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Effect of using lycopene compared with BHT antioxidants on productive performance in Lohmann Brown laying hens.

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ABSTRACT

The experiment was conducted on 112 Lohmann Brown hens at the Poultry Farm / Kirkuk University / College of Agriculture, for 70 field days, from 10/2/2023 until 11/28/2023, with 14 days as a preparatory period. The birds were distributed to (7) treatments, (4) replicate, and (4) birds/replicate, as follows: - T1: Adding BHT, standard company recommendations, 250 mg/kg-diet, T2, T3 and T4 Adding lycopene for 1, 1.5 and 2 gm/kg-diet, T5: Add lycopene of 1 g/kg diet + BHT colorant 250 mg/kg diet, T6: Add lycopene of 1.5 g/kg diet + BHT 250 mg/kg diet, T7 add lycopene of 2 gm/kg diet + BHT 250 mg/kg diet. The results from the experiment were: At a significant level about the average of productive traits, the seventh treatment recorded the highest egg production rate (90.25%), with all addition treatments outperforming the control treatment, which recorded the lowest measured percentages (77.22%), and the highest egg mass. Eggs weighed in the fourth treatment, which recorded (57.37) grams, with all treatments exceeding the control treatment (48.60) grams. As for the food conversion ratio in the fourth treatment, A significant improvement in the food conversion factor was observed in all addition treatments compared to the control, with the best improvement recorded (2.01) compared to the control treatment, which was recorded (2.36).

***Keywords*:** lycopene, BHT, productive performance, laying hens.

INTRODUCTION

Scientific research has begun to reduce the use of medicines and drugs [1]. Plants are valuable natural resources that provide essential nutrients. natural treasures as they provide an important source of nutrients [2]. Consumers have also accepted natural additives because they have good results in improving the product, whether eggs or meat [3]. The process of producing eggs causes stress on the bird's body and leads to the synthesis of free radicals that negatively affect the health of the bird and the final product that humans consume [4]. Recently, some researchers discovered that the use of industrial antioxidants, such as (BHT) Butylated Hydroxyl Toluene, has bad side effects on the health of the organism when they accumulate in the body [5]. Lycopene has antioxidant properties and is found in many nutrition, like tomatoes, vegetables, and the pigment that gives the fruit its red color [6]. It is considered one of the most powerful natural antioxidants that protects the body's cells from damage from free radicals by oxidative stress [7]. It also plays an important role in lowering triglycerides and cholesterol through the deposition of this pigment in blood serum [8]. This study aimed to demonstrate the effect of adding the natural antioxidant lycopene compared to synthetic BHT on the productivity and biochemistry of blood components of laying hens. Improving the state of antioxidants and fat peroxidation in the body.

MATERIALS AND METHODS

The experiment was conducted on 112 Lohmann Brown hens in the poultry fields / College of Agriculture / University of Kirkuk, for a period of 70 days for the period from 10/2/2023 to 11/28/2023, which included 14 days as an introductory period, and the laying hens were fed the diet according to Table (1) where the birds were distributed as (7) treatments, (4) replicates, and (4) birds for the replicate, as follows: T1: Adding BHT, 250 mg/kg feed, T2,T3 and T4 Adding lycopene for 1, 1.5 and 2 gm/kg, T5: Add lycopene at of 1 g/kg to the diet + BHT 250 mg/kg diet, T6: Add lycopene at of 1.5 g/kg diet + BHT 250 mg/kg diet, T7 add dried lycopene at a rate of 2 gm/kg diet + BHT 250 mg/kg diet.

statistical analysis

data were analysis by using Completely Randomized Design (CRD) to analyze the data of the studied coefficients in productive traits using the statistical program SAS (2005), and the significant differences between the means were tested using the Duncan multilevel test [9]. to test the significance at the significance level (0.05). As in the following mathematical model- :

$Yij = \mu + Ti + eij$

Table 1 shows the components of poultry feed and their calculated chemical composition included in feeding laying hens

%	ingredients
23.02	Wheat
41.00	Corn
20.50	Soybean meal
3.50	Sun flower oil
9.63	Limestone
1.83	Dicalcium phosphate
0.20	Salt
0.149	Methionine
0.068	Lysine
0.10	vitamins and minerals
100	Total
Calculated chemical composition	
2900.67	energy (calories/kg feed)
16.4231	Crude protein %
0.397297	methionine %
0.809559	Lysine %
4.0986	Calcium %
0.3546	Available phosphorus %*

Different letters within the same column indicate significant differences ($P \leq 0.05$) between treatments.

