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EFFECT OF ADDING ALLICIN IN BROILER DIET ON SOME PHYSIOLOGICAL CHARACTERISTICS AND OXIDATION INDICATORS

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Abstract

This study was conducted at the field of poultry - Abu Gharib, Department of Animal Production, College of Agricultural Engineering Sciences, University of Baghdad, during the period from 12/10/2019 to 24/11/2019 duration (42 days), to demonstrate the effect of adding different levels of Allicin to the broiler diet in its productive, physiological and immunogenicity performance and some indicators of, total of 225 Ross 308 chicks was used. Birds were randomly distributed into five treatment groups which were: First treatment T1: without additives to diet (control), other treatments T2, T3, T4, T5 was added Allicin at a rate of (800, 600, 400, 200 mg/Kg diet) respectively and Allicin was added from first day until the end of the experiment for all addition treatments, results of this experiment showed: The results of this study indicated that there were no significant differences in the Lipid profile of broiler at the age 21 days and 42 days when adding Allicin to broiler diet in all treatments, While the results indicated the presence of highly significant differences ($P<0.01$) in some oxidation indicators in blood plasma at the age 21 days if T3, T4 and T5 treatments recorded a significant decrease in the characteristic of maloneldhyde compared to the control treatment and T2 treatment, Likewise, all addition treatments recorded a significant decrease ($P <0.05$) in the peroxide value compared to the control treatment ,while no significant differences were recorded between all treatments in the percentage of free fatty acids, in the other hand the results of the addition of Allicin in some oxidation indicators in the blood plasma at the age 42 days showed a high significant decrease in ($P <0.01$) in the value of maloneldhyde and the value of peroxide in T5, T4, T3, T2 treatments compared to the control treatment T1, While the T5, T4, T2, T1 treatments coefficients recorded a significant decrease ($P<0.05$) in the percentage of free fatty acids compared to the T3 treatment.

Key words: Allicin, Lipid profile, oxidation indicators, broiler.

Introduction

With a lot of pressure in the poultry industry to use many materials, whether they are antibiotics, minerals, vitamins and others among the materials that will lead to better production and physiological performance with the use of antibiotics, he faces great criticism for the presence of bacteria that are resistant to them, as well as the survival of these drugs in meat (Iji *et al.,* 2001), therefore, there is a greater focus on finding new ways to maximize bird health and well-being some extent from the early stages, hence the motivation to study plants and medicinal herbs, extracts and active substances in them and the role that they can play in assessing bird performance, as the use of growth stimuli of natural origin in recent years has become of great importance (Iji *et al.,* 2001), the overview of natural products is largely safe and harmless when compared to their chemically manufactured counterparts, as they were one of the reasons consumers increasingly favored them and their widespread use in medicine and agriculture (Slusarenko *et al.,* 2008). The newly crushed garlic contains compounds such as Allicin, Allen, Agoyen, dialecaldeethylene, and s-allylcysteine. Garlic can be used as natural food additives in poultry feed and has a great benefit and value especially for broilers. this is due to the anti-bacterial, anti-inflammatory, antiseptic, and anti-parasitic properties of garlic, and garlic is used as a stimulant in various dishes, medicines, antioxidants, antihypertensive, anti-aging, hypoglycemic, anti-platelet ,and detoxification of heavy metals (Agarwal, 1996 and Marilynn, 2001). Allicin is a natural organic sulfur compound obtained from garlic belonging to the family of Alliceae(Vaidya *et al.,* 2009 and Block *et al.,* 2010), because the efficacy of garlic Allium sativum is due to its contain of sulfur-Allicin with a distinct smell (Cavallito and Bailey, 1944), it has many biological properties and is responsible for the pungent aroma and

