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Using celery seed as a natural antioxidant with synthetic antioxidant (BHT) on the productive and physiological performance of laying hens.

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ABSTRACT

This study was conducted in the poultry field of the Animal Production Department, in College of Agriculture, University of Kirkuk, for the period from 1/9/2024 to 24/11/2024 for a period of 84 days, with the aim of studying the effect of using celery seeds as a natural antioxidant with the industrial antioxidant Butylated Hydroxy Toluene (BHT) on the productive and physiological performance of LOHMANN BROWN laying hens. 128 laying hens, 86 weeks of age, were used. The birds were randomly distributed into eight nutritional treatments, with four replicates for each treatment, and each replicate had four hens. The nutritional treatments were as follows: First treatment: Control feed free of celery seed additives and BHT, The second treatment: Adding 100 mg/kg of the synthetic antioxidant BHT ,Third treatment: Adding 1% of celery seeds, Fourth treatment: Adding 1.5% of celery seeds, Fifth treatment: Adding 2% of celery seeds, Sixth treatment: Adding 1% of celery seeds with the addition of 100 mg/kg of the synthetic antioxidant BHT, Seventh treatment: Adding 1.5% of celery seeds with the addition 100 mg/kg of the synthetic antioxidant BHT, Eighth treatment: Adding 2% celery seeds with 100 mg/kg of the synthetic antioxidant BHT, At the end of the nutritional study, blood samples were taken from the jugular vein of the 12-weeks-age chickens to conduct chemical blood analyses and some production traits. The results of the study showed a significant superiority (P≤0.05) of the eighth treatment over the control treatment in terms of egg production, egg mass, and feed conversion ratio. As for the blood chemical characteristics, there was a significant improvement (P≤0.05) in the level of glucose (mg/dl), cholesterol (mg/dl), high density lipoproteins mg/dl (HDL) and low density lipoproteins mg/dl (LDL), while there were no significant differences in the concentration of total protein (g/dl) and albumin (g/dl) in blood.

Keywords: Celery seed, BHT, Productive performance, Laying hens.

INTRODUCTION

Nutrition is one of the most important aspects of animal production projects, which constitutes approximately (60-70%) of the investment cost of egg and meat production projects [1] Among the nutritional additives such as spices, herbs and some types of plants, they were added to the feed to improve the flavor and enhance its sensory properties, which took a distinguished position in scientific research and those private to the production of poultry [2]. Many medicinal plants and herbs have been used in animal diets for the sake of the activity of their components, as growth stimulants [3], Antibacterial and antifungal [4], or improving the immune status [5]. Antioxidants [6]. Antioxidants found in nature may be either exogenous or endogenous. Endogenous antioxidants can be classified into enzymatic and non-enzymatic. There has been a global shift towards using natural substances found in medicinal plants as antioxidants [7]. Therefore, celery seeds *Apium graveolens* were chosen because they contain active ingredients such as flavonoids, terpenes, limonene and choline [8]. The celery plant is known mainly for its taste and aromatic smell due to it containing the compound L-3-n-butyphthalide [9]. Volatile oils constitute 1.3 -3% of seeds and fatty acids such as linoleic acid, palmitic acid and oleic acid [10]. In addition, it contains amino acids such as thyrosine, minerals such as calcium, potassium, sodium, iron, magnesium, phosphorus, and vitamins A, C, and E [5,11]. The celery plant has a positive effect on liver activity, in addition to its role in improving digestive factors [12]. The antioxidants that are formed naturally within cells are insufficient, which led to the manufacture of a group of compounds that act as antioxidants, which are called synthetic antioxidants, some of which are added to feed and rations for poultry birds to prevent oxidation. Their components are fats, sugars, and proteins, and among these compounds is the substance (BHT), Butylated Hydroxy Toluene, one of the important and strong synthetic antioxidants [13]. Adding it to bird feeds enhances their growth and productive performance, in addition to being a powerful antioxidant thanks to its ability to remove free radicals. It also contributes to causing changes in the properties of foods, including taste and color [14].

