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Effect of some antioxiadnts and methyl- donors on the productive and reproductive performance of turkey hens

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ABSTRACT

The objective of this study was to investigate the effect of using some antioxidants and methyl-donors on the productive and reproductive performance of turkeys. This study was carried out at Mehalet Mousa Animal Production Research Station, Kafr El-Sheikh, belonging to the Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt. A total of 168 Bronze female turkeys, 36 weeks of age were used. The birds were randomly distributed into 8 experimental groups, each treatment consisted of three equal replicates. The birds were individually housed in battery cages. The experimental period lasted 12 weeks (from 36 to 48 weeks of age). The birds were fed a basal yellow corn-soybean meal diet, supplemented with two natural antioxidants, vitamin E (alpha-tocopheryl acetate) at 250 mg/kg diet and vitamin C (L-ascorbic acid) at 200 mg/kg diet in addition to Choline (Choline chloride 60%) at 2.25 g/kg diet one of labile methyl group donors, singly or in combination. The results obtained can be summarized as follows. Dietary supplementation with vitamin E had positive effects on feed conversion, hen-day egg production rate (P≤0.05), egg fertility and total hatchability and length of oviduct of turkey hens as compared to those of the control hens. There were no significant differences among the different dietary treatments in mortality rate, relative weights of egg albumen, egg yolk, yolk index, shell thickness, yolk color, concentrations of blood haemoglobin and serum total protein, hatchability of fertile eggs or in relative weights of carcass traits of turkey hens. It can be concluded that dietary supplementation with vitamin E at 250 mg/kg diet can induce beneficial effects on productive productive and reproductive performance of turkey hens.

INTRODUCTION

The generation of free radicals and lipid peroxidation can contribute to the development of different diseases in humans as well as animals, with a decrease in the live performance and product quality in poultry. Antioxidants are involved in the prevention of cellular damage, which is commonly responsible for aging and a variety of diseases. Antioxidants can safely interact with free radicals and terminate the chain reaction before vital molecules are damaged. Although there are several enzyme systems within the body that scavenge free radicals, the most important micronutrients serving as antioxidants are vitamin E and vitamin C.

Vitamin E is a natural fat-soluble antioxidant and a major chain-breaking antioxidant in biological systems in birds (Khan *et al.,* 2011). Poultry cannot synthesize vitamin E, therefore, their requirements of this vitamin must be met from dietary sources (Chan and Decker, 1994). Vitamin E has been reported to be an excellent biological antioxidant that protects cells and tissue from lipoperoxidative damage induced by free radicals (McDowell, 1989). Vitamin E is also known to be a lipid component of biological membranes

(Halliwell and Gutteridge, 1989). Vitamin E serves as a physiological antioxidant through inactivating free radicals, increasing feed intake and improving egg production (Kirunda *et al.,* 2001), and egg quality (Puthpongsiripon, 1998). Vitamin E requirements in laying hens and other food producing animals have been established to avoid clinical symptoms of deficiency (NRC, 1994). It has been proposed that the recommended levels of dietary vitamin E should vary depending on the susceptibility to oxidation rather than the amount needed to prevent signs of deficiency and mortality (Wang *et al.,* 1996).

Vitamin C is a water-soluble antioxidant, vitamin that poultry can synthesize it, so they do not require dietary source of vitamin C (NRC, 1994). It has been, however, reported that ascorbic acid synthesis and utilization are inadequate under stress conditions such as low or high environmental temperatures, humidity, high productivity, and parasite infestation (McDowell, 1989). Vitamin C is involved in several biochemical processes and its function is also related to its reversible oxidation and reduction characteristics within the cells (McDowell, 1989). Vitamin C exhibits an antioxidant effect by removing free radicals from the environment (Tanaka *et al.,* 1997) while the effective mechanism of vitamin E in its reactions with active radicals is to break chains, to exert pressure, to renovate, and to increase endogen defence (Azzi and Stocker, 2000).

Choline, is, β-hydroxy ethyl trimethyl ammonium hydroxide (Sheard and Zeisel, 1989). Choline is considered as an essential water soluble nutrient and is usually grouped within the B-complex family. It is chemically unique as it has three methyl groups attached to the structure and takes part in various functions in the body as a methyl group's donor.

