

The use of marjoram leaf powder and vitamin E in the productive traits and some biochemical blood characteristics of laying hens

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ABSTRACT

The study was carried out at the College of Agriculture / University of Kirkuk/Department of animal production for the period from 16/11/2025 to 14/2/2026 in order to identify the impact of adding marjoram leaf powder and vitamin E on productive traits and some biochemical characteristics of blood for laying hens. One hundred and twenty Lohmann White laying hens were used in the study, and hen was 54 weeks old, were used for period of 12 weeks. The first treatment received a basal feed (as control) without any nutritional supplements. The second treatment was assigned to a control diet with 250 mg of vitamin E/kg diet. As the third, fourth, fifth and sixth treatments received control diets with 0.5%, 1%, 1.5% , 2% of marjoram leaf powder/kg diet. The supplementation of leaf powder obtained from marjoram at the concentration of 1.5% led to a statistically significant difference ($p \leq 0.05$) in egg production during the total period . In addition, a concentration of 1% resulted in ($p \leq 0.05$) an increase in egg mass and a reduction (improvement) in the feed conversion ratio (FCR). The study suggested the addition of medicinal herbs like marjoram leaf powder (*Origanum majorana*) at a dietary concentration of 1% kg can improve laying hens' productive performance.

Keywords: Egg production, egg mass, marjoram leaf powder, vitamin E, poultry nutrition

INTRODUCTION

Medicinal plants are used as a feed additives in poultry rations (26). They are rich in natural antioxidants, that improves poultry feed efficiency and maintaining product quality without adverse effects. These agents have active compounds including phenolics and flavonoids (20). For example, (*Origanum majorana* L.) is an aromatic and medicinal plant belonging to the mint family (Lamiaceae). Its distribution area includes much of the Mediterranean basin (8). Its a perennial shrub with simple, opposite, oval leaves, reaching a height of 30–60 cm. It has branching, forked stems, ranging from 10 to 13 mm in length. Its well-dried leaves are used in medicinal preparations. Its small, purple or white flowers have a pungent, aromatic scent reminiscent of camphor (25). Its essential oil can be used as a natural preservative in the food industry to prevent spoilage (13). It is also used to flavor many foods, especially sauces, soups, fish, meat, and canned foods (9). Research has shown that marjoram has a variety of medicinal properties. It is used in herbal medicine to treat various digestive

disorders and improve digestion, Some ancient peoples used it to treat colds and coughs, and for therapeutic purposes including topical cleansing of wounds and injuries (6).

Vitamin E is a term encompassing a group of antioxidant compounds, which include tocopherols and tocotrienols. It consists of four forms of tocopherol (alpha, beta, gamma, and delta) and four forms of tocotrienol (alpha, beta, gamma, and delta) (10). It is fat-soluble and, due to its antioxidant properties, protects cells and tissues from damage caused by free radicals (22). Vitamin E is a natural antioxidant, its play a vital role in maintaining growth and metabolic processes in animals, protecting them from the harmful effects of oxidative stress. (5),(19). It has various potential health benefits and plays a crucial role in human health and the prevention of certain diseases, including cardiovascular diseases and neurodegenerative disorders(7). Vitamin E is also used in dermatology, providing protection from photosensitivity and delaying skin aging (21).

Materials and Methods:

This experiment was conducted at the poultry farm of the Animal Production

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evaluate the effect of supplementation with different levels marjoram powder and vitamin E on the productive traits and some biochemical characteristics of the blood of laying hens. One hundred and twenty Lohmann White laying hens of 54 weeks were used including the initial period of 14 days to adapt the birds to the experimental conditions; the hens were randomly distributed into six treatments with five replicates per treatment, and four hens per replicate. The hens were housed in vertical battery cages, each battery containing four floors, with each floor containing five cages, The size of each cage were 40 x 30 x 35 cm. but The feed groups were: The first treatment received a basal feed

(as control) without any nutritional supplements. The first treatment (T1) was fed a basic feed as a control group without any nutritional additives. The second treatment (T2) was assigned to a control diet with 250 mg of vitamin E/kg in feed. Treatments (T3, T4, T5, T6) Fed the basic ration with added marjoram leaf powder (*Origanum majorana*) at levels of 0.5%, 1.0%, 1.5%, and 2.0%./ Kg diet, respectively. The duration of light and darkness throughout the experiment were set at sixteen hours a day and eight hours a night, respectively. The marjoram leaf powder was purchased from a local market in Kirkuk Governorate. It was manually mixed with the laying hen feed ingredients.

