

Evaluation of Oregano and α -Tocopheryl Acetate on Laying Japanese Quail Diets

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Abstract: In this experiment 108 *Coturnix japonica* quail, 149 days old, were randomly allocated into four equal groups with three subgroups of 9 birds each (6 females and 3 males). A commercial laying diet was fed to the control group. The remaining three groups were fed the same diet supplemented with ground oregano at 10 g/kg or 20 g/kg or additional 300 mg α -tocopheryl acetate /kg. The birds were offered feed and water *ad libitum* for a period of 29 days, while being kept under commercial conditions. During the whole experiment, egg production, feed consumption and mortality were recorded daily. Also, at the end of the experiment the egg weight, the weight percentages of egg yolk, albumen and shell, the egg yolk colour (using the L*a*b* colour space) were determined. Moreover, blood serum total cholesterol and triglycerides were determined. The results showed that the α -tocopheryl acetate addition did not affect any of the examined parameters. In contrast, oregano at 10 g/kg increased the a* yolk colour parameter (redness) compared to control, but did not affect the other examined parameters.

Keywords: Vitamin E, *Coturnix japonica*, antioxidants, egg laying, performance, egg quality, yolk color.

INTRODUCTION

Japanese quail (*Coturnix japonica*) are reared in many part of the world, both for meat and egg production. Also, this quail is commonly used for biological and genetic studies because of its many advantages as a laboratory animal. For example, it has small body size, is easily reared and can be housed in large numbers in limited space [1]. Moreover, it reaches sexual maturity early, which results in a fast turnover of new generations [2]. The egg production rate of the Japanese quail is high and many offspring can be produced from a limited number of parents [1].

Oregano (*Origanum vulgare subsp. Hirtum*) is an herb that belongs to the Labiatae family, well known in countries around the Mediterranean Sea. This plant is rich in important bioactive components, such as carvacrol, thymol, γ -terpinene and p-cymene. Accordingly, ground oregano has recently been shown that it exhibits considerable antimicrobial, antifungal and antioxidant activity [3-7]. Therefore, it is considered as a promising dietary supplement, but data concerning its use in laying quail diets are very limited.

Vitamin E is an important antioxidant and is usually added in the diets of productive animals in the form of α -tocopheryl. Supplementation of antioxidants in animal diets is considered to play significant role for the

good health and performance of poultry and the oxidative stability of their products [8-9]. Nevertheless, there is limited knowledge about the efficacy of this vitamin on the performance and egg quality traits of laying quail [10], and especially compared to aromatic plants containing natural antioxidant substances.

The focus of this study was the investigation of dietary oregano and α -tocopheryl acetate on the production, some egg quality traits and some blood serum biochemical parameters of the Japanese quail.

MATERIALS AND METHODS

Material Procurement

In this study the oregano consisted of flower tops and leaves of the plant. The oregano used was of Greek origin. It was dried and ground before incorporating in the diets. Proximate analysis of the oregano, was performed according to the guidelines of AOAC [11] that showed the following composition: Dry mater 88.3%, crude protein 10.8%, crude fat 6.4%, crude fiber 12.9%, ash 9.1%.

Animals and Diets

A total of 108 *Coturnix japonica* quail (72 females and 36 males), 149 days old, were divided into four groups with three replicates of 9 birds each (6 females and 3 males). All birds were individually weighted before placing them in the cages and the average body weight did not differ ($P > 0.100$) between the four groups. The birds were fed a commercial layer diet

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Table 1: Composition of Laying Quail Diet

Ingredients	g/kg	Chemical analysis	g/kg
Maize	456.7	Dry matter	900
Soybean meal	305.4	Crude protein	198
Wheat	100.0	Crude fat	45
Calcium carbonate	62.1	Crude fiber	34
Soybean oil	30.0	Ash	94
Corn gluten meal	27.7		
Dicalcium phosphate	10.4	Calculated analysis	
Vitamin and trace mineral premix ¹	3.5	Calcium	26.0
Salt	2.1	Total phosphorus	6.0
Sodium bicarbonate	1.9	Lysine	10.2
Methionine	0.2	Methionine & Cystine	7.2
		Metabolisable energy, kcal/kg	2900

¹Supplying per kg feed: 14000 IU vitamin A, 5000 IU vitamin D₃, 30 mg vitamin E, 13 mg vitamin K, 3 mg vitamin B₁, 8 mg vitamin B₂, 3 mg vitamin B₆, 20 µg vitamin B₁₂, 85 mg vitamin niacin, 20 mg pantothenic acid, 2 mg folic acid, 200 µg biotin, 10 mg vitamin C, 960 mg choline chloride, 100 mg Zn, 116 mg Fe, 120 mg Mg, 20 mg Cu, 0.2 mg Co, 1 mg I, 0.3 mg Se.

