by free radicals (Jena *et al.,* 2013) and has multi-effects on fortification of immune system (Kaiser *et al.,* 2012; Nayaka *et al.,* 2012). The feeding of vitamin E reduces oxidative stress and lipid peroxidation (Eid *et al.,* 2002), and increases immunoglobulin in broiler chicken, turkey, and ducks (Gore and Qureshi, 1997; Selim *et al.,* 2012).

The influence of supplementary vitamin C on the harmful effect of physiological stress has met with rising interest in recent times. The physiological requirement of vitamin C has been shown to exceed the vitamin C synthesizing ability of chicken under stressful condition like high ambient temperature, humidity, production rate and parasitic infestation (Sahin and Kucuk, 2001; Sahin *et al.,* 2002a).

Pyridoxine (vitamin B_6) has an important role in amino acid, carbohydrate and fatty acid metabolism and also plays a major role in energy production through citric acid cycle (McDowell, 1989). Vitamin B_6 is essential for brain development and function and helps the body to synthesize serotonin, norepinephrine, and melatonin hormones (Pond *et al.,* 1995). Deficiency of pyridoxine leads to early embryonic death.

Vitamin B_{12} is an essential component of several enzyme systems that carry out a number of very basic metabolic functions in the animal's body (McDowell, 1989). This vitamin plays a central role in normal functions of the brain and the nervous system, in the homocystein metabolism, in the blood function, energy metabolism, cell division and functions of the immune system (EFSA, 2009 and 2010).

The objective of this study was to evaluate the effect of adding vitamins A, E, C, B_6 and B_{12} to Japanese quail breeder diets on productive performance, fertility, hatchability and some semen traits under summer conditions of Egypt.

MATERIALS AND METHODS

The current experiment was carried out at the Poultry Research Farm, Poultry Department, Faculty of Agriculture, Zagazig University, Zagazig, Egypt, during the period from June till August under Egyptian summer conditions.

A total number of 126 females and 54 males of Japanese quails at 8 weeks of age with nearly equal body weight were randomly divided into six treatment groups (21 females and 9 males in each group). Each group of birds was subdivided into 3 replicates, each of 7 females and 3 males. Each replicate was housed in one cage under the same managerial conditions. The first (1st) group received the basal diet (without supplementation) and used as control. While, the 2nd, 3rd, 4th, 5th and 6th groups received the basal diet supplemented with one of the following vitamins: vit. A (5 mg /kg diet), vit. E (150 mg /kg diet), vit. C (250 mg /kg diet), vit. B_6 (3 mg /kg diet) or vit. B_{12} (2 mg /kg diet), respectively. Composition and calculated analysis of the experimental basal diet are shown in Table 1. The basal experimental diet was formulated to cover the nutritional requirements of layer Japanese quails throughout the experimental period (from 8 to 20 weeks of age) according to NRC (1994). Vitamins A, E, C, B_6 and B_{12} were purchased from Multivita Company, Sixth of

October City, Giza Governorate, Egypt in the forms of: vitam. A (retinol), vitam. E (DL-α-Tocopherol), vitam. C (ascorbic acid), vitam. B_6 (pyridoxine) and vitam. B_{12} (cyanocobalamin), respectively.

Table 1. Composition and calculated analysis of layer Japanese quail basal experimental diet

Ingredient	Percentage
Yellow corn	59.79
Soybean meal (44%)	25.05
Protein Concentrate (52%)	07.80
Corn oil	01.49
Calcium carbonate	04.99
Limestone	00.17
Dl-Methionine	00.06
Lysine	-
Premix*	00.30
Salt	00.35
Total	100.0
Calculated analysis (%)	
Crude protein	20.00
ME kcal/kg	2900
Lysine	01.00
Methionine+cysteine	00.45
Calcium	02.50
Available phosphorus	00.35

*: Vitamin and mineral premix per kg of diet: Each kilogram of diet contains : Vitam. A,4mg., D3, 2500 I.U., E, 10mg., B_1, 2mg., B_2, 5mg., B_6, 4mg., B_{12}, 10µg., Niacin, 25mg., Pantothenic acid, 10mg, Biotin, 50µg, Folic acid, 1000µg., and Choline chloride, 255mg. Selenium, 300µg, Copper, 10mg, Iodine, 1.0mg, K, 2.0mg, Iron, 33mg, Manganese, 60mg and , 60mg Zinc.