Choline has three essential metabolic functions Chan (1984) and Kettunen *et al.* (2001) that cannot be performed by other methyl donors in the system which include:

1) Structural component of cell membranes, as a constituent of phospholipids (phosphatidylcholine) and thereby playing an essential role in building and maintenance of cell structure.
2) Lipotropic agent in fat metabolism in the liver by utilizing and transporting fat and thereby preventing fatty liver.
3) Precursor for acetylcholine synthesis, (a neurotransmitter agent) for nerve impulses. NRC (1994) suggested that the choline requirement of turkeys ranges from 800 to 1600 mg/kg feed. The dietary need for choline is known to be influenced by levels of other nutrients involved in methyl group metabolism as well as type or strain, age and physiological status of the bird. This study aimed to study the effect of using some antioxidants and methyl-donors on the productive and reproductive performance of turkey hens.

MATERIALS AND METHODS

The experimental work of this study was carried out at Mehalet Mousa Animal Production Research Station, Kafr El-Sheikh, belonging to the Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt. This experiment was carried out to study the effect of using some antioxidants and methyl-donors on the productive and reproductive performance of turkey hens. A total of 168 Bronze female turkeys, 36 weeks of age were used. The birds were randomly distributed into 8 experimental groups, each treatment consisted of three equal replicates. The birds were individually housed in battery cages fitted with individual feeders and automatic nipple drinkers. The experimental period lasted 12 weeks (from 36 to 48 weeks of age). Birds were fed *ad-libitum* and fresh water was available all the time, during the experimental period. Photoperiod was 16 hours daily during the experimental period.

Table 1: Composition and calculated analysis of the basal diet used in the experimental diets:

Ingredients	%
Yellow corn	70.00
Soybean meal (44%CP)	11.50
Fish meal (65%CP)	10.00
Di calcium phosphate	2.00
Limestone	6.00
Salt (NaCl)	0.30
L-Lysine	0.15
DL.Methionine	0.05
Total	100
Calculated analysis:	
Crude protein %	17.72
Metabolizable Energy(kcal/kg diet)	2920

The experimental groups in this experiment were fed one of the following diets :

T1: a basal diet (control group) without any supplementation.
T2: basal diet + (vitamin C) 200 mg/kg diet .
T3: basal diet + (vitamin E) 250 mg/kg diet.
T4: basal diet + (Choline) 2.25 g/kg diet.
T5: basal diet + (vitamin C) 200 mg/kg diet + (vitamin E) 250 mg/kg diet.
T6: basal diet + (vitamin C) 200 mg/kg diet + (Choline) 2.25 g/kg diet.
T7: basal diet + (vitamin E) 250 mg/kg diet + (Choline) 2.25 g/kg diet.
T8: basal diet + (vitamin C) 200 mg/kg diet + (vitamin E) 250 mg/kg diet + (Choline) 2.25 g/kg diet .

Egg weight, egg number and mortality rate were recorded daily and feed intake was calculated weekly. Feed conversion (g feed/g egg mass) was also calculated. Egg quality parameters were measured at peak of egg production (42 weeks of age) during the experiment using 80 eggs (10 eggs/treatment). These parameters involved relative weight of egg

components (yolk, albumen and shell), and some exterior and interior parameters of egg quality. Egg shell thickness was measured in mm using a micrometer. Egg shape index was calculated as egg width divided by an egg length. Yolk index was calculated as yolk height divided by yolk diameter. Haugh unit was measured according to the formula presented by Eisen *et al.* (1962). Yolk color was determined by using a Roche yolk color fan. Semen was collected from toms housed in floor pens and fed on the same experimental diets and artificially inseminated to hens .The insemination was made as soon as possible after semen collection. The artificial insemination was done once a week. All hens were inseminated intra-vaginally. Raw semen was diluted in the rate of 1:1 with 0.9 % NaCl . The insemination was performed by inserting 0.1 ml of the diluted semen with one millimeter tuberculin syringe into the vagina of each hen. Fertility and hatchability (four hatches) of eggs were made every 3 weeks of the experimental period . Fertility was calculated as the number of fertile eggs relative to total number of eggs set; while egg hatchability was calculated as the number of healthy hatched chicks relative to total number of eggs and of fertile eggs. In this experiment, blood samples were collected from 48-week-old turkey hens (3 specimens per treatment) by venipuncture of the wing vein. Immediately after collection, blood sample was transferred into two tubes, a heparinized tube and non-heparinized one. Heparinized whole blood samples were used for the determination of hemoglobin concentration according to Pilaski (1972) and haematocrit value, as described by Hunsaker (1969). The separated sera from non-heparinized blood samples were used for the colorimetric estimation of levels of glucose (Trinder, 1969), total protein (Henry *et al.* 1974), albumin (Doumas *et al.* 1977), cholesterol according to Watson (1960) and total lipids according to Zollner and Kirsch (1962), using commercial kits. The concentration of serum globulin was calculated by the difference between serum total protein and albumin.

