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The Response of Broiler to the Addition of Different Levels of Nutmeg and Vitamin E to the Diet for Reducing the Effect of Oxidative Stress

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Abstract

This experiment was conducted in the poultry farm of the Animal Production Department / College of Agriculture / Anbar University, for the period from 1/12/2020 until 11/1/2021 for (42 days). The experiment aims to compare the addition of different levels of nutmeg and one level of vitamin E to the diet on the productive performance of broiler from the age of 1-42 days. Furthermore, the oxidative stress was created by adding hydrogen peroxide (H2O2) to drinking water from 21-42 days at a concentration of 0.5% for all treatments except for the negative control treatment for twice a day, was used in the experiment, 300 unsexed chicks (308 Ross) at age of one day with an average weight of 40g, and were randomly distributed to 6 treatments by 3 replicates per treatment, each replicates contained 13 chicks. The treatments included the following: • T1 Control • T2 Adding H2O2 to drinking water at a concentration of 0.5% • T3 Vitamin E of 300 mg kg feed + H2O2 to drinking water at a concentration of 0.5% • T4 Nutmeg of 2 g per kg feed + H2O2 to drinking water at a concentration of 0.5% • T5 Nutmeg of 4 g per kg feed + H2O2 to drinking water at a concentration of 0.5%• T6 Nutmeg of 6 g per kg feed + H2O2 to drinking water at a concentration of 0.5%•. The results showed that there were no significant differences in live body weight, weight increase ,and feed conversion Ratio, while significant differences occurred between treatments in the weight gain and feed intake rate during the sex week, where there was a significant increase ($P \leq 0.05$) for treatment T3 compared with treatment T5, and it did not differ significantly compared with other treatment in a weight increase rate. the sixth week, significant superiority was obtained for the treatments T1, T2 ,and T3 compared with treatment T5 in feed intake. and no significant differences were observed between the treatments in the cumulative period (0 - 6 weeks) in the weight gain, feed intake and feed conversion ratio.

Keywords: nutmeg, vitamin E, oxidative stress

Introduction

Poultry feed is often contaminated with a wide range of environmental toxins and bacterial and fungal toxins known to influence the intestines. Once these toxins are submitted with epithelial cells or during absorption, the digestive system is significantly affected by expulsion of oxidative stress (Wu et al. 2010). The oxidative stress in poultry produces from environmental, nutrition, microbiological, and administrative factors that negatively affect poultry health and production. Anxiety stress in cells/tissue produces imbalances between free and self-defense and antioxidant defense and leads to fat oxidation, protein nitrates, DNA damage, and die of

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programmed cells. Cells are constantly exposed to free roots during physiological oxygen metabolism (Estevez,2015). The excessive production of interactive oxygen (ROS) and interactive types (RNS) through the metabolism of oxygen is also equipped with oxidation composition and oxidation disposal rate (Kurutas,2016), and oxidative stress hurt the intestinal mucosa and hinder the efficiency of digestion and absorption of nutrients Natural growth of animals (Yara et.al.,2013). The food insertion of antioxidants reduces gastrointestinal radicals and also helps maintain intestinal mucosa. Most synthetic antioxidants that are widely used are Hydroxy Tuline Butyl (BHT) and Hydroxy Yanzol Botel (BHA) which have been restricted by liver damage and capacity to cause cancer. The primary function of vitamin E is to prevent the formation of peroxides of free radicals in fat cells by blocking the beginning of the formation of these free radicals that interact with proteins, nucleic acids, lipids, etc., change their composition and cause tissue damage (Jena et.al.,2013and Nafea and Ahmed,2020), Therefore, in the current scenario, it has been severely focused on the search for new and natural antioxidants of food plants because they can protect the human body from different diseases caused by damage to fat, proteins and nuclear acids (Hinneburg et.al.,2006) and became necessary strategic formulation Cost-effective for relieving oxidative stress. Including the use of nutmeg. Is dried nucleus for wide oval seeds Family Family Myristica Fragrans Houtt (Myristicaceae) is widely used as a spice and in alternative medicine. They have been reported to contain sexual aphorsim and anti-microbial properties (Okwu,2001), and anti-diarrhea (Grover et.al.,2002) anti-inflammatory and anti-inflammatory properties For cancer (Olajide et.al.,1999). Hartanto et.al.(2019) and Nafea (2018) there was found that the addition of nutmeg oil to the chicken breast diet reduced the malondialdehyde value and inhibited the oxidation of fats resulting from heat stress. (