Birds were fed *ad libitum* and fresh water was available throughout the experiment. Artificial light source was used, giving a total of 16 hr., of light per day. The maximum and minimum ambient temperatures during the experimental period (12 weeks) were daily recorded at noon (12.00 pm). The ambient temperature ranged between 23.6 and 34.7°C, while the relative humidity (RH) was between 31.8 and 80.7%.

Egg number and egg weight were daily recorded. Feed consumption was weekly calculated. Egg mass was calculated by multiplying egg number by average egg weight. Feed conversion ratio (g feed/g egg) was calculated after subtracting the male consumption (one third) from the total amount of the feed consumed.

At the end of experiment (20 weeks of age) three males from each treatment group were used for semen evaluation. Semen samples were collected according to Burrows and Quinn (1937). Sperm motility (%) was determined according to the percentages of spermatozoa moving forward motion according across the field of vision with a normal vigorous swimming motion. Dead spermatozoa (%) were determined according to Hackett and Macpherson (1965) using nigrosin-eosin staining.

After 12 weeks of the experimental treatment, a total number of 540 quail eggs were collected from all experimental groups (90 eggs per group) for a period of 7 days. Eggs were gathered daily and stored at large end up in plastic trays at 14°C. Eggs were warmed to room temperature before placing in automatic incubator at 37°C and 65 -75% RH and turned through 45° every 1 hr. At the 14^{th} day of incubation, eggs were kept till hatching at 37.5°C and 70% RH without turning. After hatching, chicks from every treatment group were counted and individually weighed to determine hatchability percentage of fertile eggs, chick weight and relative chick weight. Eggs that failed to hatch were broken out to determine the number of fertile eggs, as well as, percentages of early and late embryonic mortality depending on the number of fertile eggs.

Analysis of variance for data of random design was accomplished using the SAS General Liner Models Procedure (SAS Institute, 1996). The model was assessed for different traits according to Snedecor and Cochran (1982). The statistical fixed model used was: $Y_{ij} = \mu + T_i + _{eij}$

Where:

Y_{ij} = an observation.

μ = Overall mean.

T_i = the fixed effect of treatment.

e_{ij} = Random error.

Duncan's new multiple range test was used to test the differences among the means according to Duncan (1955).

RESULTS AND DISCUSSION

Productive Performance

Results in Table 2 show that, the addition of vitamin C (250 mg /kg diet) or B_6 (3 mg /kg diet) in the diets of Japanese quail layers significantly ($P \leq 0.01$) improved egg number and feed conversion ratio (FCR) followed by the groups supplemented with vit. E, A and B_{12}, respectively comparatively with unsupplemented one. Egg mass values were significantly improved ($P \leq 0.05$) in layers fed diet supplemented with vitamin C, E, or B_6 when compared with layers fed control diet. Egg mass increased by 22.74, 22.18 and 14.77% in layers fed diets supplemented with C, E and B_6, respectively.

However, egg weight was not significantly affected due to vitamins supplementation. Egg number improved by 16.13and 19.92% in layers fed diets supplemented with vitam. C and B_6, respectively compared with those fed unsupplemented diet. The corresponding values of FCR were 15.58 and 14.93%, respectively.