At the end of experimental period (48 wks old), 3 hens from each treatment were randomly selected and slaughtered for carcass evaluation. Carcass was eviscerated and head and shanks were removed. Each portion was expressed as a percentage of live body weight.

Statistical analysis:

Data were statistically analyzed by one-way analysis of variance by General Linear Model (GLM) procedures (SAS, 2003). Significant difference among means of treatments were detected by Duncan Multiple Range Test (Duncan, 1955). The following model was used to study the effect of vitamin C, vitamin E, Choline and their combinations on parameters investigated as follows: $Yij = \mu + Ti + eij$

Where, Yij = an observation

μ = overall mean

Ti = treatments (i = 1, 2 … and 8)

eij = residual "random error".

RESULTS AND DISCUSSION

Productive performance of turkey hens:

Data on the effect of dietary single and combined addition of vitamin C, vitamin E and choline on productive performance, in terms of feed intake, hen-day egg production rate, egg weight and feed conversion ratio, of turkey laying hens from 36 to 48 weeks of age are given in (Table 2).

As presented in Table 2, hens fed diet supplemented with vitamin C plus vitamin E consumed significantly more (P≤0.05) feed compared with the control group. Feed intakes of the remaining experimental groups were not significantly different from that of the control birds. The highest mean of hen-day egg production rate (P≤0.05) was achieved by hens fed vitamin E-supplemented diet, followed by that of hens fed diet supplemented with vitamin C plus vitamin E (P≤0.05). Hen-day egg production rates of the other experimental groups were not significantly different from that of the controls. The best means of egg weight (P≤0.05) were attained by hens fed diets supplemented with vitamin C plus choline, vitamin C alone, vitamin E plus choline and a mixture of vitamin C, vitamin E and choline in a descending order as compared to that of the control turkey hens. The worst mean (P≤0.05) of egg weight was recorded for hens fed diet supplemented with choline alone compared with that of the controls. Egg weights of the other experimental groups did not differ from that of the control group. The best means of feed conversion (P<0.05) was attained by hens fed diet supplemented with vitamin E alone compared with that of the control hens.

Table (2): Effects of dietary single and combined addition of vitamin C , vitamin E and choline on productive performance of turkey hens from 36 to 48 weeks of age.

Means having different superscrips in the same column are significantly (P≤ 0.05) different

Items	Feed intake (g) 36-48 wks	Egg Production (%) 36-48 Wks	Egg weight (g) 36-48 wks	Feed conversion (g feed /g egg) 36-48 wks	Mortality (%) of turkey hens
Control (Basal diet)	128.22 ^{bc}	51.70 ^{c}	76.30 ^{bc}	3.24 ^{ab}	0.00
Basal diet +Vitamin C	133.33 ^{b}	54.42 ^{bc}	78.36 ^{a}	3.12 ^{ab}	0.04
Basal diet +Vitamin E	133.00 ^{b}	62.75 ^{a}	75.21 ^{cd}	2.81 ^{c}	0.00
Basal diet +Choline	126.99 ^{c}	50.56 ^{c}	73.83 ^{d}	3.39 ^{a}	0.00
Basal diet + Vitamin C + Vitamin E	138.94 ^{a}	57.31 ^{b}	77.59 ^{ab}	3.12 ^{ab}	0.00
Basal diet + Vitamin C + Choline	126.27 ^{c}	51.47 ^{c}	79.00 ^{a}	3.10 ^{b}	0.00
Basal diet + Vitamin E + Choline	132.27 ^{b}	53.51 ^{bc}	78.27 ^{a}	3.16 ^{ab}	0.04
Basal diet + Vitamin C + Vitamin E + Choline	132.22 ^{b}	52.72 ^{c}	78.12 ^{a}	3.21 ^{ab}	0.00
SEM	1.56	1.39	0.48	0.08	0.02
Significance	*	*	*	*	NS

Means of feed conversion of the other experimental groups were comparable to that of the controls, with no significant differences among

them. As given in Table 2, no significant differences were observed in mortality rates of turkey hens due to feeding the dietary treatment.

These results agree with the findings of Sahin *et al.* (2003) who reported that combined addition of dietary vitamin C and E, significantly increased feed intake of laying Japanese quails.