STUDIED TRAITS:

Percentage of Egg Production (%H.D): Eggs were collected daily at 2:00 PM over the experiment duration. The eggs were counted every day in each replicate through the length of the experiment. The experiment was divided into five periods (each 14-day long), then the average rate of egg production (H.D.) was calculated for each period using the formula described by Al-Zubaidi (4).
$$\text{Egg production rate H.D\%} = \frac{\text{Number of eggs produced in 14 days}}{(14 \text{ days} * \text{Number of hens present in 14 day})} * 100$$

Egg Mass (g/bird/day) : The mean egg mass for each 14-day period within the experiment was determined using average egg weight and the number of eggs produced per day in each replicate over 14 days, using the equation provided by Al-Fayyadh (3).
$$\text{Egg mass produced (eggs (g) /bird/day)} = \text{Egg production H.D\%} * \text{average egg weight (g) /100}$$

Feed Conversion Ratio: The feed conversion ratio was calculated based on the amount of feed consumed (g) and egg mass (g), according to the equation mentioned by Al-Zubaidi (4).
$$\text{Food Conversion Ratio (feed/ egg)}$$

mass) = Average feed consumption(g) over 14 days / Average egg mass produced(g) over 14 days.

Blood Examination: At the end of the rearing period (experiment), blood samples were taken from each replicate from the flank vein and placed in anticoagulant-free tubes. The serum was separated by centrifugation at 3000 rpm for 15 minutes. The serum samples were stored in sterile plastic tubes at -21°C. A state-of-the-art automated chemical analyzer manufactured by the Chinese company Biobase was used to estimate total serum protein. Analytical kits from the same company were used to analyze the concentrations of, total cholesterol, high-density lipoproteins (HDL), low-

density lipoproteins (LDL), and total protein, liver enzymes such as AST (Aspartate Aminotransferase) and ALT (Alanine Aminotransferase).

Statistical Analysis : A completely randomized design was used to study the effect of the treatments the statistical analysis was performed using the SAS program (23). The differences between the means were tested using Duncan's multiple limit test (14) at a statistical significance level of $P \leq 0.05$. according to the following mathematical model:

$$Y_{ij} = M + T_i + E_{ij}$$

Table 1 The ration used in the first experiment with its proportions and chemical composition

components	Usage rate
yellow corn	42
wheat	16
barley	8.2
Soybean meal (protein 48%)	19.5
Laymix2.5 *	2.5
limestone	7.7
Vegetable oil	2
Lysine	0.2
methionine	0.1
Dicalcium Phosphate	0.8
Choline Chloride 60%	0.25

salt	0.2
total	100
chemical composition **	
Represented energy (kilo calories / kilogram of feed)	2739
Crude protein %	15.75
Calcium %	3.67
%available phosphorus	0.53
methionine	0.46
methionine + cysteine %	0.63
Lysine %	0.97

* Laymix2.5 of Holland origin, each 1 kg of vitamin and mineral mixture provides: Vitamin A 400.000 IU/kg, Vitamin D3 60.000 IU/kg, Vitamin E 1.200 mg/kg, Vitamin K3 120 mg/kg, Vitamin B12 1.000 mg/kg, Vitamin B1 80 mg/kg, Vitamin B2 240 mg/kg, Vitamin B6 120 mg/kg, Biotin 4 mg/kg, Calcium D-Pantathionic 400 mg/kg, Folic Acid 40 mg/kg, Choline Chloride 16,000 mg/kg, Niacin 1.200 mg/kg, Fe 1.200 mg/kg, Zn 2.8 mg/kg, Cu 300 mg/kg, Mn 4 mg/kg, Se 10 mg/kg, Iodine 20 mg/kg.