With respect to dietary ascorbic acid (vit. C) Supplementation under heat stress in terms of better performance of poultry, results of the present study are in agreement with many investigators (McMurry *et al.*, 1980; McDowell, 1989; Gonzalez *et al.*, 1995). Similarly to the present study Sahin *et al.* (2003) found that vitamin C and E supplementation improved the performance namely live weight, egg production in laying Japanese quails reared under high ambient temperature. It is well known that growth rate and egg production decreased when ambient temperature goes above therms neutral zone (Kafri, 1989). At temperature above or below therms neutral zone, corticosteroid secretion increases as a response to stress (Sahin *et al.*, 2001). Kultu and Forbes (1993) reported that, ascorbic acid reduces the synthesis of corticosteroid hormones in birds by decreasing synthesis and secretion of corticosteroid, vitamin C alleviates the negative effects of stress. It has been also postulated that, the improved performance of laying hens results from a decrease in protein derived gluconeogenesis (Orban *et al.*, 1993).

In the present study, dietary vitamin E supplementation resulted in a better egg mass. Heat stress causes oxidative damage of the membrane of hepatic cells leading to decrease in plasma egg yolk precursor protein (Siegel, 1995). This kind of negative effect was alleviated by dietary vitamin E supplementation. It was speculated that, the positive influence of vitamin E supplementation on egg production may be explained by enhanced synthesis of egg yolk precursors in liver through protecting the liver from lipid peroxidation and damag to cell membranes. This was previously confirmed in hens by Bollengier *et al.* (1998).

Similar results were obtained by laying Japanese quail reared under heat stress (34°C) by Abd El-Galil and Abd El-Samad (2004) and Ciftci *et al.* (2005). The present results confirm the previous results of Abdel-Maksoud (2006) and El-Mallah *et al.* (2011) who found that supplemental vitamin E increased egg production by alleviating the adverse effect of high ambient temperature in laying hens during summer months.

Table 2. Effect of dietary vitamins A, E, C, B_6 and B_{12} supplementation (Mean ± SE) on productive performance of Japanese quail breeder hens

Treatment	Trait				
	Average egg weight (g)	Egg number (monthly)	Egg mass (monthly)	Feed consumption (g/hen/week)	Feed conversion ratio (g feed : g egg mass)
Control	12.19±0.29	20.08±0.30^{c}	244.67±6.18^{c}	201.62±2.44^{a}	3.08±0.08^{a}
A	12.77±0.20	21.40±0.96^{bc}	272.96±8.07^{abc}	187.45±2.00^{c}	2.75±0.05^{ab}
E	12.57±0.20	22.32±0.62^{bc}	280.81±12.22^{ab}	188.46±4.77^{bc}	2.88±0.09^{ab}
C	12.84±0.36	23.32±0.90^{ab}	298.94±3.24^{a}	194.19±2.62^{abc}	2.60±0.06^{b}
B_6	12.47±0.15	24.08±0.15^{a}	300.32±5.49^{a}	196.49±1.62^{ab}	2.62±0.07^{b}
B_{12}	12.35±0.32	21.48±1.02^{bc}	265.60±16.82^{bc}	190.39±0.98^{bc}	2.89±0.19^{ab}
Sig.	NS	*	*	*	*

Means in the same column within each classification bearing different letters are significantly different. * = ($P \leq 0.05$), and NS = Not significant.

Feed intake was significantly affected ($P \leq 0.05$) by dietary vitamins supplementation. It could be noticed that, feed intake was decreased in birds fed diet supplemented with vitamins of A, E and B_{12} while it was insignificantly decreased in hens fed diets supplemented with vit. C and B_6 .These findings are in agreement with those obtained by Sahin *et al.* (2003) who found that feed intake was decreased by vitamin C and E supplementation in laying Japanese quails diet reared under high ambient temperature.

Egg Quality

As shown in Table 3, statistical analysis revealed significant ($P \leq 0.01$) effects of dietary treatments on egg length and egg shape index. Egg width, egg shell thickness and yolk diameter were not significantly affected with dietary treatments. It could be noticed that the highest egg length value was obtained for hens fed diets supplemented with 150 mg vit. E /kg diet, while the lowest value was obtained by hens fed diets supplemented with 3 mg vit. B_6 /kg diet when compared with control. The remaining other treatment groups (A, C and B_{12}) had insignificant effect when compared with control.