These results agree also with those of Wahyuni *et al.* (2011) who showed that vitamin E supplementation did not affect feed consumption in Kedu and Cemani hens. Krishnan and Scheideler (2010) showed that dietary supplementation with choline (choline chloride 60%) at 0, 500 and 1000 ppm did not show any difference in feed intake in 29-week-old White Leghorn hens. Panda *et al.* (2007) showed that daily feed consumption was not influenced by vitamin C supplementation at 200 mg/kg diet in White Leghorn layer. On the other hand, these results disagree with those of Shit *et al.* (2012) who showed that feed consumption of laying Japanese quails was significantly higher in groups fed L-ascorbic acid (250 and 500 ppm) supplemented diets than that of the control laying Japanese quails, at low ambient temperature. Ariana *et al.* (2011) found that feeding alpha-tocopheryl acetate diet (200 mg/kg) significantly improved feed intake in laying hens.

The present results agree also with those of Khan *et al.* (2011) who found that dietary supplementation of vitamin E improved egg production in laying hens. Ariana *et al.* (2011) found that feeding alpha -tocopheryl acetate diet (200 mg/kg) significantly improved egg production in laying hens. Noll (2000) indicated that egg production of turkey hens was improved by ascorbic acid supplementation (200 ppm) for 24 weeks. Sahin *et al.* (2003) showed that administration of vitamin C and E significantly increased egg production of laying Japanese quails.

The present results agree with those of Mbajiorgu (2011) who found that Venda hens supplemented with 200 and 500 mg of ascorbic acid per kg feed (Dry matter basis) produced heavier eggs than those produced by the unsupplemented birds. However, Heydari *et al.* (2009) found that dietary vitamin E (alpha -Tocopheryl acetate), 0 or 1000 mg/kg of diet had no significant effect on egg weight of laying hens, from 38-46 weeks of age.

The present results agree also with those of El-Zaiat *et al.* (2007) who showed that the addition of vitamin E to the diet (200 mg vitamin E/kg diet) caused an improvement of feed conversion of laying hens fed lead-poluted diet. Lin *et al.* (2004) found that the addition of 80 mg of vitamin E/kg diet gave the best feed conversion. Khan *et al.* (2011) found that dietary supplementation of vitamin E of heat-stressed poultry can improve feed efficiency.

In view of present results, laying hens fed diets containing vitamin C alone gave numerically better feed conversion ratio when compared with that of the control group. These results agree with those of Metwally (2004) who showed that supplemental vitamin C at the level of 2000 ppm improved feed conversion of Dandarawi laying hens.

The present results disagree with those of Çiftci *et al.* (2005) who found that mortality was significantly decreased in vitamin E-supplemented birds (125 mg of alpha –tocopheryl acetate /kg of diet) compared to the controls. Chung *et al.* (2005) indicated that dietary supplementation with vitamin C to

heat stressed Ross broiler breeder caused a significant decrease in mortality rate (15% - 20%).

Egg Components and Egg Quality:

Data on the effect of dietary single and combined addition of vitamin C, vitamin E and choline on egg components and certain parameters of egg quality of 42-week-old turkey hens are shown in (Table 3). The present results revealed that there were no significant differences among dietary treatments with respect to relative weights of egg albumen, egg yolk, egg yolk index, shell thickness or yolk color (Table 3). As indicated in Table 3, turkey hens fed diets supplemented with vitamin E alone or vitamin E plus choline produced eggs with lowered (P≤0.05) percentages of egg shell than those of the control birds. Relative weights of egg shell of the other experimental groups were not significantly different from that of the control group.

(Table 3): Effects of dietary single and combined addition of vitamin C , vitamin E and choline on egg quality and egg components of turkey hens at 42 weeks of age

Means having different superscrips in the same column are significantly (P≤0.05) different