(Table 1) *ad libitum* for an acclimatization period of 10 day. The commercial diet contained 30 mg α -tocopheryl acetate/kg. After this period the birds in the control group (CONTR) remained on the same diet. The other three groups were fed the same diet with the addition of ground oregano at 10 g / kg (OREGA10 group) or 20 g / kg (OREGA20 group) or α -tocopheryl acetate at 300 mg / kg (TOCOPH group). The α -tocopheryl acetate product used was from Roche Products Ltd, Hertfordshire, UK. The birds were given feed and water *ad libitum* for a period of 29 days, while being kept under commercial conditions. The quail were handled according to the principles of the Greek Directorate General of Veterinary Services for the care of animals in experimentation.

The egg production, feed consumption and mortality were measured on a daily basis. Moreover, egg weight and egg yolk, albumen and shell (with shell membrane) percentages were measured in ten eggs per replicate. Also, the egg yolk colour was determined in a mixture of ten egg yolk from each replicate, using the L*a*b* colour space (L = lightness, a = redness, b = yellowness) according to Herber-McNeill and Van Elswyk [12], with the aid of a Konica Minolta Chroma Meter CR-410 (Japan).

At the last day of the experiment, blood serum total cholesterol of quail was measured according to Roeschlau *et al.* [13] and blood serum triglycerides were measured according to Fossati and Prencipe [14].

For these measurements a biochemical analyser Flexor E, Vital Scientific N.V. (Holland) was used.

Statistical Analysis

The experimental data were subjected to statistical analysis with the aid of SPSS 16.0.1 statistical package (SPSS Inc., Chigaco, IL, USA). The general linear model function was used for the analysis of variance (ANOVA). Pearson's chi square test was applied for the mortality analysis. A value of $P \leq 0.05$ was considered significant. The homogeneity of the variances was examined with Levene's test and Tukey's test was used to determine statistical differences between the means.

RESULTS

Table 2 presents the egg production, daily feed intake and mortality of the quail. No significant differences were noticed between the four experimental groups.

The results concerning the examined egg quality parameters are given in Table 3. Dietary oregano at 10 g/kg significantly ($P < 0.05$) increased the a* colour parameter (redness), but did not affect the other examined egg quality parameters (egg weight; egg yolk, albumen and egg percentages; yolk colours L*, b*). Moreover, the dietary addition of α -tocopheryl acetate did not affect any of the examined parameters.

Table 2: Performance of Laying Quail (mean \pm s.d) Fed Ground Oregano (10 g/kg or 20 g/kg) or α -Tocopheryl Acetate (300 mg/kg)

Group ¹	Egg Production %	Daily Feed Intake g	Mortality %
CONTR	70.88 \pm 11.51	32.2 \pm 4.3	0.0 \pm 0.0
OREGA10	79.89 \pm 14.36	31.2 \pm 2.6	3.7 \pm 6.4
OREGA20	77.78 \pm 12.93	30.0 \pm 1.5	0.0 \pm 0.0
TOCOPH	59.39 \pm 10.54	31.5 \pm 0.5	0.0 \pm 0.0
P value	0.252	0.778	0.387

¹Groups: CONTR = control; OREGA10 = 10 g oregano/kg; OREGA20 = 20 g oregano/kg; TOCOPH = 300 mg α -tocopheryl acetate/kg. Values did not differ significantly ($P > 0.05$) between the groups.

Table 3: Egg Quality Parameters (mean \pm s.d) of Laying Quail Fed Ground Oregano (10 g/kg or 20 g/kg) or α -Tocopheryl Acetate (300 mg/kg)

Group ¹	Egg weight g	Egg yolk %	Egg albumen %	Egg shell %	Yolk Colour		
					L*	a*	b*
CONTR	11.95 \pm 0.02	31.39 \pm 0.48	54.10 \pm 1.41	14.52 \pm 0.99	68.80 \pm 0.41	2.16 \pm 0.74 ^a	64.13 \pm 0.35
OREGA10	12.27 \pm 1.03	32.42 \pm 1.06	53.35 \pm 0.97	14.24 \pm 1.36	69.24 \pm 2.46	4.30 \pm 0.29 ^b	66.65 \pm 3.01
OREGA20	11.65 \pm 0.48	31.79 \pm 0.83	53.67 \pm 1.08	14.53 \pm 0.71	67.50 \pm 0.76	3.76 \pm 0.97 ^{ab}	64.68 \pm 0.65
TOCOPH	11.84 \pm 0.24	32.27 \pm 1.14	53.73 \pm 2.68	14.00 \pm 1.80	67.65 \pm 0.58	3.72 \pm 0.10 ^{ab}	65.11 \pm 0.72
P value	0.637	0.530	0.957	0.947	0.344	0.016	0.317

¹Groups: CONTR = control; OREGA10 = 10 g oregano/kg; OREGA20 = 20 g oregano/kg; TOCOPH = 300 mg α -tocopheryl acetate/kg. Values in the same column with a superscript in common do not differ significantly ($P \leq 0.05$).