It is worthy noting that, layers fed diet supplemented with 150 mg vit. E /kg diet recorded the lowest value of egg shape index comparatively with control and other treatment groups. Japanese quail layer fed diet supplemented with 150 mg vit. E /kg diet or 250 mg vit. C /kg diet showed insignificantly higher value of egg shell thickness followed by those fed diet supplemented with 5 mg vit. A /kg diet and 2 mg vit. B_{12}/kg diet when compared with control (Table 3). Yolk diameter was numerically increased due to vitamins supplementation in Japanese quail layers diet as compared with unsupplemented diet.

Our results are in agreement with those obtained by Abdou (2009) who reported that exterior egg quality traits were improved with adding vitamins E and A either alone or in a combination and the improvements were more pronounced for Japanese quail hens fed on 300 mg vit. E /kg diet. While, Sahin *et al.* (2002b) and Abou-Kassem (2010) found significant ($P \leq 0.05$) improvement in egg shell thickness of Japanese quail when the diet contained vit.E (250 to 500 mg/kg diet).

Table 3. Effect of dietary vitamins A, E, C, B_6 and B_{12} supplementation (Mean ± SE) on egg quality traits of Japanese quail breeder hens

Treatment	Egg quality					
	Egg weight (g)	Egg length (mm)	Egg width (mm)	Shell thickness (mm)	Egg shape index (%)	Yolk diameter (mm)
Control	12.44±0.32	33.46±0.21[bc]	26.52±0.08	0.22±0.00	79.26±0.13[a]	24.99±0.08
A	12.80±0.16	33.40±0.09[cd]	26.50±0.11	0.23±0.01	79.34±0.14[a]	24.52±1.17
E	13.11±0.03	34.13±0.18[a]	26.43±0.09	0.24±0.01	77.44±0.73[b]	25.76±0.04
C	12.46±0.03	33.11±0.03[cd]	26.51±0.06	0.26±0.02	80.06±0.19[a]	24.47±0.08
B_6	12.47±0.02	33.01±0.04[d]	26.35±0.03	0.22±0.00	79.81±0.24[a]	26.63±0.06
B_{12}	12.88±0.23	33.83±0.10[ab]	26.84±0.08	0.23±0.00	79.34±0.13[a]	26.70±0.11
Sig.	NS	**	NS	NS	**	NS

Means in the same column within each classification bearing different letters are significantly different. ** = ($P \leq 0.01$), and NS = Not significant.

The results obtained are in partially agreement with those of El-Mallah *et al.* (2011) who found that, both level of vit.E (20 or 40mg /kg diet) significantly improved shell thickness and decreased shape index and yolk color than the control. Similar results were reported by Engelmann *et al.* (2001), Abd El-Galil and Abd El-Samad (2004) and El-Sheikh and Salama (2010).

In this connection, the achieved improvement in shell thickness may be due to enhancement of calcium bioavailability by the action of supplemental vit. E. Moreover, vit. E addition was stated to influence the oestradiol dependent mechanisms by exerting a direct effect on oestradiol or indirect effect through maintaining more normal function of cellular processes regulating oestradiol and restoration of estrogen secretion (Bollengier *et al.*, 1998). Oestrdiol has a role on circulating calcium through the control of synthesis of 1, 2, 5 hydroxy cholecalciferol (Taylor and Darke, 1984), the active cholecalciferol metabolite that regulates calcium absorption. Circulating calcium and estrogen concentration are highly correlated in laying hens (Tojo and Huston, 1980).

