



Effect of dietary supplementation of lavender and rosemary essential oil on quails' productive performance, egg quality, and physiological parameters

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Received: May 02, 2025	Abstract The objective of this study was to examine adding lavender essential oil (LEO), rosemary essential oil (REO), or a combination of the two oils to laying quail diets affected productive performance, egg quality, and physiological traits. The study material comprised 72 42-day-old quails, which were assigned to four treatments; each contained 18 quails, three males and 15 females, divided into three replicates reared in a cage system. Concerning the diet, the T1 control group quails were fed standard feed, the T2 group added 0.6% LEO to standard feed, the T3 group added 0.6% REO to the layer diet, and the T4 group added a 0.6% mix of 0.3% LEO and 0.3% REO to standard feed. As a result, it was found that diet supplementation with LEO and REO had no significant effect on feed conversion ratio (FCR) but had a substantial influence on performance metrics, feed intake (FI), and hen-day egg production (HD). No significant differences were observed in egg quality parameters among treatments. High-density lipoprotein (HDL) significantly increased in all essential oil treatments as compared to the control group, but other physiological parameters and egg quality did not alter significantly when the two essential oils were supplemented. In conclusion, feeding laying quails LEO and REO increased their productivity while having a limited impact on their physiological characteristics. However, egg quality parameters did not show any significant differences. Keywords: LEO, REO, egg production, physiological parameters.
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Introduction

Quails (*Coturnix Japonica*) production is one of the most successful sectors of commercial poultry production. Quails have a lot of features for raising, including early maturation and starting egg production in the 35th days of age, and the rapid investment necessary for commercial purposes [1].

Nutritionists and livestock production managers, on the other hand, must identify feasible alternatives in light of antibiotic resistance and the negative impacts of antibiotic use on animal and human health. The *Labiatae* (*Lamiaceae*) family includes



aromatic plants such as lavender (*Lavandula angustifolia*) and rosemary (*Rosmarinus officinalis*) [2]. These compounds of vegetable origin are called essential oils (EOs). Lavender and rosemary essential oils are plants high in active compounds [3]. Lavender's effect is attributed to phenolic compounds and flavonoids such as linalool, linalyl acetate, camphor, limonene, and eucalyptol. On the other hand, rosemary's effect is attributed to carnosic acid, carnosol, camphene, ursolic acid, rosmarinic acid, 1,8-cineole, α -pinene, and other volatile fatty acid components that give the herb its distinct odor [4,5].

In the view of [6], these two essential oils have antibacterial and antioxidant qualities in addition to stimulating the digestive system and appetite. Many studies indicated that LEO and REO had stimulated more egg production in layers. It has been found that they improve poultry health and performance by maintaining a healthy intestinal microbiota and preventing pathogens from colonizing the gut [7]. Recently, they have been shown to stimulate the release of digestive enzymes, improve immunity, and promote the absorption and synergy of vitamins and minerals in the body, as well as carcass features and meat quality in partridges [8]. The objective of this study was to determine the effects of dietary lavender and rosemary essential oils, as well as their combination, on the performance, egg quality, and physiological parameters of laying Japanese quail.

Materials and methods

Study period and study location

This study started on 22 October 2023 and continued for 42 days of working in a quail scientific farm in Gradarash-Collage of Agriculture, Engineering Science, Salahaddin University. In this study, a total of 72 quails (*Coturnix coturnix Japonica*) at 42 days of age were randomly distributed into four treatments with three replicates for each treatment. Each treatment contained 18 quails, with six quails (5 female; 1 male) for each treatment. T1 Control group quails fed standard feed. T2 0.6% lavender essential oil (LEO) was added to the standard feed. T3 0.6% rosemary essential oil (REO) was added to the standard feed. T4 0.6% LEO + REO were added to the standard feed. 35 g of feed was provided daily for each quail. Water provided *ad libitum*. The quails were placed in cages. The study was continued from 42 to 84 days.

Studied traits

Productive performance: hen day egg production (HDEP%), feed intake (FI), feed conversion ratio (FCR) (g feed/g egg) (g feed/1 egg). All these parameters were recorded weekly as the following equation.

HDEP: Total number of eggs produced on a day/ Total number of hens present on that day *100.

FCR Feed intake (kg) / Egg production (kg)

Egg quality measurements: external and internal egg quality traits were recorded weekly.



-Physiological parameter: blood was collected in a serum tube for biochemical tests. All data were analyzed via one-way analysis of variance (ANOVA) using SAS software to determine the effect of the stocking density level by using a complete randomized design system (CRD). Duncan multiple range tests [9] were used to determine the significant differences among treatments. The diet composition is shown in Table 1.