Materials and methods

This study was conducted in the poultry field of the Animal Production Department dedicated to scientific research at the College of Agriculture, Kirkuk University, for the period 15/8/2024 until 24/11/2024. The total duration of the study was 84 days, including 15 days as a preliminary period. The experiment was conducted using 128 LOHMANN BROWN laying hens at the age of 86 weeks. The chickens were raised in 4-storey (battery) cages, and the birds were randomly distributed into 8 nutritional treatments, with 4 replicates for each treatment, and 4 chickens for each replicate and , the nutritional treatments were as follows: First treatment: control diet free of celery seed additives and BHT, The second treatment: Adding 100 mg/kg of the artificial antioxidant BHT, Third treatment: Adding of 1% celery seeds, Fourth treatment: Adding 1.5% celery seeds, Fifth treatment: Adding 2% celery seeds, Sixth treatment: Adding of 1% of celery seeds with the addition of 100 mg/kg of the synthetic antioxidant BHT, Seventh treatment: Addition of 1.5% of celery seeds and addition of 100 mg/kg of the synthetic antioxidant BHT, Eighth treatment: Adding of 2% of celery seeds and addition of 100 mg/kg of the synthetic antioxidant BHT. The lights were available for 16 hours per day, and the duration of darkness was 8 hours. One battery consisted of four floors with one feeder for each floor, installed and separated manually. One floor consisted of four cages, each containing two chickens. The dimensions of each cage were (48 x 40 x 45). A continuous water system was provided through nipples connected to the water supply lines in each cage. The feed was manually provided at 8 am, amounting to 120 g/day/bird, the eggs were collected daily after 2 p.m, and the eggs were weighed twice a week using a sensitive balance, At the end of the nutritional experiment, blood samples were taken from the jugular vein of the 12-week-old chickens to conduct chemical analyses of their blood. The data were statistically analyzed using the SAS system [15]. Data were compared between means using Duncan's multinomial test [16]. Table 1 shows the chemical composition of feed materials for nutritional treatments, with the percentage ratios of their components.

Table 1: Chemical composition of feed materials for nutritional treatment diets, with percentages of feed components of laying hens

Feed materials	%
Ground wheat	15.8
Corn	47.9
Soybean 47%crude protein	22.3
Sunflower oil	1
Barley	4
DI-calcium phosphate	0.45
Limestone	9.54
salt	0.2
Methionine	0.06
Vitamins and minerals mixture	2.5
Choline	0.25
Total	100
Calculated chemical composition	
ME (calories\Kg feed)	2700
Crude protein %	16.1
Methionine %	0.47
Calcium %	4.38
Available phosphorus %	0.60
Choline chloride %	0.25
Lysine %	1

*1 kg of vitamin and mineral mixture contains: Vitamin A 8000 IU, Vitamin D 31500 IU, Vitamin E 1000 IU, K3 2 mg, B1 0.50 mg, B2 0.50 mg, B6 0.20 mg, B12 0.008 mg, Calcium 4 mg, Folic acid 0.05 mg, Nicotinic acid 6 mg, Iron sulfate 0.5 mg, Manganese sulfate 0.4 mg, Zinc sulfate 0.15 mg, Copper sulfate 0.4 mg, Cobalt chloride 0.01 mg.

**Chemical composition according to the National Reproductive Nutrition Council [17].

Results

Table 2: The effect of adding celery seed as a natural antioxidant with the industrial antioxidant BHT on egg production of laying hens, H.D%. The results of the statistical analysis in the first period showed no significant differences ($P<0.05$) between all experimental treatments compared to the control treatment. In the second period, the eighth treatment was significantly superior to the control and the rest of the treatments, as the rate for this trait was recorded as 80.41%. In the third period, it had no significant effect among the treatments compared to the control treatment. While it was noted that the eighth treatment outperformed all treatments in the fourth and fifth periods significantly, in addition to the control treatment, as the rate of this characteristic reached 74.03% and 81.94%, respectively. In the sixth period, the seventh and eighth treatments outperformed the rest of the treatments significantly compared to the control treatment. The trait rate of these two treatments reached (79.25, 76.75) %, respectively in the general average, results showed the eighth treatment outperformed all the treatments as it recorded the highest egg production, reaching 79.31%.