Jukic et.al.(2006) found that the aglycone fraction, enzymatically isolated from glycosidically isolated volatiles of nutmeg, possesses a higher antioxidant capacity compared with free volatiles from its essential oil. Another view that favors the antioxidant role of eugenol in nutmeg could be that it promotes the activities of catalase, superoxide dismutase, glutamine transferase, glutathione peroxidase, and glucose-6-phosphate dehydrogenase enzymes (Kumaraveluet et.al.,1996). The main cause of the nutmeg choice for this study is that although its traditional use in many medical cases, nutmeg is not assessed comprehensively for antioxidants and antibiotics, which can contribute to a variety of active plant chemicals including vitamins and carotenes, Tribonoid, Qaloids, Flavonoids, Peeling and Minol, etc. These compounds make their impact across different mechanisms such as radical scenes, metal, and fat plucks and extinguish oxygen shirts to work as antioxidants (Jukic et.al.,2006) . The research also proved to add good nut powder for the broiler diet has led to an increase in production performance of body weight, weight gain, feed consumption ,and feed conversion ratio (Onunkwo and Ukoha,2017).

MATERIAL AND METHODS

This experiment was conducted in the poultry farm of the Animal Production Department / College of Agriculture / Anbar University, for the period from 1/12/2020 until 11/1/2021 for (42 days), where the Nutmeg Powder and vitamin E were added to the diet from one day to the end

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of the experiment. Furthermore, the oxidative stress was created by adding hydrogen peroxide (H_2O_2) to drinking water from 21-42 days at a concentration of 0.5% for all treatments except for the negative control treatment for twice a day, in the experiment, 300 unsexed chicks (308 Ross) were used at age of one day with an average weight of 40g Belgian origin, from the Al-Rafidain hatchery, located in Abu Ghraib, and were randomly distributed to 6 treatments by 3 replicates per treatment, each replicates contained 13 chicks. The treatments included the following: • T1 Control • T2 Adding H_2O_2 to drinking water at a concentration of 0.5% • T3 Vitamin E of 300 mg kg feed + H_2O_2 to drinking water at a concentration of 0.5% • T4 Nutmeg of 2 g per kg feed + H_2O_2 to drinking water at a concentration of 0.5% • T5 Nutmeg of 4 g per kg feed + H_2O_2 to drinking water at a concentration of 0.5%• T6 Nutmeg of 6 g per kg feed + H_2O_2 to drinking water at a concentration of 0.5%• The birds were fed on a starter, growth and finisher diet (Table 1) , and the recommended health and preventive program was followed by the specialized veterinarian for the duration of the rearing period. . The chicks were weighed at the end of each week individually, where calculate the following traits were calculated as follows: • Live body weight rate = Birds total weight at the end of the week / the bird's number at the end of the week •Weight gain = Average body weight at the end of the week - average body weight at the beginning of the week (Al-Fayadh and Naji,1989) • Feed intake = Amount of consumed feed during the week the number of live birds at the end of the week / • Feed conversion ratio = Amount of consumed feed the / weight gain rate of the birds.

Statistical analysis

Data were analyzed based on a completely randomized design by using the General Linear Models Procedure in SPSS (2020). Pens were treated as the experimental unit. Significant differences among treatment groups were further analyzed using Duncan's multiple-range test (Duncan,1955). A significant level of $P < 0.05$ was implemented.

Table (1) The diets used in the experiment and the calculated chemical composition

Components	Starter diet (1-11 day)	Growth diet (12-21 day)	Finisher diet (22-42 day)
corn	30	29.7	42
wheat	23	27	19.5
Soya bean meal	35.65	31.5	26.5
Protein conc.	5	5	5
Oil	4.2	5	5.5
Limestone	1.2	1.12	1.05
DiCa Ph.	0.6	0.45	0.2
DL-Methionine	0.2	0.13	0.1
L-Lysine	0.05	0.0	0.05
salt	0.1	0.1	0.1
Calculated chemical composition			

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Crude protein%	22.8%	21.49%	19.47%
Metabolizable energy (Kcal/kg feeding)	3001	3095	3207
Fibers	2.85	2.80	2.65
Fat	6.52	7.37	8.10
Lysine	1.44	1.29	1.19
Methionine+ Cysteine	1.10	0.99	0.91
Ca%	0.96	0.89	0.79
Available p%	0.47	0.44	0.39

* Brocorn-5 special W protein concentrate produced by (WAFI BV ALBLASSERDAM HOLLAND) crude protein 40%, crude fat 5%, crude fibers 2.20%, moisture 7.13%, ash 28.32, Calcium 4.50%, phosphorous 2.65%, available phosphorous 4.68%, Lysine 3.85%, Methionine 3.70%, Methionine + Cysteine 4.12%, Tryptophan 0.42%, Threonine 1.70%, Metabolizable energy 2107, Selenium 2.30%, copper 4%.