** Chemical analysis calculated according to NRC (1994),(18).

Results:

Table (2): Effects of supplementation with marjoram leaf powder and vitamin E on the egg production rate (HD%) of laying hen. In the first period, it was found that there was significant ($P \leq 0.05$) difference between the 3rd, 4th, 5th and 6th treatments than the 1st and 2nd treatments. However, In second period, the 2nd, 6th treatments was significantly ($P \leq 0.05$) higher than the 1st and 3rd treatments, without significant differences from the 4th, 5th, treatments. During the third and fourth period between all treatments no significant differences were observed. While In the fifth period, the fifth

treatment was significantly ($P \leq 0.05$) higher than the 6th treatment but did not differ significantly from 1st, 2nd, 3rd, and 4th treatments. In the total period the 5th treatment was significantly ($P \leq 0.05$) higher than the 1st and 3rd treatments but it did not differ from 2nd, 4th and 6th treatments significantly.

Table (2): Effect of adding marjoram leaf powder and vitamin E to the diet of laying hens on the rate of egg production H.D % (standard error $\pm$ mean).

Treatments	First period	Second period	Third period	Fourth period	Fifth period	Total period
T 1	0.79 $\pm$ 78.57 b	0.35 $\pm$ 78.21 b	1.04 $\pm$ 75.35 a	1.18 $\pm$ 74.64 a	$\pm$ 75.35 0.66 ab	42.76 $\pm$ 0.40 c
T2	0.66 $\pm$ 78.92 b	1.18 $\pm$ 82.50 a	1.18 $\pm$ 78.21 a	0.87 $\pm$ 76.42 a	$\pm$ 76.42 0.66 ab	78.49 $\pm$ 0.47 ab
T3	1.42 $\pm$ 82.50 a	0.97 $\pm$ 78.57 b	1.07 $\pm$ 78.57 a	0.66 $\pm$ 75.35 a	$\pm$ 74.64 1.04 ab	77.92 $\pm$ 0.20 b
T4	1.42 $\pm$ 83.57 a	0.97 $\pm$ 80.35 ab	1.65 $\pm$ 77.50 a	1.53 $\pm$ 77.14 a	$\pm$ 75.71 0.91 ab	78.85 $\pm$ 0.56 ab
T5	0.91 $\pm$ 85.00 a	1.55 $\pm$ 81.42 ab	1.04 $\pm$ 77.14 a	1.21 $\pm$ 75.71 a	$\pm$ 77.73 0.95 a	79.40 $\pm$ 0.40 a
T6	0.71 $\pm$ 83.21 a	0.71 $\pm$ 82.85 a	1.73 $\pm$ 78.92 a	0.97 $\pm$ 75.00 a	$\pm$ 73.57 1.73 b	78.71 $\pm$ 0.29 ab
significant level	*	*	NS	NS	*	*

Treatment T1: control diet, Treatment T2: control diet + 250 mg/kg feed Vitamin E, Treatment T3: control diet +0.5 % / kg feed Marjoram leaf powder, Treatment T4: control diet +1% /kg feed Marjoram leaf powder, Treatment T5: control diet+ 1.5% /kg feed Marjoram leaf powder and Treatment T6 : control + 2% /kg feed Marjoram leaf powder.

* Means there is a significant difference at the level of significance ($P \leq 0.05$).