Table 2: The effect of adding celery seeds as a natural antioxidant with the synthetic antioxidant BHT on egg production for laying hens (H.D) % (mean ± standard error)

**Treatments	First period (14 days)	Second period (14 days)	Third period (14 days)	Fourth period (14 days)	Fifth period (14 days)	Sixth period (14 days)	General average periods (84 days)
T1	78.7±2.19 a	73.3±3.66 ab	75.9±3.28 a	71.1±1.18 bc	64.4±2.28 bc	69.2±3.96 ab	72.1±5.78 bc
T2	76.6±2.35 a	71.2±3.42 ab	72.5±5.28 a	71.5±4.41 bc	68.7±2.40 ab	75.2±3.11 ab	72.6±2.06 bc
T3	78.7±3.93 a	73.7±2.75 ab	74.5±1.44 a	69.1±3.86 bc	59.1±2.13 c	72.50±1.70 ab	71.2±2.74 bc
T4	74.5±3.21 a	67.9±2.57 b	70.1±3.88 a	68.4±1.82 c	60.5±3.55 bc	72.2±3.63 ab	68.9±1.35 c
T5	77.9±3.62 a	76.2±3.75 ab	80.7±1.35 a	78.8±1.53 ab	67.7±0.48 abc	65.7±1.79 b	74.5±2.54 abc
T6	77±3.49 a	73.7±3.28 ab	76.9±5.71 a	72.5±4.25 abc	64.4±4.26 bc	69.5±5.37 ab	72.3±1.96 bc
T7	82.5±4.73 a	77.5±3.08 ab	82.2±2.87 a	76±1.91 abc	67.7±4.03 ab	76.7±0.75 a	77.2±1.91 abc
T8	80.4±2.39 a	80.4±3.38 a	79.8±4.33 a	81.9±2.94 a	74±1.66 a	79.2±2.09 a	79.3±1.11 a

*Different letters within one column indicate the presence of significant differences at the level (P≤0.05).

**T1: control treatment, T2: Adding 100 mg/kg BHT to the diet,T3: Adding of 1% celery seeds,T4: Adding 1.5% celery seeds,T5: Adding 2% celery seeds,T6: Adding of 1% celery seeds + BHT colorant 100 mg/kg to the diet, T7: Adding 1.5% celery seeds + BHT colorant 100 mg/kg to the diet,T8: Adding 2% celery seeds + BHT colorant 100 mg/kg to the diet.

Table 3 showed the effect of adding celery seeds as a natural antioxidant with the synthetic antioxidant BHT on the egg mass of laying hens. The results of the statistical analysis in the first period indicate that there are no

Table 3: The effect of adding celery seed as a natural antioxidant with the synthetic antioxidant BHT on the egg mass of laying hens (mean ± standard error)

**Treatments	First period (14 days)	Second period (14 days)	Third period (14 days)	Fourth period (14 days)	Fifth period (14 days)	Sixth period (14 days)	General average periods (84 days)
T1	49.03±0.69 a	46.55±2.86 ab	50.13±2.17 ab	47.14±1.22 abc	40.83±0.92 bc	45.38±2.62 ab	46.51±1.33 c
T2	48.12±1.19 a	45.08±2.01 ab	47.38±3.82 ab	46.62±3.35 bc	43.93±1.69 abc	48.28±2.70 ab	46.56±0.76 c
T3	49.20±2.43 a	46.93±2.38 ab	47.19±1.23 ab	44.16±3.32 c	38.70±1.12 c	46.94±1.14 ab	45.52±1.51 c
T4	46.17±1.65 a	42.80±2.65 b	45.52±2.17 b	45.98±1.45 bc	38.56±2.52 c	46.25±1.69 ab	44.21±1.24 c
T5	48.82±1.90 a	49.66±3.09 ab	52.66±0.94 ab	51.91±1.45 ab	43.82±5.92 abc	42.14±0.90 b	48.17±1.75 abc
T6	49.02±1.81 a	47.13±2.35 ab	50.92±2.94 ab	47.55±2.74 abc	42.86±1.83 bc	45.36±2.80 ab	47.14±1.14 bc

T7	52.01±2.87 a	50.14±2.15 ab	55.02±2.44 a	50.56±0.76 abc	45.24±3.05 ab	50.22±0.88 a	50.53±1.29 ab
T8	49.61±1.80 a	52.20±2.16 a	52.96±4.94 ab	54±2.12 a	49.27±1.81 a	51.84±1.53 a	51.64±0.76 a

*Different letters within one column indicate the presence of significant differences at the level (P≤0.05).