** The chemical composition values were calculated according to N.R.C (1994)

***The diets were created based on the 2009 ROSS company manual.

Result and Discussion

- **Average body weight**

Table (2) shows the Effect of adding Nutmeg and Vit E to the diet on average body weight (g) for the broiler. It is also clear that there were no statistically significant differences between the treatments for all weeks in the experiment. These results were in agreement with Hartanto et.al.(2019), These results were not consistent with Ukpong(2019) who found a significant ($p < 0.05$) improvement in daily body weight gain, feed conversion ratio ,and protein efficiency by the addition of *Monodora myristica* (nutmeg) into the diets at 0.25, 0.5, 0.75 ,and 1.0% inclusion.

Table (2) Effect of adding Nutmeg and Vit E to the diet on average body weight (g) for broiler (average± standard error)

Treatments / **weeks**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**Significance level**
1nd week	126.36 ±3.83	128.05± 7.88	123.47 ±5.43	128.33± 11.61	136.67± 2.19	131.67± 2.85	N.S
2nd week	326.59 ±15.10	338.47 ±21.18	341.38± 11.45	309.33± 17.46	339.00± 10.58	330.33± 12.35	N.S
3rd week	683.00± 45.39	671.33 35.41	693.33± 21.06	623.33± 40.17	672.67± 12.67	657.00± 15.62	N.S
4th week	1215.67± 42.05	1190.00±39.53	1212.67± 30.37	1137.33± 56.02	1179.67± 24.88	1146.67± 41.17	N.S
5th week	1798.00± 89.32	1830.00± 63.34	1812.00± 82.37	1757.67± 49.54	1758.67± 34.80	1723.00± 27.01	N.S
6th week	2456.33 ±102.51	2480.33 ±88.83	2506.00± 78.83	2356.33± 54.85	2183.00± 179.57	2346.67± 34.65	N.S

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* N.S.: Not significant at significant level (P≤0.05).

a, b, c: The different letters within a single row indicate a significant difference between the treatments at a significant level (P≤0.05). T1: control,T2 Adding H2O2 0.5% , T3 Vitamin E of 300 mg kg feed + H2O2 0.5% , T4 Nutmeg of 2 g per kg feed + H2O2 0.5% , T5 Nutmeg of 4 g per kg feed + H2O2 0.5%, T6 Nutmeg of 6 g per kg feed + H2O2 0.5%

- **weight gain**

Table (3) shows the effect of adding Nutmeg and Vit E to the diet on average weight gain (g) for broiler, it was also evident that there were no statistically significant differences between the treatments for all weeks and the cumulative period (0 - 6 weeks) except for the sixth week, where there was a significant increase (P≤0.05) for treatment T3 compared with treatment T5, and it did not differ significantly compared with other treatments. Vitamin E (tocopherols) are fat-soluble and have antioxidant efficacy and properties to protect cell membranes from oxidation (Traber and Atkinson (2007). Niu et.al.(2009) found that Vitamin E a role in body weight gain (BWG) was effective. Moreover, Rajput et.al.(2009) found that broiler chickens fed a flexible diet with 300 mg vitamin E had greater BWG than the control group. During the total period (0-6 weeks) Hartanto et.al.(2019) were not seen any significant differences in the weight gain rate between treatments when using two levels of nutmeg oil (250 and 500 ppm) / kg feed compared to the control treatment.