taste of garlic, whether it is fresh or powder (Slusarenko *et al.,* 2008) and it also has a different set of physiological effects that make Allicin important in medical applications since garlic has been used for centuries because of its health-promoting properties (Newman *et al.,* 2000). Allicin possesses anti-bacterial and fungicide-inhibiting activity (Bautista *et al.,* 2005; Vaidya *et al.,* 2009; Block *et al.,* 2010) and likewise has antioxidant, anti-inflammatory and anti-stress activity (Qureshi *et al.,* 1983), It reduces oxidative stress (Choudhary, 2008) and has stimulant and stimulating effect (Cho *et al.,* 2006). The presence of garlic powder with various (biologically active) compounds such as polysulfide's, vinyldithiins and Allicin means that not all health-promoting activities in the formulations can be categorically attributed toAllicin Directly, therefore, the trend has recently been turned to the use of Allicin in feeding domestic poultry because of its medicinal properties Therefore, this study came to indicate the addition of Allicin with different concentrations in the diet. Broiler meat to know its effect on physiological and immunological. This study is the first of its kind for this substance in Iraq.

Materials and Methods

Birds and Dietary treatment

This study was conducted at the field of poultry - Abu Gharib, Department of Animal Production, College of Agricultural engineering Sciences, University of Baghdad, during the period from 12/10/2019 to 24/11/2019 duration (42 days), to demonstrate the effect of adding different levels of Allicin to the broiler diet in its productive, physiological and immunogenicity performance and some indicators of, total of 225 Ross 308 chicks was used. Birds were randomly distributed into five treatment groups which were: First treatment T1: without additives to diet (control), other treatments T2, T3, T4, T5 was added Allicin at a rate of (800, 600, 400, 200 mg/Kg diet) respectively, Allicin the active ingredient extracted from garlic, is used in this study as a powder, as it was added at various levels to the broiler diets to determine their effect on physiological and oxidative indicators and Allicin was added from first day until the end of the experiment for all addition treatments, All the treatments gave ad libitum diet and water in all the experiment period and the diet contents chosen as a (NRC, 1994) which showed in table 1.

Blood samples and analysis

At the termination of the study, at 21 and 42 days of experiments, 6 birds per group totaling 2 birds per treatment replication, was removed randomly for blood collection. Blood samples (1 mL/bird) were collected from the ulnaris wing vein into EDTA tubes. within two hours after blood samples were collected, they were centrifuged (4000 × *g*, for 10 min at room temperature) to separate plasma from blood cells, Blood parameters analyzed in this study were cholesterol, triglycerides, very low density lipoprotein(VLDL), high density lipoprotein (HDL), low density lipoprotein (LDL) and some oxidation indicators maloneldhyde, peroxide value, percentage of free fatty acids.

Statistical analysis

Completely randomized design (CRD) was used to study the effect of different treatment in all traits Duncan (1955) and multiple range tests was used to compare the significant differences between means. Data were analyzed by using statistical analysis system (SAS, 2012).

Results and Discussion

Noticed from two tables 2, 3 effect of adding Allicin in the broiler diet at different levels on Lipid profile were

Table 1: Percentage composition of the experimental diets.

Types of diets	Initiator 1-10 day	Growth 11-24 day	Final 25-42 day
Corn	47.7	45.7	58.6
Wheat	10	15.2	4.1
Soybean Meal[1]	33	28.9	26.2
Protein[2]	5	5	5
Hydrogenated Vegetable Fat	2	3.2	4.1
Dicalcium Phosphate	0.7	0.5	0.4
Na Cl	0.3	0.2	0.2
limestone	1.1	1.1	1.2
Mix vitamins and minerals	0.2	0.2	0.2
Total	100	100	100
Chemical Calculated Values[3]			
M.E. Kcal/ Kg Diet	3000.5	3103.7	3204.65
Crude Protein %	23.0	21.5	20.0
Methionine %	0.50	0.48	0.47
Lysine, %	1.32	1.21	1.13
Ca %	0.92	0.87	0.87
Available P %	0.47	0.424	0.41

[1]Soybean cake used an Argentine source of crude protein content by 48% and 2440 Kcal/Kg M.E.