Table (1): Diet ingredients and chemical composition

Laver ratio 6-17 weeks	
Ingredients	Composition%
Yalow corn (mash)	48.0
Wheat flour	15.0
Soybean meal 48%	24.2
Soybean oil	1.5
Limestone	4.5
Mono-calcium phosphate (MCP)	2.5
Vitamins- premix ¹	0.10
Minerals premix ²	0.10
Salt	0.30
Methionine	0.40
Lysine	0.40
Calculated analysis nutrient (%) ³	
Dry matter	89
Moisture	11
Crude protein	18.55
Metabolized energy(kcal/kg)	2850
Ash	6.1
Crude fat	4.10
Crude fiber	3.65
Calcium (Ca)	3.18
Lysine	1.143
Methionine	0.591

*Vitamin premix (1kg) contains 334000 IU A, 67000 mg E, D3 500mg, B1 167 mg, B2 1000mg, B6 0.66 mg, B12 67 mg, and Niacin 1000mg. 2 Minerals: premix Fe 1.667 mg, Mn 3.334 mg, Colin 17000 mg, folic acid 17 mg, Butin 1.33 mg, Zn 2.667 mg, Cu 334 mg, and I 17 mg. Methionin 27.000mg, zinc-bastracin 667mg, antioxidant 3.333 ppm, phosphorus 10.6%, and sodium 4-4.5%. 3 The feed Brill program calculated the chemical analysis of components in accordance with the NRC [10].

Results and Discussion

Effect of LEO and REO on quails' productive performance

The influence of adding lavender and rosemary essential oils and their mixture on quail performance table (2). The effect of supplementing lavender and rosemary essential oils significantly ($p < 0.01$) increased feed intake (FI), T4, and other treatments compared to the control group. Hen day (HD%) significantly ($p < 0.01$) recorded the



highest egg production (T4, T3, and T2) at 90.95, 86.35, and 85.4%, respectively, compared to quails in control, which recorded the lowest 69.21% of egg production. However, it did not affect the feed conversion ratio (FCR). The current results are in agreement with those [11], which showed that adding 3000 mg/kg of rosemary powder to the diets of laying hens enhanced their productive performance and egg quality characteristics. The result is in contrast with those [12] who recorded that lavender and rosemary essential oils did not affect FCR significantly. Additionally, laying hens fed 100, 200, and 300 mg/kg of rosemary essential oil did not differ from the control group in terms of egg production, weight, or quality attributes; however, dietary supplementation with rosemary essential oil had a significant impact on feed intake and feed conversion ratio [13].

Natural medicinal items produced from herbs and spices used in animal and poultry nutrition to improve performance are known as "phytogenic feed additives". Phytogenic feed additives and herbal plants have recently attracted much attention as alternatives to standard antibiotics, probiotics, and prebiotics. These phytogenic plants are considered natural products; thus, customers may be prepared to accept their use in poultry feed. Comprehensive studies on phytogenic plants have revealed their growth-promoting, antibacterial, antioxidant, and anti-inflammatory activities [14]. The main reason for returning to essential oils is that they stimulate appetite and feed consumption, which leads to increased growth and egg production. To be more specific, increasing appetite and egg production may be due to volatile fatty acids found in active compounds linalol, linalyl acetate, and lavender, as well as rosmarinic acid in rosemary, which are responsible for stimulating the appetite center in the brain to eat more than those who did not receive essential oils [15]. Essential oils, on the other hand, are classified as natural, safe, and non-residual plant-based alternative nutritional supplements. Plant oils can improve poultry growth by stabilizing intestinal microbial flora and stimulating endogenous digestive enzymes. Another possible explanation for this phenomenon is that the addition of essential oil improves body resistance and lowers the likelihood of disease onset. As a result, the body can enhance product performance with sufficient energy without requiring the production or release of additional immunoglobulin protein to protect the body [16].

Table (2): Effect of adding lavender and rosemary essential oil and the combined on quails' performance

Treatments \ Traits	FI	FCR	HDEP%
T1	44.13 ± 0.98c	2.68 ± 0.17	69.21 ± 2.72c
T2	46.01 ± 1.06b	2.85 ± 0.17	85.4 ± 3.23b
T3	48.46 ± 0.76ab	2.93 ± 0.18	86.35 ± 2.88ab
T4	50.33 ± 0.46a	3.09 ± 0.2	90.95 ± 1.6a
Significance level	**	N.S.	**



*T1= control group, T2= adding 0.6% Lavender Essential oil to standard feed , T3= adding 0.6% Rosemary Essential oil to standard feed , T4=0.6% mixed lavender and rosemary essential oil to standard feed. ^{a-c} Means within columns with different superscripts are significantly different. ** (P<0.01), N.S. non-significant.± Standard error.

Effect of LEO and REO on quail egg quality parameters

The impact of adding lavender and rosemary essential oils and their combination on quail egg quality is given in Table 3. The results indicate that adding the two essential oils did not significantly affect egg quality. The present results are in line with those of [17, 18, 19], who observed that adding essential oils to the laying hen diet did not have a significant effect on egg weight, egg index, shell weight, and haugh unit. However, [20] showed that oil-supplemented groups also showed a linear improvement in eggshell breaking strength starting from a dietary 50 mg/kg rosemary essential oil level.