	Egg components (%)			Egg quality				
Items	**Egg albumen %**	**Egg yolk %**	**Egg shell %**	**Egg shape index %**	**Egg yolk index %**	**Haugh units**	**Shell thickness (mm)**	**Yolk color**
Control (Basal diet)	54.02	31.00	14.96 ^{a}	71.57 ^{b}	48.54	89.17 ^{c}	0.371	7.40
Basal diet +Vitamin C	56.30	30.06	13.62 ^{ab}	75.79 ^{a}	48.07	91.02 ^{abc}	0.397	7.30
Basal diet +Vitamin E	55.79	30.88	13.32 ^{b}	74.28 ^{ab}	49.42	95.58 ^{ab}	0.401	7.60
Basal diet + Choline	54.65	30.63	14.71 ^{ab}	75.62 ^{a}	48.37	91.11 ^{abc}	0.395	7.70
Basal diet +Vitamin C + Vitamin E	55.05	30.11	14.82 ^{ab}	75.38 ^{a}	48.36	89.62 ^{c}	0.388	7.40
Basal diet + Vitamin C + Choline	55.05	31.11	13.83 ^{ab}	75.44 ^{a}	48.45	90.40 ^{c}	0.388	7.40
Basal diet + Vitamin E + Choline	56.24	30.38	13.36 ^{b}	73.91 ^{ab}	47.82	96.49 ^{a}	0.388	7.80
Basal diet + Vitamin C + Vitamin E + Choline	55.20	30.82	13.96 ^{ab}	76.45 ^{a}	49.86	92.92 ^{abc}	0.398	7.60
SEM	0.93	0.82	0.48	1.13	1.30	1.74	0.957	0.27
Significance	NS	NS	*	*	NS	*	NS	NS

The best means of egg shape index (p≤0.05) were achieved by hens fed diets supplemented with a mixture of vitamin C, vitamin E and choline

(76.45%), vitamin C alone (75.79%), choline (75.62%), vitamin C plus choline (75.44%) and vitamin C plus vitamin E (75.38%) in a descending order as compared to that of the control turkey hens. Egg shape indices of the other experimental groups were not significantly different from that of the controls. Compared with the control birds, turkey hens fed diets supplemented with vitamin E plus choline or with vitamin E alone produced eggs with better albumen quality as measured by Haugh units. No significant differences were observed in Haugh units among the other experimental groups of turkey hens.

The present results agree with those of Mohiti-Asli and Zaghari (2010) who found that shell thickness, yolk color and yolk weight of laying hens were not significantly affected by dietary supplementation with vitamin E. Radwan *et al.* (2008) showed that the addition of 200 mg vitamin E /kg of hen's diet numerically increased the percentage of egg shape index in El-Salaam strain laying hens. Kirunda *et al.* (2001) found that supplemental vitamin E can slightly improve egg albumen solids of laying hens.

The current results agree also with those of Heydari *et al.* (2009) who found that added dietary vitamin E (alpha -Tocopheryl acetate) at 1000 mg/kg had no significant effect on yolk weight, shell thickness of layers, from 38-46 weeks of age. Ehran and Bolukbasi (2011) found that dietary supplementation with 85 U vitamin E for laying hens increased Haugh units. Yan and Kim (2011) found that dietary supplemental vitamin E improved the Haugh units of laying hens compared with those of hens fed basal diet in 35-week-old (Hy-line brown) layers. Rama Rao *et al.* (2001) indicated that Haugh unit score and egg shell weight were not influenced by supplementary choline (760 and 1520 mg/kg) in diets of broiler breeders (29 to 48 weeks of age). Sahn and Sahn (2001) found that egg shell thickness and Haugh units of laying hens were improved due to feeding diet containing 250 mg vitamin C. Ajakaiye *et al.* (2011) found that Haugh Units of egg were higher in the vitamins C+E treated group (150 mg of l-ascorbic acid/kg of diet plus 150 mg of alpha-dl-tocopherol acetate/kg of diet) when compared to control group in laying hens at 39 weeks old.

On the other hand, the present results disagree with those of Ariana *et al.* (2011) who found that feeding alpha -tocopheryl acetate supplemented-diet (200 mg/kg) significantly improved yolk index in laying hens. Tsiagbe *et al.* (1988) observed an increase in yolk weight of eggs produced by hens given 1000 ppm of choline supplemented to a corn-soy based diet compared to that with no choline supplementation. Panda *et al.* (2008) reported that supplemental vitamin C to laying hens at 200 mg/kg diet significantly increased eggshell thickness. Çiftci *et al.* (2005) found a significant increase in relative weight of egg yolk in response to feeding vitamin E + vitamin C-supplemented diet (125 mg of alpha -tocopheryl acetate /kg of diet plus 200 mg of L-ascorbic acid of diet) as compared to the control group.