As for the characteristic of the egg mass ,Table (3) shows the effect of adding different levels of marjoram leaf powder and vitamin E to the

laying hen diet on egg mass. In the first period the 5th treatment significantly increased egg ($P \leq 0.05$) compared to the 1st,2nd,and 3th treatments, but it did not differ

significantly from 4th and 6th treatments. As for second period, no significant differences between all treatments were found. In the third period, the 6th treatment was significantly increased ($P \leq 0.05$) compared to 1st treatment, but it did not differ significantly from the 2nd, 3rd, 4th, and 5th treatments. But in the fourth period, the 4th treatment significantly increased ($P \leq 0.05$) compared to the 1st treatment, while

it did not differ significantly from the 2nd, 3rd, 5th, and 6th treatments. The results showed no significant differences among the experimental treatments during the in the fifth period. As for the total period, the 4th treatment significantly increased ($P \leq 0.05$) compared to the 1st, 2nd, 3rd, and 6th treatments without significant differences from the 5th treatment.

Table (3): Effect of adding marjoram leaf powder and vitamin E to the diet of laying hens on the average egg mass (eggs(g)/bird/day) (standard error $\pm$ mean).

Treatments	First period	Second period	Third period	Fourth period	Fifth period	Total period
T 1	0.34 $\pm$ 48.33 cd	0.61 $\pm$ 48.81 a	0.75 $\pm$ 47.12 b	1.18 $\pm$ 46.08 b	0.47 $\pm$ 47.77 a	0.27 $\pm$ 47.62 d
T2	0.59 $\pm$ 46.85 d	0.89 $\pm$ 50.83 a	0.74 $\pm$ 49.02 ab	0.36 $\pm$ 48.60 ab	0.73 $\pm$ 49.17 a	0.34 $\pm$ 48.91 bc
T3	1.35 $\pm$ 49.78 bc	0.76 $\pm$ 47.79 a	0.56 $\pm$ 48.55 ab	0.60 $\pm$ 47.22 ab	0.68 $\pm$ 47.37 a	0.26 $\pm$ 48.17 cd
T4	0.98 $\pm$ 51.96 ab	0.63 $\pm$ 50.78 a	0.93 $\pm$ 48.84 ab	0.84 $\pm$ 49.40 a	0.77 $\pm$ 48.92 a	0.21 $\pm$ 49.99 a
T5	0.62 $\pm$ 52.75 a	1.34 $\pm$ 51.08 a	0.52 $\pm$ 48.76 ab	0.88 $\pm$ 47.36 ab	0.53 $\pm$ 48.64 a	0.26 $\pm$ 49.72 ab
T6	0.80 $\pm$ 52.08 ab	2.18 $\pm$ 49.33 a	0.85 $\pm$ 49.80 a	0.75 $\pm$ 47.10 ab	1.14 $\pm$ 46.99 a	0.34 $\pm$ 49.09 b
significant level	*	NS	*	*	NS	*

Treatment T1: control diet, Treatment T2: control diet + 250 mg/kg feed Vitamin E, Treatment T3: control diet +0.5 % / kg feed Marjoram leaf powder, Treatment T4: control diet +1% /kg feed Marjoram leaf powder, Treatment T5: control diet+ 1.5% /kg feed Marjoram leaf powder and Treatment T6 : control + 2% /kg feed Marjoram leaf powder.

* Means there is a significant difference at the level of significance ($P \leq 0.05$).

Table (4) shows the effect of adding different levels of marjoram leaf powder and vitamin E to the feed of laying hens on the feed conversion ratio , During the first period, the fifth treatment showed a significant improvement($p \leq 0.05$) compared to 1st ,2nd, and 3th treatments , while it did not differ significantly from 4th and 6th treatments. For the second period, there were no significant differences between the treatments. In the third period, 6th treatment significantly improved ($p \leq 0.05$) than the 1st treatment , but did not differ significantly from the 2th, 3th, 4th , 5th treatments. As for In the fourth period, 4th treatments significantly

improved ($p \leq 0.05$) than the 1st treatment, but did not differ significantly from the other treatments. In the fifth period, no significant differences were observed between the treatments. In the total period, the fourth treatment recorded the best food conversion factor and amounted to 2.41 (gm of feed / gm of eggs), with a significant difference ($P \leq 0.05$) over the first treatment (control), which recorded a food conversion factor of 2.51. (gm of feed / gm of eggs), As its showed a significant improvement ($p \leq 0.05$) compared to the 1st ,2nd,3th and 6th not differing significantly from the 5th treatment.