With respect to dietary ascorbic acid supplementation under heat stress, the obtained results agreed with those of Pavlik *et al.* (2009) who found that exposure of hens to high temperatures results in significant decrease in egg quality (shell weight, shell thickness, and specific gravity) when the birds were exposed to heat stress. This finding could be due to reduction in feed consumption. The adverse effect of high environmental temperature on egg shell quality has been well documented (Mahmoud *et al.*, 1996). The decrease in shell quality in the current study may be partially due to a reduction in plasma calcium level. Since the plasma calcium level was significantly decreased in laying hens when the birds were exposed to high temperature as reported by (Mahmoud *et al.*, 1996). Also, Desoky (2008) stated that dietary supplementation of vitam. C (200 mg/kg diet) or vitam. E (150 mg/kg diet) either alone or its combination showed high ability of alleviating the negative effect of heat stress and improved egg quality.

Egg Components

In view of the result in Table 4, it is clearly noted that, the addition of different dietary vitamins (A, E, C, B_6 and B_{12}) in the current study had no significant effect on shell, albumin and yolk percentages. However, shell and yolk percentages and yolk diameters were numerically increased due to vitamins supplementation in Japanese quail layer diets as compared with unsupplemented one.

Table 4. Effect of dietary vitamins A, E, C, B_6 and B_{12} supplementation (Mean ± SE) on egg components percentage of Japanese quail breeder hens

Treatment	Shell percent	Albumin percent	Yolk percent
Control	7.86±0.20	61.09±0.11	31.05±0.09
A	9.24±0.08	56.62±0.60	34.15±0.62
E	9.05±0.35	54.07±0.25	36.88±0.44
C	8.49±0.36	58.27±0.26	33.24±0.11
B_6	9.78±0.31	57.82±0.19	32.40±0.47
B_{12}	9.03±0.30	53.80±0.69	37.17±0.71
Sig.	NS	NS	NS

This results may indicate that laying quails do not require high dietary levels of A, E, C, B_6 and B_{12} vitamins which may provide some evidence that the vitamins content of the ingredients itself, can meet the requirements of the laying quails so that extra supplementation might not be required to obtain high egg quality traits. Therefore, dietary sources of vitamins may have contributed to the apparent effects of the vitamins (A, E, C, B_6 and B_{12}) on egg quality traits. It is possible that the improvements of yolk and shell percentages are related to stimulatory effects of vitamins supplementation on growth of the female reproductive system. This finding agreed with the previous results of Fu *et al.* (2000) who reported an enhanced growth of female quail reproductive system accompanied with high levels of follicle stimulatory hormone (FSH) by feeding vitam. A. On the other hand, Abdel-Fattah and Abdel-Azeem (2007) showed high egg quality traits of quail egg by feeding different dietary levels of vitam. E with or without thyroid hormone (T4) to laying quails.

It is widely accepted that, high dietary levels of vitam. A and vitam. E could interact with vitam. D_3 metabolism. This relationship was more obvious for the exterior egg quality traits (shell percentage and shell weight) and to lesser extent in case of interior egg traits. Although most workers have generally agreed on the existence of nutritional relationships among fat soluble vitamins in general and nutritional interactions among vitam. A, D3 and vitam. E in particular (Aburto and Britton 1998; Grobas *et al.,* 2002; Amiri *et al.,* 2006).

Our findings are in line with those of Abdou (2009) who found that interior egg qualities were not improved by adding vitam. A and vitam. E either alone or in a combination. Abou-Kassem (2010) reported that quail layers fed diets supplemented with vitam. E produced eggs with significantly ($P \leq 0.01$) lower albumin (%), higher yolk and shell percentages. On the other hand, Ajakaiye *et al.* (2011) found that, egg yolk and egg albumin weights in groups administrated vitamins E and E+C were significantly ($P \leq 0.05$) high as compared with the control group. With regared to vitamin B_{12}, Halle and Ebrahem (2012) noted that supplementation of diets with vit. B_{12} or cobalt or both additives did not dirctly improve the egg composition or the yolk color.