Blood parameters of turkey hens :

Data on the effect of dietary single and combined addition of vitamin C, vitamin E and choline on blood biochemical and haematological parameters of 48– week–old turkey hens are shown in (Table 4). As given in Table 4, concentrations of blood haemoglobin and serum total protein of the different experimental groups of turkey hens were comparable to that of the control birds, with no significant differences among them. Serum level of glucose for hens fed diets supplemented with vitamin C, choline, vitamin C plus vitamin E, vitamin C plus choline or a mixture of vitamin C, vitamin E and choline were significantly lower (P≤0.05) than that of the controls. No significant differences were observed in serum glucose levels among the remaining experimental groups of turkey hens. Serum level of albumin for hens fed diets supplemented with choline alone or a mixture of vitamin C, vitamin E and choline were significantly lower (P≤0.05) than that of the controls. No significant differences were observed in serum albumin levels among the remaining experimental groups of turkey hens.

Table 4: Effects of dietary single and combined addition of vitamin C , vitamin E and choline on blood biochemical and hematological parameters on turkey hens at 48 weeks of age

Means having different superscrips at the same column are significantly (P≤0.05) different

Items	Glucose (mg/dl)	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Total lipids (g/dl)	Cholesterol (mg/dl)	Hemoglobin (g/dl)	Haematocrit (%)
Control (Basal diet)	389.66 ^{a}	4.90	2.78 ^{a}	2.12 ^{cd}	3.57 ^{a}	303.00 ^{a}	10.33	36.63 ^{ab}
Basal diet + Vitamin C	347.33 ^{bcd}	5.83	2.73 ^{ab}	3.10 ^{abc}	2.41 ^{b}	274.00 ^{b}	11.50	31.00 ^{d}
Basal diet + Vitamin E	375.33 ^{ab}	4.53	2.60 ^{ab}	1.93 ^{d}	2.26 ^{bc}	198.33 ^{d}	10.73	35.80 ^{abc}
Basal diet + Choline	329.33 ^{d}	4.86	2.57 ^{bc}	2.29 ^{bcd}	2.46 ^{b}	282.33 ^{ab}	8.53	32.16 ^{cd}
Basal diet + Vitamin C + Vitamin E	341.33 ^{cd}	5.06	2.63 ^{ab}	2.43 ^{bcd}	1.79 ^{c}	169.33 ^{e}	11.23	35.06 ^{abc}
Basal diet + Vitamin C + Choline	353.00 ^{bcd}	5.90	2.74 ^{ab}	3.16 ^{ab}	3.32 ^{a}	227.33 ^{c}	10.16	34.00 ^{bcd}
Basal diet + Vitamin E+ Choline	368.33 ^{abc}	4.50	2.68 ^{ab}	1.82 ^{d}	2.49 ^{b}	220.66 ^{cd}	11.96	36.53 ^{ab}
Basal diet + Vitamin C + Vitamin E + Choline	353.00 ^{bcd}	5.90	2.40 ^{c}	3.50 ^{a}	3.36 ^{a}	258.33 ^{b}	12.10	38.20 ^{a}
SEM	9.47	0.33	0.05	0.31	0.18	8.48	0.60	1.22
Significance	*	NS	*	*	*	*	NS	*

Serum globulin concentrations of hens fed the diets supplemented with vitamin C plus choline or a mixture of vitamin C, vitamin E and choline were significantly higher (P≤0.05) than that of the control group, however, other experimental groups of hens exhibited insignificantly comparable levels of globulin to that of the controls. The turkey hens fed diets supplemented with vitamin C plus vitamin E, vitamin E, vitamin C, choline and vitamin E plus choline exhibited significantly lower (P≤0.05) levels of serum total lipids compared with that of the control hens.

Serum levels of total lipids of hens fed diets supplemented with vitamin C plus choline or with the three feed additives were comparable to that of the control birds, with no significant differences among them. Dietary single and combined addition of vitamin C, vitamin E and choline caused significant reductions (P≤0.05) in serum cholesterol levels as compared to that of the controls, with the exception of hens fed choline- supplemented diet which gave insignificantly comparable level of serum cholesterol. Dietary supplementation with vitamin C or choline resulted in significant decreases (P≤0.05) in blood haematocrite values (%) of turkey hens compared with that of the controls, other groups exhibited comparable means of haematocrit value.

The present results agree with those of El-Medany (2008) who found that serum or plasma glucose content was significantly reduced when vitamin C (250 mg /kg diet) was added to the diet of laying hens. Sahin *et al.* (2003) showed that dietary supplementation with vitamin C and E either separately or in combination, at 250 mg/kg of both vitamin C and E decreased serum (plasma) glucose concentrations of laying Japanese quails. Imik *et al.* (2009) reported that the serum glucose level was lower in vitamin C group and vitamin E when compared with the control group given a normal diet without supplementation.