Table (4): Effect of adding marjoram leaf powder and vitamin E to the feed of laying hens on the feed conversion ratio. (feed(g)/ egg mass(g)) (standard error $\pm$ mean).

Treatments	First period	second period	third period	fourth period	fifth period	total period
T1	0.01 $\pm$ 2.48 ab	0.03 $\pm$ 2.45 a	2.54 $\pm$ 0.03 a	0.06 $\pm$ 2.60 a	0.02 $\pm$ 2.51 a	0.015 $\pm$ 2.51 a
T2	0.03 $\pm$ 2.56 a	0.04 $\pm$ 2.36 a	2.44 $\pm$ 0.03 ab	0.01 $\pm$ 2.46 ab	0.03 $\pm$ 2.44 a	0.016 $\pm$ 2.45 bc
T3	0.06 $\pm$ 2.41 bc	0.03 $\pm$ 2.51 a	2.47 $\pm$ 0.02 ab	0.03 $\pm$ 2.54 ab	0.03 $\pm$ 2.53 a	0.013 $\pm$ 2.49 ab
T4	0.04 $\pm$ 2.30 dc	0.02 $\pm$ 2.36 a	2.45 $\pm$ 0.04 ab	0.04 $\pm$ 2.42 b	0.03 $\pm$ 2.45 a	0.010 $\pm$ 2.40 d
T5	0.02 $\pm$ 2.27 d	0.05 $\pm$ 2.35 a	2.46 $\pm$ 0.02 ab	0.04 $\pm$ 2.53 ab	0.02 $\pm$ 2.46 a	0.011 $\pm$ 2.41 dc
T6	0.03 $\pm$ 2.30 dc	0.1 $\pm$ 2.43 a	2.41 $\pm$ 0.04 b	0.04 $\pm$ 2.54 ab	0.06 $\pm$ 2.55 a	0.019 $\pm$ 2.44 bc
significant level	*	NS	*	*	NS	*

Treatment T1: control diet, Treatment T2: control diet + 250 mg/kg feed Vitamin E, Treatment T3: control diet +0.5 % / kg feed Marjoram leaf powder, Treatment T4: control diet +1% /kg feed Marjoram leaf powder, Treatment T5: control diet+ 1.5% /kg feed Marjoram leaf powder and Treatment T6 : control + 2% /kg feed Marjoram leaf powder.

* Means there is a significant difference at the level of significance ($P \leq 0.05$).

Table (5) shows the effect of adding different levels of marjoram leaf powder and vitamin E to laying hen diet on blood biochemical parameters, including high-density lipoproteins (HDL), low-density lipoproteins

(LDL), total protein, total cholesterol, and liver enzymes (AST, ALT). The results showed there were no statistically significant differences between treatments for any characteristics of the recorded characteristics.

Table (5): Effect of adding marjoram leaf powder and vitamin E to the diet of laying hens on total protein, total cholesterol, liver enzymes (AST, ALT), high-density lipoproteins (HDL), and low-density lipoproteins (LDL) (standard error $\pm$ mean).