To our knowledge, the improved results obtained for eggshell quality indicators may be partly due to the effect of EO on the metabolic activity of beneficial colonies in the guts of laying hens, positively affecting the absorption rate of minerals (especially Mg 2+ and Ca 2+) [19].

Table (3): Effect of adding lavender and rosemary essential oil and their combine on egg quality

Treat.	Egg wt.	Egg in- dex	Albumin height	Yolk. Height	Yolk di- ameter	Shell wt.	Yolk wt.	Haugh unit
T1	17.36 ± 0.93	79.36 ± 2.65	5.13 ± 0.22	11.45 ± 0.35	27.82 ± 0.5	15.22 ± 0.91	5.42 ± 0.31	96.35 ± 0.89
T2	16.91 ± 0.84	79.31 ± 1.41	4.5 ± 0.31	11.48 ± 0.22	27.98 ± 0.73	14.61 ± 0.76	5.3 ± 0.26	93.14 ± 1.48
T3	17.44 ± 0.88	75.89 ± 1.47	4.64 ± 0.22	11.53 ± 0.26	28.2 ± 0.5	14.89 ± 0.63	5.38 ± 0.24	93.83 ± 1.09
T4	17.37 ± 0.95	78.1 ± 0.93	4.88 ± 0.27	11.87 ± 0.22	27.83 ± 0.35	15.33 ± 0.83	5.39 ± 0.28	94.99 ± 1.23
Significance	NS	NS	NS	NS	NS	NS	NS	NS

T1= control group, T2= adding 0.6% Lavender Essential oil to standard feed, T3= adding 0.6% Rosemary Essential oil to standard feed, T4=0.6% mixed lavender and rosemary essential oil to standard feed. ^{A-c} means that within columns with different superscripts are significantly. N.S. non-significant. ± Standard error.

Effect of LEO and REO on quails' physiological parameters

The influence of supplementing lavender and rosemary essential oils and their combined effects on serum biochemicals is shown in Table 4. However, adding two essential oils significantly (p<0.01) raised the serum HDL, particularly in T3 rosemary essential oil, which recorded the highest level 72.23 mg/dl compared to the control group, which recorded the lowest level 18.93 mg/dl of HDL. In contrast, other parameters did not significantly change. The outcomes are similar to those of [20], who found that adding rosemary essential oil did not affect serum glucose and cho-



lesterol (mg/dl) while increasing HDL ratio (mg/dl) in chucker blood. Moreover, [7] recorded that LEO increased the level of omega-3 in Japanese quail blood.

In terms of the antioxidant activity of the lavender plant, phenols (camphor in this study) are preferred as a more effective ingredient against lipid peroxidation. Essential oils are thought to be a practical nutritional addition for chicken feed due to their antibacterial properties against harmful bacteria like *E. coli* [5]. The two essential oils serve as antioxidants because they have free radical scavenging properties. Free radicals produced by metabolic activities trigger oxidative reactions. Peroxides are the principal results of oxidative processes, with hydrocarbons, aldehydes, ketones, alcohols, and organic acids as subsequent products [6]. Antioxidants have a vital function in scavenging free radicals and extending the shelf life of animal products. Antioxidants are well known for significantly reducing lipid peroxidation, which is regarded as the primary indication of free radical presence in muscle tissue [12]. Consequently, some essential oils also have anti-heat stress properties, which lead to minimizing heat production that causes lipid oxidation. Several investigations have revealed that herbal essential oils display antibacterial activity in the gastrointestinal lumen and act as growth enhancers in young pigs and broiler chicks (21).

Table (4): Effect of adding lavender and rosemary essential oil and their combine on serum biochemical

Traits Treatments	Glucose mg/ml	T. Cholesterol mg/dl	Triglyceride (TG) mg/dl	HDL mg/dl	LDL mg/dl	S. Ca mg/dl
T1	334.23 ± 8.66	190.63 ± 30.31	1178.63 ± 19.08	18.93 ± 6.09 c	118 ± 28.59	23.58 ± 1.55
T2	308 ± 5.93	254.93 ± 51.97	1178.77 ± 25.03	36.77 ± 21.29 b	164.33 ± 34.65	27.69 ± 1.45
T3	315.8 ± 8.2	288.17 ± 52.99	1117.2 ± 47.62	72.23 ± 41.97 a	165.33 ± 12.84	28.04 ± 1.64
T4	314.7 ± 5.55	230.03 ± 72.22	1133 ± 110.6	35.77 ± 12.3 b	143 ± 59.28	24.91 ± 0.48
Significance	NS	NS	NS	**	NS	NS

^{A-c} means that within columns with different superscripts are significantly. ** (P<0.01), N.S. non-significant. ± Standard error.

To sum up, adding essential oils of lavender and rosemary to laying quail diets had no negative impact on the performance metrics. Increased consumption of feed and production of hen day eggs, especially when combined. Additionally, there was no discernible impact of the two essential oils on the criteria of egg quality. Essential oils had little effect on the serum biochemicals other than raising HDL levels.

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