Table (2) effect of using lycopene compared with BHT antioxidants on egg production(H.D%) of laying hens (mean ± standard error)

General mean	fourth period	third period	Second period	first period	treatments
77.22±2.26b	82.29±2.62b	78.62±2.25c	71.42±1.26c	78.57±3.17d	T1**
84.99±2.77a	92.70±3.55a	83.93±3.17	79.46±2.12b	83.9±1.03cd	T2
83.81±1.59a	87.50±1.70a	82.14±1.45abc	80.35±1.62b	85.26±2.45dc	T3
86.23±1.55a	86.46±2.62a	82.59±0.85ab	82.59±0.85ab	90.17±1.85abc	T4
87.34±1.56a	89.58±1.20ab	86.16±1.68ab	83.48±0.44ab	90.17±185abc	T5
87.512±1.97a	87.55±1.74ab	88.84±2.56ab	82.14±1.92ab	91.51±3.37ab	T6
90.25±1.67a	92.71±2.62a	89.73±1.84a	85.71±1.92a	92.85±0.72a	T7

Results:

The data in Table (2) shows significantly differences in the results of the statistical analysis. Therefore, we note that the production rate in the first period was higher in the seventh treatment than in the control, as it reached 92.85%, and did not differ significantly from the fourth, fifth, and sixth treatments, which recorded (90.18, 90.17, 91.51) % as well. It was observed in the second and third period that the seventh treatment continued to outperform (85.71 and 89.73) %, respectively. The fourth measurement, second and seventh treatments outperformed (92.70 and 92.71) % over the control treatment. We also notice in the general average that all the transactions outperformed the control treatment significantly, with the seventh treatment remaining in the lead by recording the highest productivity of 90.25%

** ControlT1: Adding BHT, standard company recommendations, 250 mg/kg feed, T2, T3 and T4 Adding lycopene desiccant for 1, 1.5 and 2 gm/kg, T5: Add lycopene dryer at a rate of 1 g/kg to the diet + BHT colorant 250 mg/kg to the diet, T6: Add lycopene dryer at a rate of 1.5 g/kg to the diet + colorant. BHT 250 mg/kg per diet, T7 add dried lycopene at a rate of 2 gm/kg per diet + BHT 250 mg/kg per die

Table (3) effect of using lycopene compared with BHT antioxidants on the average egg weight of laying hens (g/bird) (mean ± standard error)

General mean	fourth period	third period	Second period	first period	treatments
62.48±1.28a	62.40±1.66a	62.83±2.73a	65.49±1.42a	59.23±1.74b	T1**
63.57±1.21a	64.20±2.75a	63.10±1.80a	66.43±1.29a	60.56±1.81b	T2
60.02±3.41a	65.22±1.53a	63.59±1.38a	64.80±1.22a	64.47±0.88ab	T3

66.47±1.99a	63.74±2.61a	62.56±1.88a	68.58±1.23a	71.01±1.95a	T4
63.14±1.22a	66.00±2.35a	61.50±3.37a	64.33±1.05a	60.73±1.51b	T5
62.64±0.56a	61.70±1.23a	63.50±1.23a	63.73±2.04a	61.66±1.69ab	T6
63.14±0.53a	62.66±1.50a	61.89±1.76a	63.70±1.40a	64.31±1.35ab	T7

Table (4) effect of using lycopene compared with BHT antioxidants on the egg mass rate of laying hens (g/hen/day) (mean ± standard error)

General mean	fourth period	third period	Second period	first period	Treatments
48.60±1.04b	51.36±2.23a	50.05±2.15a	46.80±1.53b	2.36±46.19c	T1**
54.00±1.07a	59.57±3.76a	52.93±2.41a	52.72±0.63ab	50.78±0.98bc	T2
54.07±1.45a	57.09±1.92a	52.22±1.21a	51.93±1.79ab	55.04±2.33abc	T3
57.37±2.70a	55.25±3.66a	53.61±2.00a	56.64±3.59a	63.99±4.26a	T4
55.20±2.46a	59.20±2.81a	53.05±3.44a	53.70±2.59ab	45.86±3.90abc	T5
54.83±1.65a	53.97±2.05a	56.49±2.64a	52.36±2.15ab	56.50±3.05ab	T6
56.97±0.99a	58.01±2.20a	55.61±2.54a	54.56±1.31a	59.69±0.99ab	T7

The results in table (3) for the means of egg weight show that in first period, the fourth treatment (P≤0.05) compared to other treatments, as it recorded 71.01 g, while it did not differ significantly with the third, sixth and seventh treatments, which recorded (64.31, 61.66, 64.47) g, respectively, which in turn outperformed the T1, which recorded the lowest measured value of 59.23 g, while we did not notice significant differences with the T2 and the T5, which recorded (60.73, 60.56) g. It was also shown that there were no significant differences between the experimental treatments and the T1 in the second, third and fourth periods and the general average

* Different letters within the same column indicate significant differences (P≤0.05) between treatments.