Reproductive Performance

Results in Table 5 illustrate that, fertility percentages were insignificantly affected due to dietary supplementation by different vitamins when compared with unsupplemented diet. This finding may be related to the improvement of egg and semen quality with feed additives in this study. It could be noticed that the best value of fertility percentage (89.78%) was recorded in eggs collected from quail layers fed diet supplemented with 150 mg vitam. E/kg diet, while the lowest fertility value (84.60%) was recorded with eggs produced from quail layer fed unsupplemented diet.

Table 5. Effect of dietary vitamins A, E, C, B_6 and B_{12} supplementation (Mean ± SE) on percentages of fertility and hatchability of Japanese quail eggs

Treatment	Trait		
	Fertility (%)	Hatchability from fertile eggs (%)	Chicks weight at hatch
Control	84.60±0.63	82.50±1.44[c]	9.08±0.30
Vit. A	85.87±2.77	85.00±1.44[bc]	9.00±0.15
E	89.78±3.42	86.67±1.66[abc]	9.20±0.17
C	88.78±0.99	87.50±2.50[abc]	9.25±0.69
B_6	88.52±4.67	91.00±1.50[a]	9.09±0.37
B_{12}	87.44±5.75	89.33±0.47[ab]	9.05±0.26
Sig.	NS	*	NS

Means in the same column within each classification bearing different letters are significantly different.
* = ($P \leq 0.05$) and NS = Not significantly.

Contrary to the present results, Lin *et al.* (2002) added 80 mg vitam. E /kg diet, Lin *et al.* (2005) with a level of 160 mg vitam. E /kg diet and Abou-Kassem (2010) added 250 mg vitam. E/kg diet in Japanese quail and reported improve in fertility percentage. They postulated that fertility percentage might be improved by supplementing these vitamins. However, Hooda *et al.* (2007) concluded that supplemental of 75 mg vitam. E /kg in Japanese quail's diet did not effect on fertility percentage.

It was noticed from Table 5, that hatchability percentage was significantly increased ($P \leq 0.05$) by dietary supplementation of vitamins A, E, and C when compared with unsupplemented diet (control group). However, Japanese quail layers given B_6 or B_{12} had significantly ($P \leq 0.01$) highest hatchablility values for eggs than those unrecieving vitamins. This finding may be related to improvement of egg quality. It is clearly observed that the best value of hatchability percentage (91.00%) was obtained with eggs hatched from quail layers fed diet supplemented with B_6, while the lowest one (82.50%) was recorded with egg produced from quail layers fed basal diet group. Also, the results showed that treated groups were better than that at control one regarding hatchability percentage (Table 5).

These results are in agreement with those obtained by Abdou (2009) who reported that the hatchability values of hens fed vitamins for 6 weeks increased in 5 mg vitam. A /kg diet combined with either 150 or 300 mg vitam. E /kg diet compared with the unsupplemented one (control). The results also indicated that continued supplementation of vitamins more than 4 weeks could improve the hatchability percentage.

Results in Table 5 revealed insignificant effect in the chick weights due to vitamins supplementation in quail layer's diet.

Our results are in agreement with these obtained by An *et al.* (2010) who indicated that high level of supplemental vit.E did not affect one day old chick weight. Contrary results were reported by Abdou (2009) who found that, the weights of one day old chicks hatched from hens fed on diets supplemented with 5 mg vitam. A /kg diet combined with either 150 or 300 mg vitam. E /kg diet were improved.

Semen Characteristics

Each of mass motility (%), individual motility (%) and dead sperm (%) were significantly ($P \le 0.01$) improved in male Japanese quail fed diets supplemented with all vitamins studied except vitam. B_{12} where the improvements were not significant (Table 6).

It could be observed that the best semen characteristics values were recorded in males fed diet supplemented with vitamin E while, the worst values recorded by unsupplemented one.