Treatments	LDL mg/dL	HDL mg/dL	ALT U/L	AST U/L	T.cholesterol mg/dL	T.Protein mg/dL
T1	3.17 $\pm$ 42.68 a	2.48 $\pm$ 53.92 a	0.50 $\pm$ 11.16 a	4.38 $\pm$ 156.89 a	3.84 $\pm$ 128.46 a	0.71 $\pm$ 5.45 a
T2	1.66 $\pm$ 41.25 a	2.59 $\pm$ 52.09 a	0.75 $\pm$ 10.63 a	4.29 $\pm$ 158.93 a	4.21 $\pm$ 126.05 a	0.37 $\pm$ 5.49 a
T3	2.74 $\pm$ 41.31 a	6.34 $\pm$ 50.93 a	0.66 $\pm$ 10.03 a	7.05 $\pm$ 157.36 a	0.80 $\pm$ 127.98 a	0.08 $\pm$ 5.67 a
T4	2.03 $\pm$ 41.61 a	2.51 $\pm$ 54.63 a	0.49 $\pm$ 9.96 a	2.52 $\pm$ 157.40 a	2.42 $\pm$ 128.83 a	0.34 $\pm$ 5.49 a
T5	3.97 $\pm$ 40.05 a	4.27 $\pm$ 54.46 a	0.52 $\pm$ 10.20 a	6.21 $\pm$ 158.54 a	4.44 $\pm$ 129.23 a	0.91 $\pm$ 5.68 a
T6	3.29 $\pm$ 43.16 a	3.29 $\pm$ 52.42 a	0.63 $\pm$ 10.83 a	7.54 $\pm$ 154.02 a	1.78 $\pm$ 127.48 a	0.77 $\pm$ 5.73 a
significant level	NS	NS	NS	NS	NS	NS

Treatment T1: control diet, Treatment T2: control diet + 250 mg/kg feed Vitamin E, Treatment T3: control diet +0.5 % / kg feed Marjoram leaf powder, Treatment T4: control diet +1% /kg feed Marjoram leaf powder, Treatment T5: control diet+ 1.5% /kg feed Marjoram leaf powder and Treatment T6 : control + 2% /kg feed Marjoram leaf powder.

* Means there is a significant difference at the level of significance ($P \leq 0.05$).

Discussion

The results of the current study showed that adding (majorana) leaf powder in laying hen diets led to an increase in egg production characteristics, egg mass, and feed conversion ratio During the overall experimental period. There are limited data about effect of *Origanum majorana* powder on Production Performance in laying hen . The results of the present study are consistent with previous report that using oregano oils at different concentrations in the feed of laying hens resulted in significant differences ($P < 0.05$) in egg production rate, egg mass, and improved feed conversion ratio compared to the control treatments (16). This can be due to the high concentrations of phenols, flavonoids, and tannins, which are respectively the main active components in the marjoram extract acting as natural antioxidants capable of efficiently scavenging free radicals and protecting tissues from oxidative stress damage (12).. On the other hand the increased egg production could be due to the rapid stimulation of follicle growth and the increased number of developing follicles in the ovary. Gonadotropins such as follicle-stimulating hormone (FSH), which stimulates egg growth and maturation, and luteinizing hormone (LH), which plays a role in ovulation, may also be involved (11). Because egg mass is strongly correlated with average egg

weight and production rate , the increase in egg mass for marjoram leaf powder can be attributed to an accumulated effect of continued improvement in yolk weights from higher yolk contents, along with improved daily egg production rate that led to higher cumulative egg masses across the experiment (17). The study reported that dietary supplementation of 200 mg/kg oregano essential oil in broiler chickens improves gut immune system and protection against oxidative stress and increased performance (27). So, it was shown from another trial the Marjoram significantly increase ($P < 0.05$) some growth factors as bodyweight , weight gain and significantly improved feed conversion ratio (FCR) at 3rd, 5th weeks in comparison with the control group) in broilers. (24). while one study indicated that Marjoram (*Origanum majorana*) is characterized by wide range of bioactive compounds, including phenolic compounds such as thymol and carvacrol(6).which positively affect intestinal flora, In addition to their effectiveness in inhibiting pathogens within the digestive tract (2). Therefore, enhancement in feed conversion ratio could because of the addition of marjoram leaf extract containing these compounds , which can enhance productive performance and

physiological characteristics through its antioxidant and antibacterial activity in the digestive tract, thus promoting digestion and absorption in the intestines (1). Also the use of *Origanum majorana* has the ability to

improving the intestinal environment and increasing nutrient digestibility due to its significant impact on metabolic processes. It affects chicken health and nutrition (15).

Conclusion:

The present study concluded that the use of feed additives such as marjoram leaf powder at concentrations of 1% and 1.5%/kg feed in laying hen rations improved some production characteristics,

including egg production rate, egg mass, and feed conversion ratio.

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