**T1: control treatment, T2: Adding 100 mg/kg BHT to the diet,T3: Adding of 1% celery seeds,T4: Adding 1.5% celery seeds,T5: Adding 2% celery seeds,T6: Adding of 1% celery seeds + BHT colorant 100 mg/kg to the diet, T7: Adding 1.5% celery seeds + BHT colorant 100 mg/kg to the diet,T8: Adding 2% celery seeds + BHT colorant 100 mg/kg to the diet.

significant differences (P<0.05) between the treatments compared to the control treatment, In the second period, the eighth treatment outperformed the rest of the treatments, in addition to the control treatment, as it recorded 52.20 g eggs/bird/day, as we notice in the third period, the seventh treatment outperformed the rest of the treatments compared to the control treatment. The value of this trait was recorded at 55.2 g of eggs/bird/day. In the fourth and fifth periods, the eighth treatment outperformed the rest of the treatments compared to the control treatment, as its value reached 49.27g and 54g, respectively, eggs/bird/day. In the sixth period, the seventh and eighth treatments were significantly superior to the rest, as they recorded (51.84g and 50.22g) of eggs/bird/day, respectively. In the sixth period, the seventh and eighth treatments significantly outperformed the rest, as they recorded (51.84g, 50.22g) of eggs/bird/day, respectively. In the general average, results showed the eighth treatment outperformed the rest of the treatments compared to the control treatment, and the highest average for the egg mass trait was
51.64 g eggs/bird/day.

Table 4: The effect of adding celery seeds as a natural antioxidant with the synthetic antioxidant BHT on the feed conversion factor for laying hens (mean ± standard error)

**Treatments	First period (14 days)	Second period (14 days)	Third period (14 days)	Fourth period (14 days)	Fifth period (14 days)	Sixth period (14 days)	General average periods (84 days)
T1	2.44±0.03 a	2.60±0.16 ab	2.40±0.10 ab	2.55±0.06 ab	2.94±0.06 ab	2.67±0.15 ab	2.60±0.07 ab
T2	2.49±0.05 a	2.68±0.14 ab	2.58±0.21 ab	2.61±0.18 ab	2.74±0.11 abc	2.51±0.15 ab	2.60±0.03 ab
T3	2.54±0.11 a	2.57±0.12 ab	2.54±0.67 ab	2.76±0.18 a	3.10±0.09 ab	2.56±0.06 ab	2.67±0.09 a
T4	2.60±0.09 a	2.83±0.16 a	2.65±0.12 a	2.61±0.08 ab	3.15±0.23 a	2.60±0.11 ab	2.74±0.08 a
T5	2.46±0.08 a	2.44±0.15 ab	2.28±0.04 ab	2.31±0.06 b	2.74±0.05 abc	2.85±0.06 a	2.51±0.09 abc
T6	2.45±0.09 a	2.56±0.13 ab	2.38±0.14 ab	2.54±0.14 ab	2.81±0.12 abc	2.60±0.17 ab	2.55±0.06 ab
T7	2.33±0.14 a	2.40±0.09 ab	2.19±0.09 ab	2.37±0.03 ab	2.68±0.18 bc	2.39±0.04 b	2.39±0.06 bc
T8	2.42±0.08 a	2.31±0.09 b	2.28±0.11 ab	2.23±0.08 b	2.43±0.05 c	2.32±0.06 b	2.33±0.03 c

*Different letters within one column indicate the presence of significant differences at the level (P≤0.05).

**T1: control treatment,T2: Adding 100 mg/kg BHT to the diet,T3: Adding of 1% celery seeds,T4: Adding 1.5% celery seeds,T5: Adding 2% celery seeds,T6: Adding of 1% celery seeds + BHT colorant 100 mg/kg to the diet, T7: Adding 1.5% celery seeds + BHT colorant 100 mg/kg to the diet,T8: Adding 2% celery seeds + BHT colorant 100 mg/kg to the diet.

Table 4 shows the effect of adding celery seeds as a natural antioxidant with the synthetic antioxidant BHT on the feed conversion ratio of laying hens. The results of the statistical analysis in the first period indicate that there are no significant differences (P<0.05) between the experimental treatments compared to the control treatment. In the second period, the eighth treatment improved over the fourth treatment, but it is similar to the rest of the treatments, as it recorded 2.31 g feed/g eggs, and over the control treatment, which recorded 2.60 g feed/g eggs. In the third period, the feed conversion ratio improved in the fifth, seventh, and eighth treatments, which recorded (2.28g, 2.19g, 2.28g) feed/g eggs, respectively, compared to the control treatment, which recorded 2.40 g feed/g eggs. We note in the fourth and fifth periods that the feed conversion ratio improved in the eighth treatment, which reached (2.23g, 2.43g) feed/g eggs, respectively, compared to the control treatment,

which recorded (2.55g, 2.94g) feed/g eggs, respectively. In the sixth period, the seventh and eighth treatments improved significantly, recording (2.39g, 2.32g) feed/g eggs compared to the control treatment, which recorded 2.67 g feed/g eggs, respectively. We also note that the general average improved the feed conversion ratio in the eighth treatment significantly over the rest of the treatments, which recorded the best improvement, which was 2.33 g feed/g eggs compared to the control treatment, which recorded 2.60 g feed/g eggs.