The quail blood serum total cholesterol and triglycerides are given in Table 4. Neither the addition of oregano nor α -tocopheryl acetate affected these two parameters.

DISCUSSION

The first important aim in this study was the investigation of the effect of dietary oregano (10 or 20 g/kg) in the performance and egg quality of the laying Japanese quail. Regarding the quail performance neither beneficial nor adverse effect was noticed due to

this addition. According to previous works, that examined dietary oregano in quail diets, egg production and feed consumption were not affected [15-17]. Also, in our study mortality was already very low and was not modified, a finding that is in agreement with Cetingul *et al.* [16]. A possible improvement of these parameters could be expected, due to available literature for other productive poultry species, such as broilers [3-4], hens [5-6] and turkeys [9]. Probably the lack of significant findings can be attributed to the fact that the nutritional benefit of feed additives is more pronounced in less adequate diets or in stressful housing conditions,

Table 4: Blood Serum Cholesterol And Triglycerides (mean \pm s.d) of Laying Quail Fed Ground Oregano (10 g/kg or 20 g/kg) or α -Tocopheryl Acetate (300 mg/kg)

Group ¹	Total Cholesterol mg / dl	Triglycerides mg / dl
CONTR	204.7 \pm 35.5	257.0 \pm 74.8
OREGA10	198.7 \pm 16.0	219.7 \pm 33.7
OREGA20	174.0 \pm 29.6	144.7 \pm 109.1
TOCOPH	204.3 \pm 32.0	259.3 \pm 116.2
P value	0.556	0.415

¹Groups: CONTR = control; OREGA10 = 10 g oregano/kg; OREGA20 = 20 g oregano/kg; TOCOPH = 300 mg α -tocopheryl acetate/kg. Values did not differ significantly ($P > 0.05$) between the groups.

whereas it is not so clear in well feed and healthy animals.

Moreover, dietary oregano did not affect egg weight and egg yolk, shell, and albumen percentages. Nevertheless, it significantly affected the egg yolk colour by increasing the a^* color index (redness). In previous papers [15-16] it was reported that dietary oregano did not modify either egg weight or yolk color (measured using the Roche index). This modification of yolk color might be attributed to the absorption of pigments contained in the dietary oregano and their deposit into the egg yolk.

Furthermore, dietary oregano did not affect the quail blood serum cholesterol and triglycerides. Although there isn't available literature about the oregano effect on these biochemical parameters, it is suggested that phytoestrogen consumption can regulate serum cholesterol levels in humans and animals [18-19].

The second important aim in this study was the investigation of the dietary supplementation of 300 mg α -tocopheryl acetate / kg in the laying quail diet. Neither beneficial nor adverse effects were noticed in the examined performance, egg quality and blood serum biochemical parameters. In a previous study with quails [10] it was reported that dietary addition of α -tocopheryl acetate increased egg production, but did not affect feed intake. Also, some other researchers [20-21] noticed increased egg production in laying hens, whereas in a more recent work Heydari *et al.* [22] did not find any improvement of the laying performance. As already suggested previously, although dietary α -tocopheryl acetate, is very important for the animal health, it is possible that additional benefits in the examined performance and egg quality parameters were not expressed, due to the good feeding and housing conditions.

Moreover, dietary α -tocopheryl acetate did not affect blood serum cholesterol and triglycerides. In previous study, Arslan *et al.* [23] did not find differences in plasma cholesterol and triglycerides due to the increased dietary supplementation of vitamin E in broiler diets. Also, Francini *et al.* [24] described that the dietary vitamin E decreased cholesterol and triglycerides levels in broilers, although this effect was influenced by bird's age.

CONCLUSION

Dietary oregano can be used in laying quail diets either at 10 or 20 g/kg, without any adverse effect, and

it can improve egg quality, as far as the yolk colour is concerned. Dietary addition of α -tocopheryl acetate at 300 mg/kg did not affect the quail performance, egg quality and blood serum biochemical parameters.

Therefore, the use of oregano in quail diets is promising, although further investigation is needed, especially regarding the egg quality.

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