Table (3) Effect of adding Nutmeg and Vit E to the diet on average weight gain (g) for broiler (average± standard error)

Treatments / **weeks**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**Significance level**
1nd week	84.42±4.17	85.70± 7.15	80.97± 5.05	85.39± 11.54	93.93± 2.12	90.00± 3.11	N.S
2nd week	200.23 ±12.03	210.41±13.31	217.91± 10.04	181.00± 10.02	202.33± 12.73	198.67± 11.05	N.S
3rd week	356.41± 32.37	332.87± 14.26	351.95± 9.94	314.00± 24.01	333.67± 20.73	326.67± 9.26	N.S
4th week	532.67± 37.10	518.67± 30.67	519.33 ±9.33	514.00± 28.59	507.00± 31.56	489.67± 29.55	N.S
5th week	582.33± 54.50	640.00± 45.00	599.33 ±52.15	620.33± 23.13	579.00± 21.93	576.33± 35.47	N.S
6th week	658.33± 17.84 ab	650.33± 35.35 ab	694.00± 12.50 a	598.67± 9.40 ab	424.33± 153.24 b	623.67± 17.64 ab	*
0nd – 6th week	2414.39± 102.69	2437.98± 87.24	2463.50± 78.90	2313.39± 54.35	2140.27± 179.63	2305.00 ±34.55	N.S

* N.S.: Not significant at significant level (P≤0.05).

a, b, c: The different letters within a single row indicate a significant difference between the treatments at a significant level (P≤0.05). T1: control,T2 Adding H2O2 0.5% , T3 Vitamin E of

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300 mg kg feed + H2O2 0.5% , T4 Nutmeg of 2 g per kg feed + H2O2 0.5% , T5 Nutmeg of 4 g per kg feed + H2O2 0.5%, T6 Nutmeg of 6 g per kg feed + H2O2 0.5%.

- **Feed intake (g)**

Table (4): shows the Effect of adding Nutmeg and Vit E to the diet on feed intake rate (g) for broiler, In the first week, a significant superiority was obtained (P≤0.05) for treatment T5 compared to treatment T2, and it did not differ significantly with other treatments, and in the second week the treatments T1, T2 ,and T3 significantly exceeded (P≤0.05) compared to the treatments of nutmeg (T4, T5 ,and T6). In the third week, a significant superiority was obtained (P≤0.05) for treatment T1 compared to treatment T5 and did not differ significantly with other treatments, and in the fourth week, a significant superiority was obtained (P≤0.05) for the treatments of nutmeg (T4, T5 ,and T6) compared to T1 and T2 treatments, except for treatment T3, which did not differ with T5, In the fifth week there was a significant superiority (P≤0.05) for treatment T4 compared to the two treatments T2 and T5. In the sixth week, significant superiority was obtained for the treatments T1, T2 ,and T3 compared with treatment T5, and no significant differences were observed between the treatments in the cumulative period (0 - 6 weeks). These results agreed with Godwin (2019). The superiority of nutmeg treatments during the fourth and fifth weeks in the rate of feed consumption is that nutmeg stimulates the appetite by adding taste, color ,and texture to the feed and protects it from oxidation by microbes (Susheela,2000). It also increases secretions. Bile, pancreas, and stomach (Esmail,2004). During the total period (0-6 weeks) Hartanto et.al.(2019) were not seen any significant differences in the feed consumption rate between treatments when using two levels of nutmeg oil (250 and 500 ppm) / kg feed compared to the control treatment. Whereas, hydrogen peroxide (H2O2) led to a decrease in the amount of feed intake (FI) by deteriorating health status and reducing the appetite for feed due to oxidative stress (Ahmed and Nafea,2017).

Table (4) Effect of adding Nutmeg and Vit E to the diet on feed intake rate (g) for broiler (average± standard error)

Treatments / **weeks**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**Significance level**
1nd week	120.73 ±5.96 ab	98.05± 9.74 b	103.45 ±7.94 ab	111.00 ±8.72 ab	124.67± 4.70 a	120.67± 7.62 ab	*
2nd week	329.00± 15.82 a	329.67± 8.84 a	324.67 7.42 a	273.33± 6.36 b	265.00± 5.03 b	266.00 ±7.00 b	*
3rd week	546.00 ±17.50 a	529.63± 0.69 ab	519.33± 9.68 ab	458.67 ±45.05 b	472.67± 20.30 ab	472.33 ±9.94 ab	*
4th week	652.33± 35.18	640.67± 39.77	668.67± 17.38	822.00± 49.08	770.67 ±36.32	809.00± 19.67	*

