



Effects of Dietary Oregano Essential Oil Supplementation on Performance and Eggshell Quality in Laying Hens

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ABSTRACT

This study evaluated the effects of oregano essential oil on performance and egg quality parameters of laying hens. A total of 144 forty-week-old H&N Super Nick laying hens were assigned to the basal control diet supplemented with 50, 100, 150, 200 and 250 mg/kg of oregano essential oil (6 treatment diets, 8 replicates, each replicate consists of 3 hens). Hens were fed experimental diets from 40 to 52 weeks of age. Water and diets were supplied ad libitum throughout the experiment. After 12 week of experiment, feed intake, egg production, feed conversion ratio, egg weight, egg mass did not differ among the treatment groups. Different application rate of oregano oil had no effects on eggshell ratio, eggshell thickness and eggshell breaking strength. The results of this study demonstrated that addition oregano essential oil to the diets had no effect on performance and eggshell quality parameters of laying hens at 40 to 52 weeks of age.

1. Introduction

Many countries have banned the use of antibiotics in animal production as a feed additive in 2006. The most frequently alternatives used as feed additives to improve animal productivity and health are prebiotics, probiotics, organic acids and phytogetic additives (Windisch et al., 2008). As an phytogetic additive, natural feed supplements derived from herbs such as the essential oils have been examined as alternatives to antibiotics for better growing performance and the quality characteristics of the derived products (Simitzis and Deligeorgis, 2011). The beneficial effects of the herbs and their active compounds have been recognised since antiquity and their properties reported in experimental animals (Brenes and Roura, 2010).

Oregano (*Origanum vulgare* L.) essential oils are an aromatic plant that is indigenous to the Mediterranean region. It has been reported that oregano essential oils ha many diverse biological activities, having antimicrobial, antioxidant and antifungal effects, which mainly depended on the carvacrol and thymol compositions (Zotti et al., 2013; Mooyottu et al., 2014). Several in vivo studies have been conducted on the perfor-

mance, cecal flora, digestive enzyme activities and intestinal morphology of poultry with oregano essential oils (Hashemipour et al., 2013), yet, the interest in essential oils as feed additive has mainly focused on the effect on performance (Cabuk et al., 2006; Bozkurt et al., 2012; Bolukbası et al., 2008; Kaya et al., 2013) and eggshell quality (Bolukbası et al., 2008; Bozkurt et al., 2012; Kaya et al., 2013; Olgun, 2016). Plant extracts and spices single or mixed preparations can play a role in supporting both performance and health status of animals (Alcicek et al., 2003; Cabuk et al., 2006), and their effect could be better than.

The objectives of the present study were to evaluate the effects of different application rate of oregano essential oil on performance and egg quality parameters in laying hens.

2. Materials and Method

Hundred-forty-four H&N Super Nick laying hens, 40-week-old, were used in this study. The birds were assigned into six dietary treatments replicated eight times with three hens per replicate. The six dietary treatments included a corn-soybean-based typical layer diet (Table 1) that containing 50, 100, 150, 200 and 250 mg/kg oregano essential oil (*Origanum* spp.; Ecodab®-Inan Tarım). Diets were formulated to meet the nutrient requirements of laying hens based on (NRC, 1994) and H&N Super Nick laying hens man-

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agement guide (Table 1). During the 84 days, diets and water were provided ad libitum, whereas the lighting regimen was 16 h of continuous light per day. The birds were housed in an environmentally controlled room equipped with 48 metal battery cages (50×40×50 cm).

Egg production (EP) was recorded daily. Feed intake (FI) and egg weight (EW) were recorded bi-weekly. Egg mass (EM) was calculated from the bi-weekly EP and EW data using the formula: $EM = (EP \times EW) / \text{Period (days)}$. The feed conversion ratio (FCR) was calculated using the formula: $FCR = FI / EM$. The egg quality characteristics (Shell weight, shell thickness and shell breaking strength) were evaluated using random samples of 6 eggs from each replicate every two weeks, thereby totalling 288 eggs from each treat-

Table 1.

Composition of experimental diets

Ingredients	
Corn (%)	57.00
Barley (%)	5.00
Soybean meal (%)	24.20
Vegetable oil (%)	2.50
Limestone (%)	9.00
Di-Calcium phosphate (%)	1.60
Salt (%)	0.30
Premix ¹ (%)	0.25
Methionine (%)	0.15
TOTAL	100
<i>Calculated nutrients</i>	
Metabolizable Energy (Kcal/kg)	2784
Crude protein (%)	16.40
Calcium (%)	3.85
Available phosphorus (%)	0.40
Lysine (%)	0.88
Methionine (%)	0.42
Methionine +Cystine, %	0.68

¹: Premix provided the following per kg of diet: vitamin A, 8.800 IU; vitamin D3, 2.200 IU; vitamin E, 11 mg; nicotinic acid, 44 mg; Cal-D-Pantothenate, 8.8 mg; riboflavin 4.4 mg; thiamine 2.5 mg; vitamin B12, 6.6 mg; folic acid, 1 mg; D-Biotin, 0.11 mg; choline, 220 mg; manganese, 80 mg; copper, 5 mg; iron, 60 mg; zinc, 60 mg; cobalt, 0.20 mg; iodine, 1 mg; selenium, 0.15 mg.