Table 6. Effect of dietary vitamins A, E, C, B_6 and B_{12} supplementation (Mean ± SE) on some semen trait percentages of Japanese quail males

Treatment	Trait percentages		
	Mass motility	Individual motility	Dead sperm
Control	72.50±1.44[d]	74.83±1.30[d]	27.50±1.44[a]
Vit. A	77.50±1.44[bc]	79.50±1.44[bc]	22.50±1.44[bc]
E	81.50±0.87[a]	83.67±0.88[a]	18.50±0.87[d]
C	79.00±0.58[ab]	81.33±0.73[ab]	21.00±0.58[cd]
B_6	76.50±0.87[bc]	78.67±0.88[bc]	23.50±0.87[bc]
B_{12}	75.00±0.58[cd]	77.17±0.44[cd]	25.00±0.58[ab]
Sig.	**	**	**

Means in the same column within each classification bearing different letters are ** = ($P \le 0.01$).

These results indicated that, the supplementation of vitamins might improve the function of the testis. Improvement of sperm quality by vitamin E supplementation associated with deoxidized spermatozoa (Fujihara and Howarth, 1978). Adding 80 and 160 mg vitam. E tended to increase plasma testosterone concentration and sperm concentrations (Lin *et al.,* 2005). A Similar reports indicated that vitam. E played an important role in spermatogenesis (Marin-Guzmen *et al.,* 1997).

The positive effect of ascorbic acid can be attributed to the fact that it is very efficient antioxidant and scavenges Reactive Oxygen Species (ROS) which are noxious to the sperm. Ascorbic acid is a dominant antioxidant when peroxyl radicals are located in the gaseous phase (Donoghue and Donoghue, 1997). Ascorbic acid is also, required for male hormones production like testosterone, which is essential for the reproductive performance (Sonmez *et al.,* 2005).

The present results are in agreement with those of Hood (1999) who reported that heat exposure caused an increase in the percentage of dead sperms and decrease in the sperm quality index. However, Monsi and Onitchi (1991) supplemented the feed of heat stressed broilers breeders with 0, 125, 250, and 500 mg ascorbic acid/kg diet and found that each of semen volume, total sperm and motile sperms per ejaculate were significantly increased due to the addition of ascorbic acid. Noll (1997) reported that, improvement in sperm cell concentrations in males when Turkey breeder diets were supplemented with 200 mg / kg of vitamin C. Similarly, Ezzat *et al.* (2011) found that, supplementation of vitamin C (200 mg/kg diet) of Matrouh cockerels improved sperm motility and decreased dead spermatozoa compared with the control. Recently, Jabbar *et al.* (2015) revealed that, ascorbic acid supplementation had better resistance against the Reactive Oxygen Species (ROS) damag in terms of live sperm, morphological defects and also for fertility.

Concerning supplemented Japanese quail's diet with vitam. E, our results confirm those obtained by Biswas *et al.* (2007) who concluded that, moderate supplementation of dietary vit. E may be beneficial for foam production, cloacal gland and improve the semen characteristics in male Japanese quail. Also, with those of Biswas *et al.* (2009) concluded that, moderate supplementation of dietary vitam. E may be beneficial effect for physical and biochemical characteristics of semen in Indian reared kadaknath cookerels.

Conclusion

In conclusion, from the results of the present work, it is advised that supplementing Japanese quail breeder diet with vitamins A, E and C improved the productive performance, while vit. B_6 and B_{12} gave the higher hatchability Percentage. The best semen characteristics were obtained by vitam. E supplementation.