Table 5 shows the effect of adding celery seeds as a natural antioxidant with the synthetic antioxidant BHT on the blood

Table 5:The effect of adding celery seed as a natural antioxidant with the synthetic antioxidant BHT on the blood biochemical characteristics of laying hens (mean ± standard error)

	Total portion (g/dl)	Albumin (g/dl)	Glucose (mg/dl)	Cholesterol (mg/dl)	(HDL) (mg/dl)	(LDL) (mg/dl)
**Treatments						
T1	5.70±0.55 a	1.75±0.14 a	167.25±47.2 ab	133.7±4.26 bcd	60.50±2.87 ab	69.37±6.84 dc
T2	5±0.05 a	1.66±0.17 a	229±31.0 a	159.7±2.13 ab	34.75±4.46 dc	115±10.0 ab
T3	6.03±0.23 a	1.73±0.01 a	204.5±15.2 ab	121.2±5.54 cd	30.75±3.68 dc	79.85±8.93 bdc
T4	5.15±0.19 a	1.72±0.10 a	170.2±11.4 ab	150±11.7 bc	23.75±3.32 d	108.8±15.2 abc
T5	4.96±0.39 a	1.96±0.17 a	181.7±17.9 ab	164.2±4.34 ab	38.75±9.42 dc	121.2±8.87 ab
T6	5.50±0.13 a	1.91±0.04 a	168.7±3.09 ab	188±3.62 a	48±6.16 bc	129±14.1 a
T7	4.84±0.67 a	1.81±0.07 a	157.2±7.00 ab	142±21.8 bc	74±7.11 a	61.72±20.9 b
T8	5.83±0.57 a	1.76±0.04 a	149.7±7.33 b	110±7.90 d	73.25±7.97 a	44.44±12.8 b

*Different letters within one column indicate the presence of significant differences at the level (P≤0.05).

**T1: control treatment,T2: Adding 100 mg/kg BHT to the diet,T3: Adding of 1% celery seeds,T4: Adding 1.5% celery seeds,T5: Adding 2% celery seeds,T6: Adding of 1% celery seeds + BHT colorant 100 mg/kg to the diet, T7: Adding 1.5% celery seeds + BHT colorant 100 mg/kg to the diet,T8: Adding 2% celery seeds + BHT colorant 100 mg/kg to the diet.

chemical characteristics of laying hens. The statistical analysis of total protein and albumin showed that there were no significant differences at the level (P<0.05) between the experimental treatments compared to the control treatment. As for glucose concentration, we note that in the second treatment it increased and reached 229 mg/dl, which differed significantly across all treatments, while the eighth treatment improved and recorded the best treatment in glucose concentration in the blood serum of chickens, as it recorded 149.7 mg/dl at the level (P<0.05) compared to the rest of the experimental treatments. The results of the statistical analysis in the eighth treatment showed at the level (P<0.05) a reduction in the percentage of cholesterol in the blood serum, as it reached 110 mg/dl compared to all experimental treatments. The results of the study showed statistical analysis at the level of significance (P<0.05) an increase in the level of high-density lipoprotein in the seventh and eighth treatments, which recorded (73.25, 74) mg/dl compared to the rest of the experimental treatments. The results of the study indicated A significant decrease at the level of (P<0.05) in the rate of low-density lipoprotein in the seventh and eighth treatments, which reached (44.44, 61.72) mg/dl compared to the rest of the experimental treatments