On the other hand, the present results disagree with the finding of Hassan *et al.* (2005) who found that choline supplementation (300 or 600 mg /kg feed) significantly increased blood serum level of albumin compared with that of the unsupplemented controls.

The present results agree with those of El-Medany (2008) who found that plasma levels of cholesterol and total lipids were significantly reduced when vitamin C (250 mg /kg diet) was added to the diet of laying hens. Al-Daraji *et al.* (2001) indicated that levels of serum cholesterol were significantly decreased, as a result of ascorbic acid supplementation in both males and females of broiler breeders. Sahin *et al.* (2003) found that supplemental vitamin C and E either separately or in combination, (250 mg of L-ascorbic acid plus 250 mg alpha-tocopherol-acetate/kg of diet) decreased levels of serum (plasma) cholesterol of laying Japanese quails.

Egg Fertility and Hatchability for turkeys:

As presented in (Table 5), significantly higher (P≤0.05) percentages of egg fertility and hatchability of total eggs were achieved by turkey birds fed diets supplemented with vitamin E alone, vitamin C plus choline, vitamin E plus choline or with a mixture of vitamin C, vitamin E and choline as compared to their control counterparts. The other experimental groups of birds exhibited insignificantly comparable means of egg fertility and total

hatchability compared to those of the control group. No significant differences were observed in hatchability of fertile eggs among the different experimental groups.

These results agree with those reported by Lin *et al.* (2004) who found that addition of 80 mg /kg vitamin E during the laying period increased egg fertility by 7.7% as compared with their controls. Hens fed 80 mg /Kg vitamin E exhibited an increase in percentage of hatchability by 13.4% as compared with those fed the unsupplemented diet . Sengul *et al.* (2008) showed that fertility rate and hatching rate improved with increasing levels of vitamin E at 30, 45, 60 and 75 mg/kg of laying partridges diets. Mbajiorgu (2011) found that optimum ascorbic acid supplementation (750 mg kg DM feed) supported optimum hatchability in Venda laying hens, which was mainly attributable to its positive effect on egg weight and hatchability.

Table 5: Effects of dietary single and combined addition of vitamin C , vitamin E and choline on egg fertility and hatchability of turkey hens during the experimental period

Items	Egg Fertility (%)	Hatchability of total eggs (%)	Hatchability of fertile eggs (%)
Control (Basal diet)	93.72 ^{d}	86.13 ^{c}	91.87
Basal diet + Vitamin C	96.34 ^{abcd}	91.14 ^{abc}	94.56
Basal diet + Vitamin E	96.89 ^{abc}	92.06 ^{ab}	95.02
Basal diet + Choline	94.84 ^{cd}	86.97 ^{c}	91.53
Basal diet + Vitamin C +Vitamin E	95.86 ^{cd}	87.75 ^{bc}	91.70
Basal diet + Vitamin C + Choline	98.81 ^{ab}	91.77 ^{ab}	92.87
Basal diet + Vitamin E+ Choline	98.97 ^{a}	91.58 ^{ab}	92.53
Basal diet + Vitamin C + Vitamin E + Choline	98.50 ^{ab}	93.55 ^{a}	94.98
SEM	0.93	1.66	1.46
Significance	*	*	NS

Means having different superscrips at the same column are significantly (P≤0.05) different

Selected slaughter measurements:

In turkey hens (Table 6), excepting for a significant increase in oviduct length of hens fed vitamin E-supplemented diet compared with the control group, the relative weights of their carcass, liver, heart, spleen, ovary and oviduct were not significantly affected by dietary treatments.

The present results agree with those of El-Zaiat *et al.* (2007) who found that the dietary addition of 200 mg vitamin E/kg diet) to Mandara laying hens insignificantly improved percentages of carcass, heart, spleen, and liver as compared to the control group . Rama Rao *et al.* (2001) reported that liver weight was not influenced by supplementary choline chloride (50%) and indicated that liver weight was not influenced by supplementary choline (760 and 1520 mg/kg) in broiler breeders (29 to 48 weeks of age). Fouladi *et al.* (2011) showed that dietary choline chloride supplement had no positive effect on meat yield and carcass weight in Japanese quails.