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	c	c	bc	a	ab	a	
5th week	1021.33 ±2.33 ab	927.00± 29.37 c	1021.33± 11.05 ab	1033.33± 27.44 a	942.67± 34.91 bc	976.00± 29.16 abc	*
6th week	1135.33± 31.17 a	1153.67± 6.77 a	1142.67 ±25.86 a	1088.00± 44.53 ab	1025.33± 6.36 b	1094.67 ±36.59 ab	*
0nd – 6th week	3804.73± 31.88	3678.69± 73.90	3780.11 62.39	3786.33± 131.87	3601.00± 65.27	3738.67± 41.53	N.S

* N.S.: Not significant at significant level (P≤0.05).

a, b, c: The different letters within a single row indicate a significant difference between the treatments at a significant level (P≤0.05). T1: control,T2 Adding H2O2 0.5% , T3 Vitamin E of 300 mg kg feed + H2O2 0.5% , T4 Nutmeg of 2 g per kg feed + H2O2 0.5% , T5 Nutmeg of 4 g per kg feed + H2O2 0.5%, T6 Nutmeg of 6 g per kg feed + H2O2 0.5%.

- **Feed conversion ratio (g feed / g weight gain)**

Table (5 shows the Effect of adding Nutmeg and Vit E to the diet on feed conversion ratio for the broiler. shows that there are no significant differences between the treatments in the second, third, fifth ,and sixth weeks, and the cumulative duration (0-6 weeks). In the first week, there was a significant deterioration (P≤0.05) for treatment T1 compared to T2, and it did not differ significantly from other treatments. In the fourth week, a significant deterioration occurred (P≤0.05) for treatment T6 compared to T1 (control), and treatment T6 did not differ significantly with treatments T4 and T5, the reason for the high percentage of nutmeg being a natural antioxidant, where Fdeas (2009) stated that the negative effect of antioxidants Oxidation depends on the dose. Increasing its use at high rates leads to lowering the immunity of the birds, impedes the absorption of minerals and leads to the deviation of the metabolic pathways (Ajoudi,2013) . The result is consistent with what Godwin (2019) who found in terms of a deterioration of the feed conversion ratio (FCR) with an increased proportion of nutmeg addition compared to the control group. During the total period (0-6 weeks) Hartanto et.al.(2019) were not seen any significant differences in the feed conversion ratio (FCR) between treatments when using two levels of nutmeg oil (250 and 500 ppm) / kg feed compared to the control treatment.

Table (5) Effect of adding Nutmeg and Vit E to the diet on feed conversion ratio (g feed / g weight gain) for broiler (average± standard error)

Treatments / **weeks**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**Significance level**
1nd week	1.44 ±0.13 a	1.14 ±0.02 b	1.28 ±0.04 ab	1.33 ±0.09 ab	1.33±0.07 ab	1.34±0.05 ab	*
2nd week	1.66 ±0.18	1.58 ±0.14	1.50±0.07	1.52±0.09	1.32 ±0.10	1.35±0.10	N.S
3rd week	1.57 ±0.20	1.60 ±0.07	1.48 ±0.02	1.46±0 .05	1.42±0.03	1.45±0.02	N.S
4th week	1.24±0.13	1.25 ±0.13	1.29 ±0.01	1.60±0.01	1.54 ±0.14	1.66±0.11	*

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	c	bc	bc	ab	abc	a	
5^{th} week	1.79 ±0.18	1.46 ±0.08	1.73 ±0.14	1.67±0.05	1.63±0.10	1.70±0.08	N.S
6^{th} week	1.73±0.02	1.78 ±0.10	1.65±0.04	1.82±0.05	2.41±2.24	1.75±0.03	N.S
0^{nd} – 6^{th} week	1.58±0.06	1.51±0 04	1.53±0.02	1.64±0.02	1.71±0.18	1.62±0.01	N.S

* N.S.: Not significant at significant level (P≤0.05).

a, b, c: The different letters within a single row indicate a significant difference between the treatments at a significant level (P≤0.05). T1: control,T2 Adding H2O2 0.5% , T3 Vitamin E of 300 mg kg feed + H2O2 0.5% , T4 Nutmeg of 2 g per kg feed + H2O2 0.5% , T5 Nutmeg of 4 g per kg feed + H2O2 0.5%, T6 Nutmeg of 6 g per kg feed + H2O2 0.5%

conclusion

The results of the study noted the absence of significant differences between the six treatments in each of the Average weekly body weight In week six and weight gain, Total feed Intake, feed conversion efficiency During the total period (0-6 weeks).

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