[2] Protein Meal User Product From Netherlands Origin (Brocon) Contain 40% Crude Protein 0.2107 Kcal/Kg Protein M.E., 0.5% Crude Fat 2.20% Crude Fiber 5%, Calcium 4.68%, Phosphorus 3.85% Lysine 4.12%, Methionine 4.12%, Methionine Plus Cysteine 0.42%, Tryptophan 0.38%, Threonine 1.70%. It Contains A Mixture Of Vitamins And Minerals Needed Believes Rare Birds Of These Elements.

[3]Based on (NRC, 1994).

Table 2: The effect of addition of Allicin on Lipid profile of in broiler at the age of 21 days (mean ± standard error).

Blood Plasma Treatments	Cholesterol (mg/100 ml plasma)	Tri Glyceride (mg/100 ml plasma)	HD (mg/100 ml plasma)	LDL (mg/ 100 ml plasma)	VLDL (mg/100 ml plasma)
T1	142.66 ± 5.36	111.00 ± 6.65	96.66 ± 1.45	18.00 ± 3.60	28.00 3.05
T2	133.66 ± 7.21	105.00 ± 7.21	8.33 ± 4.91	15.33 ± 1.33	30.00 ± 1.00
T3	136.00 ± 14.57	84.00 ± 12.12	92.66 ± 13.42	17.77 ± 2.72	25.66 ± 1.45
T4	132.33 ± 7.68	98.33 ± 12.19	91.00 ± 4.58	15.66 ± 2.02	25.66 ± 2.33
T5	140.66 ± 12.73	99.00 ± 7.02	97.00 ± 8.50	16.00 ± 4.50	27.66 ± 1.20
Significance	N.S	N.S	N.S	N.S	N.S

Means having with the different letters in same column differed significantly *(P<0.05), **(P<0.01). N.S: Non-Significant.

Table 3: The effect of addition of Allicin on Lipid profile of in broiler at the age of 42 days (mean ± standard error).

Blood Plasma Treatments	Cholesterol (mg/100 ml plasma)	Tri Glyceride (mg/100 ml plasma)	HD (mg/100 ml plasma)	LDL (mg/ 100 ml plasma)	VLDL (mg/100 ml plasma)
T1	115.00 ± 7.63	106.33 ± 20.83	77.33 ± 5.23	12.33 ± 0.33	25.33 ± 2.84
T2	135.33 ± 3.33	93.33 ± 3.66	90.33 ± 4.33	17.66 ± 2.90	27.33 ± 2.96
T3	136.33 ± 9.82	112.66 ± 35.89	87.66 ± 6.22	20.00 ± 4.61	28.66 ± 7.26
T4	109.66 ± 3.84	65.33 ± 18.88	79.00 ± 4.58	14.33 ± 2.18	16.33 ± 1.76
T5	120.00 ± 13.74	88.00 ± 18.00	80.66 ± 7.68	16.66 ± 2.40	22.66 ± 3.85
Significance	N.S	N.S	N.S	N.S	N.S

Means having with the different letters in same column differed significantly* (P<0.05), ** (P<0.01). N.S: Non-Significant.

no significant differences in the Lipid profile of broiler at the age 21 days and 42 days when adding Allicin to broiler diet in all treatments.

Table 4 showed a High significant (P<0.01) in the value of malalonehyde and the value of peroxide when adding Allicin to the broiler meat age (21 days), then the T3, T4 and T5 transactions recorded a significant decrease in the characteristic of malalonehyde compared to the T2 and T1 factors in When the addition factors T2, T3, T4 and T5 recorded a decrease in the value of peroxide compared to the control treatment T1, while no significant differences appeared in the percentage of free fatty acids in this week among all the treatments.

Table 4: The effect of addition of Allicin on oxidation indicators of in broiler at the age of 21 days (mean ± standard error).