** ControlT1: Adding BHT, standard company recommendations, 250 mg/kg feed, T2,T3 and T4 Adding lycopene desiccant for 1, 1.5 and 2 gm/kg, T5: Add lycopene dryer at a rate of 1 g/kg to the diet + BHT colorant 250 mg/kg to the diet, T6: Add lycopene dryer at a rate of 1.5 g/kg to the diet + colorant. BHT 250 mg/kg per diet, T7 add dried lycopene at a rate of 2 gm/kg per diet + BHT 250 mg/kg per die

Table (4) for the egg mass trait shows the data of the statistical analysis that the fourth treatment (P≤0.05) was superior among the treatments, which recorded the highest value of 63.99 g/hen/day in the first period. In addition, we note the superiority of the sixth and seventh treatments, which recorded (59.69, 56.50) g/hen/day, respectively, over the T1, which recorded the lowest value of 46.19 g/hen/day. At the same time, we did not observe any significant differences between T2,T3 and T5 compared to the control treatment. As we notice from the table in the second period, T4 and T7 outperformed if they recorded (56.64, 54.56) g/hen/day respectively over the T1 which recorded the lowest egg mass of 46.80 g/hen/day but there are no significant differences with other of the experimental treatments compared to T1. As for the third and fourth periods, there weren't any significant differences between the addition treatments and T1 for the trait of average egg weight. As for the general average, we notice from the table the superiority of all experimental treatments compared to T1 which recorded the lowest mass of 48.60 g/hen/day g/hen/day compared to the T4 which recorded the highest egg mass of 57.37 g/hen/day.

* Different letters within the same column indicate significant differences (P≤0.05) between treatments.

** ControlT1: Adding BHT, standard company recommendations, 250 mg/kg feed, T2, T3 and T4 Adding lycopene desiccant for 1, 1.5 and 2 gm/kg, T5: Add lycopene dryer at a rate of 1 g/kg to the diet + BHT colorant 250 mg/kg to the diet, T6: Add lycopene dryer at a rate of 1.5 g/kg to the diet + colorant. BHT 250 mg/kg per diet, T7 add dried lycopene at a rate of 2 gm/kg per diet + BHT 250 mg/kg per die

In Table (5), we note in the statistical analysis of the measurements that in the first period, the feed conversion ratio improved in the T4 and T7, which recorded (1.81, 1.92) compared to T1, which recorded the lowest percentage of 2.50, while it not differs in the rest of the experimental treatments with T1. We also note in the second period a significant improvement in the FC factor for T2, T4, T5, and T7, which recorded (2.18, 2.05, 2.15, 2.11) compared to T1, which recorded 2.46, and did not record a significant difference in the rest of the treatments. As for the third and fourth periods, we note from the table no significant differences between the experimental treatments and T1. As for the general average, we note a significant improvement in FCR in all additional treatments compared to the first treatment (control), which recorded 2.36, compared to the fourth treatment, which recorded the best conversion factor, which was 2.01.

** ControlT1: Adding BHT, standard company recommendations, 250 mg/kg feed, T2, T3 and T4 Adding lycopene desiccant for 1, 1.5 and 2 gm/kg, T5: Add lycopene dryer at a rate of 1 g/kg to the diet + BHT colorant 250 mg/kg to the diet, T6: Add lycopene dryer at a rate of 1.5 g/kg to the diet + colorant. BHT 250 mg/kg per diet, T7 add dried lycopene at a rate of 2 gm/kg per diet + BHT 250 mg/kg per die

Discussion:

[10] The reason for the improvement in egg production and egg weight may be attributed to the addition of lycopene, a natural antioxidant, compared to T1. These active compounds added to these treatments work to restrict free radicals, thus protecting the body from free radical damage [6]. They also increase the work of antioxidants in the body and inhibit lipid

peroxidation and protect cells from damage [11]. It reduces oxidative damage to free radicals [12]. These compounds work to maintain the materials for the growth of ovarian follicles [6], most of
which consist of fatty substances. The role of treatments as antioxidants in poultry feed works on the defense line of lipoproteins that enter into the formation of yolk against oxidation, thus leading to an abundance of these materials [14]. Therefore, it works to mature the ovarian follicles in a shorter time than in layers that do not eat certain levels of antioxidants in the feed. Therefore, it is recommended to follow a diet rich in lycopene, as it is good at preventing disease. These compounds also regulate the metabolism of body fat and encourage the deposition of materials important for growth of the ovary follicle [13]. Thus, it leads to increased egg production [14]. Researchers have shown that lycopene plays a role

Table (5) effect of using lycopene compared with BHT antioxidants on the feed conversion ratio of laying hens (mean ± standard error).