Table 6: Effects of dietary single and combined addition of vitamin C , vitamin E and choline on some relative weights of carcass and some vital internal organs of 48-week-old turkey hens :

Items	Carcass %	Liver %	Spleen %	Heart%	Ovary%	Oviduct%	Oviduct length(cm)
Control (Basal diet)	72.71	2.56	0.116	0.40	2.20	2.91	62.00 ^{bc}
Basal diet + Vitamin C	72.16	2.78	0.116	0.36	2.25	2.60	64.33 ^{bc}
Basal diet + Vitamin E	73.14	1.90	0.123	0.37 ^{b}	2.45	3.09	76.66 ^{a}
Basal diet + Choline	72.68	2.27	0.123	0.37	2.23	2.22	69.66 ^{ab}
Basal diet + Vitamin C +Vitamin E	73.26	2.35	0.110	0.38	2.00	1.93	55.00 ^{c}
Basal diet + Vitamin C + Choline	73.20	1.92	0.113	0.38	1.90	2.82	71.00 ^{ab}
Basal diet + Vitamin E + Choline	72.42	2.45	0.113	0.46	2.50	2.65	61.33 ^{bc}
Basal diet + Vitamin C + Vitamin E + Choline	71.90	3.16	0.113	0.38	2.16	2.59	65.66 ^{b}
SEM	0.92	0.28	0.003	0.02	0.32	0.40	3.05
Significance	NS	NS	NS	NS	NS	NS	*

Means having different superscrips at the same column are significantly (P≤0.05) different

In conclusion, dietary supplementation with vitamin E had positive effects on feed conversion, hen-day egg production rate (P≤0.05), egg fertility and total hatchability and length of oviduct of turkey hens as compared to those of the control hens.

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تـأثير بعـض مضـادات الاكسـدة والمـواد المعطيـة لمجموعـة الميثيـل علـى الآداء الانتاجى والتناسلى لإناث الرومى

عبـد البصـير حمـزة محمـد ريـا [١] ، فـوزى صـديق عبـدالفتاح اسـماعيل [١] ، محيـى الـدين يوسف مصطفى [٢] و مايكل عادل لبيب جورجى ٢

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الهدف من هذه الدراسة هو تقييم تـأثير استخدام بعض مضـادات الاكسدة والمواد المعطيـه لمجموعة الميثيل على الاداء الانتـاجى والتناسلى للرومـى . أجريت هذه الدراسة فى محطـة بحـوث الانتاج الحيوانى بمحلـه موسـى ، كفرالشيخ التابعـة لمعهد بحـوث الانتـاج الحيـوانى ، مركـز البحـوث الزراعية ، وزارة الزراعة ، مصر .

استخدم فى هذه الدراسه عدد ١٦٨ طـائر (انثـى) من سلالة الرومـى البرونـز ، عمر ٣٦ اسبوع . وزعـت الطيـور بطريقـة عشـوائية الـى ٨ معـاملات تجريبيـة ، احتـوت كـل معاملـة علـى ٣ مكررات متساوية . تم تسكين الطيور بطريقة فردية فى بطاريات.

استغرقت التجربة ١٢ اسبوع من عمر ٣٦- ٤٨اسبوع .

غذيت الطيور بعليقة اساسية (كنترول) مكونة من ذرة صفراء وكسب فول صـويا مضـاف اليهـا فيتـامين C بمعدل٢٠٠ مجم/كجم علف ، فيتـامين E بمعدل ٢٥٠ مجم/كجم علف (مضـادات اكسدة) والكولين بمعدل٢.٢٥ جم/كجم علف (مصدر لمجموعة الميثيل) بصورة مفردة أو مجمعة.

وكان أهم النتائج المتحصل عليها كالتالى :-

- أعطت المعاملـة المضـاف اليهـا فيتـامين E تـأثيرات ايجابيـة علـى معدل التحويل الغذائى ، معدل انتاج البيض اليومى ($P\leq0.05$) ، نسبة خصوبة البيض ، نسبة الفقس الكلية وطـول قنـاة البيض لاناث الرومى مقارنة بالاناث فى مجموعة الكنترول.
- لم تكن هناك فروق معنويـة بين مختلف المعـاملات التجريبيـة فـى معدل النفوق ، والـوزن النسبى لكـل مـن البيـاض والصـفار ،دليـل الصـفار ، سـمك القشـرة ، لـون الصـفار ، تركيـزات كـل مـن الهيموجلـوبين والبروتينـات الكليـة فـى بلازمـا الـدم ، نسـبة الفقس للبـيض المخصـب ومواصـفات الذبيحة لاناث الرومى .

يستنتج من النتائج المتحصل عليها ان اضافة فيتامين E الى العليقة بمعدل ٢٥٠ مجم/كجم يمكن ان يحدث تأثيرات ايجابية على الاداء الآنتاجى والتناسلى لإناث الرومى.

قام بتحكيم البحث

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