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تأثير إضافة الفيتامينات للغذاء على بعض الصفات الإنتاجية والتناسلية وأداء الفقس في السمان الياباني تحت ظروف الصيف المصرية

محمد ممدوح المكاوي - علي عبد الرازق عسكر - زينات عبد الجواد إبراهيم - مصطفي محمد سليمان

قسم الدواجن - كلية الزراعة - جامعة الزقازيق - مصر

هذا العمل تم إجراءه لدراسة تأثير إضافة فيتامينات أ، هـ، ج، ب٦، ب١٢ علي بعض الصفات الإنتاجية والتناسلية للسمان الياباني الناضج خلال فصل الصيف الحار تحت الظروف المصرية، استخدم في هذه التجربة ١٨٠ سمانة ناضجة (١٢٦ أنثي و٥٤ ذكر) عمر ٨ أسابيع متقاربة في الوزن تتراوح (٢١٥ إلى ٢٥٠ جرام) وقسمت عشوائيا إلى ٦ مجاميع تجريبية (٢١ أنثى و ٩ ذكور لكل مجموعة)، غذيت الطيور في المجموعة التجريبية الأولى على العليقة الأساسية (بدون إضافة)، بينما غذيت الطيور في المجموعة الثانية والثالثة والرابعة والخامسة والسادسة على العليقة الأساسية مضاف اليها أحد الفيتامينات التالية فيتامين أ (٥ مجم/كجم عليقة)، هـ (١٥٠ مجم/كجم عليقة)، ج (٢٥٠ مجم/كجم عليقة)، ب٦ (٣ مجم/ كجم عليقة)، ب١٢ (٢ مجم/ كجم عليقة)، على الترتيب، وتم قياس معدل إنتاج البيض، صفات جودة البيضة، صفات السائل المنوي، بالإضافة إلى نسبة الفقس وأداء الكتاكيت الفاقسة، وأوضحت النتائج أن إضافة فيتامين ج و ب٦ إلي علائق السمان الياباني البياض أدي إلى تحسن عدد البيض ومعدل التحويل الغذائي معنويا (٠.٠١) مقارنةً بالتي لم يضاف اليها فيتامينات، بينما تحسنت قيم كتلة البيض معنويا (٠.٠٥) في السمان المغذي على عليقة مضاف إليها فيتامين هـ، ج، ب٦ عند مقارنتها مع السمان المغذي علي العليقة الضابطة، حققت الطيور المغذاة علي علائق مضافة إليها ١٥٠ مجم فيتامين هـ/كجم أعلى قيمة لطول البيضة، بينما أقل قيمة تم التوصل إليها مع الطيور المغذاة علي ٣ مجم فيتامين ب٦/كجم وذلك بالمقارنة مع العليقة الضابطة، سجلت الطيور المغذاة على عليقة مضافة إليها ١٥٠ مجم فيتامين هـ/كجم أقل قيمة لدليل شكل البيضة بالمقارنة بالمجموعة الضابطة والمجاميع الأخرى، حققت طيور السمان الياباني البياض المغذاة علي ب٦ وب١٢ أعلى قيم لفقس البيض عن التي لم يضاف إليها فيتامينات، تحسنت صفات السائل المنوي المدروسة (نسبة الحركة الجماعية، نسبة الحركة الفردية ونسبة الحيوانات المنوية الميتة) معنويا (٠.٠١) لذكور السمان الياباني المغذي علي علائق مضاف إليها فيتامين أ، هـ، ج، ب٦ علي الترتيب مقارنةً بفيتامين ب١٢ والمجموعة الضابطة، وقد خلصت الدراسة إلى أن إضافة فيتامينات ب٦، هـ ، ج لعلائق السمان الياباني البياض قد حسنت من الأداء الإنتاجي، بينما كانت أفضل نسب الفقس التي تم التحصل عليها من الطيور المغذاة على فيتامين ب٦، كما أنه كانت أفضل صفات للسائل المنوي تم الحصول عليها من الطيور المغذاة على علائق مضاف لها فيتامين هـ.

المحكمون :

١ - أ.د. منى محمد عبدالهادي	أستاذ الفسيولوجي المتفرغ – كلية الطب البيطري – جامعة الزقازيق.
٢ - أ.د. عادل إبراهيم عطيـــة	أستاذ ورئيس قسم الدواجن – كلية الزراعة – جامعة الزقازيق.