3. Results and Discussion

The performance parameters are presented in Table 2. Essential oregano oil had no effect on the egg production, feed intake, feed conversion ratio, egg weight and egg mass ($P > 0.05$).

The eggshell quality parameters, such as, egg breaking strength, eggshell weight and eggshell thickness are presented in Table 3. The eggshell quality parameters were also not affected by dietary essential oregano oil levels.

Oregano essential oil has been used alternative to antibiotic in the poultry industry because of biological activities, such as antimicrobial, antioxidant, antiseptic and antiparasitic activity. The present study demonstrated that the performance parameters were not af-

ected by dietary levels of oregano essential oil in laying hens. Our findings are in agreement with those of Bozkurt et al. (2012) who indicated that a diet supplemented with essential oil mix had no beneficial effects on egg production, egg weight and feed conversion ratio in laying hens. Arpasova et al. (2015) showed that the body weight, feed consumption, feed conversion ratio, egg production, egg mass and egg weight were not significantly influenced with thyme or oregano oil addition in laying hens. Similarly, addition of oregano oil (Florou-Paneri et al. 2005) and thyme oil (Bolkbaşı et al. 2007) to a layer diet had no significant effects on feed conversion ratio.

Eggshell breaking strength was measured using a cantilever system by applying increasing pressure to the broad pole of the shell using an Egg Force Reader (Orka Food Technology Ltd., Ramat Hasharon, Israel). The eggshells were rinsed in running water and dried in an oven at 60°C for 12 h. Eggshells were weighed using a 0.01 g precision scale. Eggshell thickness (including the membranes) was determined at three points on the eggs (one point on the air cell and two randomized points on the equator) using a micrometer (Mitutoyo Inc., Kawasaki, Japan).

Data were analysed by one-way ANOVA using the Minitab 14.0 software package (Minitab, 2004). Duncan's multiple range tests were applied to separate means (Mstat C,1980). Differences were considered as significant when P value was less than 0.05.

Table 2.

Effect of dietary oregano essential oil on performance parameters in laying hens

Dietary oregano oil levels (mg/kg)	Egg production (%)	Feed intake (g/hen/d)	Feed conversion ratio (g:feed/g:egg mass)	Egg weight (g)	Egg mass (g/hen/d)
0	95.0±0.98	112.5±1.26	2.01±0.021	58.8±0.50	55.9±0.91
50	96.2±0.96	108.9±1.12	1.96±0.030	57.8±0.51	55.6±0.65
100	94.6±0.67	110.7±1.13	1.98±0.023	59.0±0.46	55.9±0.61
150	94.1±1.10	111.2±1.32	2.01±0.040	58.6±0.73	55.2±0.91
200	95.6±0.84	109.6±1.50	2.00±0.035	57.5±0.35	55.0±0.60
250	94.5±0.90	109.0±1.65	1.99±0.032	58.1±0.37	54.9±0.53

Cabuk et al. (2006) indicated that a diet supplemented with essential oil mix had no beneficial effect on egg weight. In contrast to our study results, He et al. (2017) observed that egg production, average egg weight and feed conversion ratio were significantly improved by a diet supplemented with 100 mg/kg ore-

gano essential oils. Bolukbaşı et al. (2007) reported that dietary supplementation with mixed essential oils and thyme oil improved the egg production, but in other study reduced feed intake was reported (Bolukbaşı et al. 2010).

Table 3.

Effect of dietary oregano essential oil on eggshell quality parameters in laying hens

Dietary oregano oil levels (mg/kg)	Eggshell weight (g/100 g egg)	Eggshell thickness (mm)	Eggshell breaking strength (kg)
0	9.84±0.127	0.365±0.0036	4.18±0.057
50	9.71±0.192	0.357±0.0046	4.21±0.079
100	9.55±0.109	0.378±0.0288	4.10±0.099
150	9.59±0.080	0.359±0.0030	4.17±0.071
200	9.78±0.080	0.367±0.0038	4.21±0.119
250	9.69±0.101	0.362±0.0049	4.18±0.091

The present study demonstrated that the egg quality parameters, including shell thickness, shell weight and eggshell breaking strength were not affected by dietary levels of oregano essential oil in laying hens. These results are in agreement with those of He et al. (2017) reported that egg weight and relative eggshell weight were not significantly affected by the addition of oregano essential oils. Bozkurt et al. (2012) reported that the egg shell weight and shell thickness were not affected by the dietary essential oil mix. Olgun (2016) reported that the specific gravity, egg breaking strength and eggshell weight were not affected by the dietary supplemented with essential oil mix in laying hens. In addition, Botsoglou et al. (2005) observed that the dietary supplementation of laying hens by rosemary, oregano and saffron essential oil had no effect on eggshell thickness. In another study (Ali et al., 2007) reported that supplementation with thyme and anise did not affect eggshell weight and eggshell thickness in native laying hens. Similarly, Olgun and Yıldız (2014) reported that eggshell weight was not affected by supplementation with mixed essential oil.

The result shows that different levels of dietary oregano essential oil had no significant effect on performance and eggshell quality parameters in laying hens.

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