General mean	fourth period	third period	Second period	first period	treatments
2.36±0.05 a	2.25±0.10 a	2.30±0.09 a	2.46±0.08 a	2.50±0.12 a	T1**
2.13±0.04 b	1.95±0.12 a	2.18±0.09 a	2.18±0.02 b	2.26±0.04 ab	T2
2.13±0.05 b	2.02±0.06 a	2.20±0.05 a	2.22±0.08 ab	2.10±0.08 bc	T3
2.01±0.09 b	2.10±0.13 a	2.15±0.08 a	2.05± b0.12	1.81±0.11 c	T4
2.09±0.10 b	1.95±0.09 a	2.19±0.14 a	2.15±0.10 b	2.12±0.14 bc	T5
2.10±0.06 b	2.14±0.08 a	2.04±0.09 a	2.20±0.09 ab	2.05±0.11 bc	T6
2.02±0.03 b	1.99±0.07 a	2.08±0.09 a	2.11±0.05 b	1.92±0.03 c	T7

Indefiance the liver from damage by protecting cell membranes from oxidative damage caused by free radicals, thus preventing damage and deterioration that occurs in liver cell membranes from oxidation [6]. It works to maintain cellular metabolic functions, so it leads to an increase in the process of yolk deposition in developing eggs, which works to increase egg mass [15]. It is known that the components of egg yolk from the liver have an adverse effect on the metabolic activity of hepatocytes due to free radicals that have the ability to destroy cell membranes by lipid peroxide or oxidation and polyunsaturated fatty acids with double bonds [16]. For this reason, we note the superiority of birds treated with natural antioxidants lycopene over birds treated with control and artificial antioxidants (BHT) in egg mass, egg production, and FCR. Natural antioxidants outside the body are of great importance in protecting fats and unsaturated fatty acids. This may be due to their efficiency as natural antioxidants from oxidation and rancidity in feed outside the body by inhibiting lipid peroxidation and preventing free radicals that attack and destroy fats [17]. causing a significant decrease in the feed value of the fat and also a decrease in the ability to utilize energy as they work to prevent the separation of hydrogen atoms from the double bond site, thus preventing oxidation and lipid peroxidation, thus leading to increased utilization of feed fats and also increased utilization of the energy released from this. This is reflected in a positive improvement in the efficiency of food conversion for natural antioxidant treatments [17]. This is what we notice in the improvement in the results of the food conversion efficiency table.

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تأثير استخدام الليكوبين مقارنة بـ BHT كمضادات للأكسدة في الأداء الإنتاجي للدجاج البياض لوهمان البني.

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الخلاصة
اجريت التجربة على 112 طائر لوهمان براون في حقول الدواجن/كلية الزراعة/جامعة كركوك لمدة 70 يوما حقليا للمدة من 2023/10/2 ولغاية 2023/11/28 والتي شملت 14 يوما فترة تمهيدية. وزعت الطيور على (7) معاملات. و (4) مكررات و (4) طيور للتكرار كما يلي: - ***T1***: إضافة ***BHT*** حسب التوصيات القياسية للشركة 250 ملغم/كغم علف، ***T2***: إضافة مسحوق اللايكوبين بمعدل 1 غم/كغم علف، ***T3***: إضافة مسحوق اللايكوبين بمعدل 1.5 غم/كجم علف، ***T4***: إضافة مسحوق اللايكوبين بمعدل 2 غم/كغم علف، ***T5***: إضافة مسحوق اللايكوبين بمعدل 1 غم/كغم علف + إضافة ***BHT 250*** ملغم/كغم علف ***T6***: يضاف مسحوق اللايكوبين بمعدل 1.5 غم/كغم علف + إضافة ***BHT 250*** غم/كغم علف ***T7*** يضاف مسحوق اللايكوبين بمعدل 2 غم/كغم علف + إضافة ***BHT 250*** ملغم/كغم علف. وكانت النتائج التي تم الحصول عليها من التجربة: عند مستوى معنوي (***P<0.05***) بالنسبة لمعدل الصفات الإنتاجية سجلت المعاملة السابعة أعلى معدل لإنتاج البيض (90.25%)، مع تفوق جميع معاملات الإضافة على معاملة السيطرة، والتي سجلت أقل النسب المقاسة (77.22%)، وأعلى معدل كتلة البيض في المعاملة الرابعة حيث سجل (57.37) جرام، مع تجاوز جميع المعاملات لمعاملة السيطرة (48.60) جرام، وكان أفضل معامل تحويل غذائي. في العلاج الرابع (2.01). كما تفوقت جميع المعاملات على معاملة السيطرة التي بلغ معامل تحويلها (2.36).

الكلمات المفتاحية: الليكوبين***,BHT***، الأداء الإنتاجي , الدجاج البياض.