Anti-oxidant Treat-ments	Malone ldhyde (mg/L. Blood)	Peroxide Value (Meq/L. Blood)	Free Fatty Acid %
T1	18.19 ± 0.19 a	3.12 ± 0.12 a	4.22 ± 3.51
T2	17.76 ± 0.09 a	2.75 ± 0.04 b	0.71 ± 0.01
T3	17.00 ± 0.11 b	2.48 ± 0.005 c	0.78 ± 0.01
T4	15.33 ± 0.16 d	1.99 ± 0.01 d	0.81 ± 0.01
T5	16.34 ± 0.08 c	2.37 ± 0.04 c	0.75 ± 0.005
Significance	**	**	N.S

Means having with the different letters in same column differed significantly* (P<0.05), **(P<0.01). N.S: Non-Significant.

Table 5 indicated the effect of adding Allicin to the broiler diet at the age of (42 days) in antioxidants in the blood plasma. (P<0.05) in the percentage of free fatty acids in treatment T3 compared to the control treatment T1 and experiment coefficients T2, T4 and T5 that recorded a decrease in this trait.

Allicin is a type of reactive sulfur (RSS) that has oxidizing properties and is able to oxidize thiol in cells such as the residues of glutathione and cysteine in proteins, and the large concentration of oxidized glutathione increases the possibility of cellular oxidation, oxidation of protein thiol can lead to changes in a protein that is believed to be necessary for its biological activity Gruhlke) and Slusarenko, 2012), so Allicin reduces oxidative stress

Table 5: The effect of addition of Allicin on oxidation indicators of in broiler at the age of 42 days (mean ± standard error).

Anti-oxidant Treat-ments	Malone ldhyde (mg/L. Blood)	Peroxide Value (Meq/L. Blood)	Free Fatty Acid %
T1	17.57 ± 0.06 a	3.45 ± 0.06 a	0.63 ± 0.008 d
T2	16.39 ± 0.02 c	2.38 ± 0.02 c	0.77 ± 0.01 c
T3	15.81 ± 0.4 d	2.56 ± 0.01 b	1.17 ± 0.03 a
T4	16.73 ± 0.08 b	1.79 ± 0.l04 e	0.98 ± 0l.01 b
T5	15.24 ± 0.02 e	2.04 ± 0.02 d	0.69 ± 0.008 d
Significance	**	**	*

Means having with the different letters in same column differed significantly* (P<0.05), **(P<0.01). N.S: Non-Significant.

(Lindsey *et al.,* 2005 and Choudhary *et al.,* 2008). Glutathione is the most low-molecular-weight thiol in the cells and plays an important role in the antioxidant defense and detoxification, as glutathione exhausts cellular defenses against oxidative damage that lead to cell death (Masella *et al.,* 2005). MDA is the final product of the lipid peroxide process, which converts the peroxyl radicals into the inner peroxide, and the balance between peroxide production and the breakdown of those oxidants by antioxidants determines the extent of lipid peroxide, and it has been found that malaldehyde decreased while GSH was raised by using Allicin in the addition parameters because it has been shown that Allicin possesses significant antioxidant activity attributable to its rapid action with thiol and proteins (Okada *et al.,* 2005; Lee-Larungrayub *et al.,* 2006 and Chung, 2006). Moreover, garlic increases protein synthesis in damaged tissues and leads to improvement in the functional state of the cell, (Hussien, 2003), Shakiba and others (2009) have reported that garlic has the ability to get rid of free radicals and inhibit the depletion of GSH. Sharma *et al.,* (2010) indicated that the use of garlic resulted in a decrease in lipid peroxide and an increase in cellular antioxidant enzymes, which may explain the obtained result.

Conclusion

The current study concluded that the use of Allicin in the proportions mentioned in the experiment did not significantly affect the Lipid profile in the blood, but it led to the improvement of oxidative indicators which in turn are a natural protection of cells against free radicals.

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