discussion

The significant improvement in productive traits (egg production, egg mass, feed conversion ratio) results from the addition of celery seeds, due to the compounds in celery such as flavonoids, d-limonene, b-selinene, and volatile oils. These compounds are considered antioxidants and play a role in influencing the anterior lobe of the pituitary gland, especially the secretion of FSH and LH hormones, thus leading to an increase in their production [3] In addition, it contains vitamins A, B1, B2, and minerals such as calcium, phosphorus, magnesium, and iron[18] On the other hand, the improvement in blood chemical properties is due to the effective antioxidant role of celery seeds in reducing blood glucose, which leads to the proper production of insulin hormone to maintain blood glucose levels within a normal range [12] The decrease in cholesterol levels is also due to the celery seeds containing antioxidants that have proven effective as free radical scavengers such as Methy propanol, B-selinene, Octadecenamide-2 and inhibitors of linolic acid oxidation [19] Flavonoids found in celery seeds lead to an increase in the level of high-density lipoproteins and play a role in enhancing the effectiveness of inhibiting lipoprotein oxidation, and the decrease in LDL levels indicates that celery seeds contribute to changing lipoprotein metabolism by increasing the number of low-density lipoprotein receptors [20].

Conclusion

The results of the study showed that adding celery seed powder at a rate of 2% with the addition of 100 mg/kg of the artificial antioxidant BHT feed resulted in a significant improvement in the production characteristics (egg production, egg mass, feed conversion ratio) in addition to an improvement in the blood chemical characteristics (total protein, glucose, high-density lipoproteins, low-density lipoproteins) in the blood plasma of laying hens. This is related to the activity of antioxidants present in celery seeds, which play a role in protecting cells from oxidative damage, as well as the ability of (Apium graveolens) to improve immunity due to the biochemical compounds, vitamins and important minerals found in its components.

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استخدام بذور الكرفس كمضاد طبيعي مع مضادة الاكسدة الصناعية BHT على الأداء الانتاجي والفسلجي لدجاج البياض.

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الخلاصة
أجريت هذه الدراسة في حقل الدواجن تابع لقسم الانتاج الحيواني في كلية الزراعة جامعة كركوك للفترة 2024/9/1 ولغاية 2024/11/*24* ولمدة *84* يوم بهدف دراسة تأثير استخدام بذور الكرفس كمضاد طبيعي مع مضادة الأكسدة الصناعية بيوتيل هيدروكسي تولوين (*BHT*) على الأداء الانتاجي والفسلجي لدجاج البياض نوع *LOHMANN BROWN* .استخدم فيها *128* دجاجة بياضة بعمر86 اسبوع وزعت الطيور عشوائياً الى *8* معاملات تغذوية بواقع *4* مكررات لكل معاملة ولكل مكرر*4* دجاجات وكانت المعاملات التغذوية كما يلي: المعاملة الاولى:عليقة السيطرة خالي من اضافات بذور الكرفس ومادة *BHT*، المعاملة الثانية :إضافة 100 ملغم/ كغم من العليقة مضادة الاكسدة الصناعي*BHT*، المعاملة الثالثة: إضافة بنسبة 1% من بذور الكرفس، المعاملة الرابعة: إضافة بنسبة 1.5% من بذور الكرفس، المعاملة الخامسة: إضافة بنسبة 2% من بذور الكرفس، المعاملة السادسة: إضافة بنسبة 1% من بذور الكرفس مع إضافة 100ملغم/كغم من العليقة مضادة الاكسدة الصناعي *BHT*، المعاملة السابعة: إضافة بنسبة 1.5% من بذور الكرفس مع إضافة 100ملغم/كغم من العليقة مضادة الاكسدة الصناعي *BHT*، المعاملة الثامنة: إضافة بنسبة 2% من بذور الكرفس مع اضافة 100 ملغم/كغم من العليقة مضادة الاكسدة الصناعي *BHT*.وفي نهاية الدراسة التغذوية تم أخذ عينات الدم الدجاج من الوريد الوداجي والبالغة 12 اسابيع لإجراء تحاليل الكيميائية لدمها، وبعض الصفات الانتاجية. أظهرت نتائج الدراسة تفوق معنوي (*P≤0.05*) لمعاملة الثامنة معنوياً على معاملة السيطرة من ناحية انتاج البيض، كتلة البيض، معامل تحويل الغذائي اما بالنسبة الصفات الكيميائية الدم الحصول تحسن معنوي(*P<0.05*) في مستوى الكلوكوز(*mg/dl*) والكولسترول (*mg/dl*) والبروتين الدهني *mg/dl*(*HDL*) والبروتين الدهني *mg/dl* (*LDL*) بينما لم تكن هناك فروق معنوية بنسبة تركيز البروتين الكلي(*g/dl*) والالبومين (*g/dl*) في الدم.
الكلمات المفتاحية: بذور الكرفس، مادة (*BHT*)، الاداء الانتاجي، دجاج بياض.