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SUPPLEMENTAL ALICINE SUPPORTS PRODUCTIVE AND PHYSIOLOGICAL STATUS OF BROILERS

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SUMMARY

Three hundred unsexed 1-day old Cobb chicks with initial live weight of 44.70±0.04 g, were randomly distributed into five experimental groups with three replicate in each, with 20 chicks (5x3x20). They used to study the effects of different supplementation levels of Allicin (0, 3, 6, 9, and 12 mg/Kg diet) on broiler performance, some blood metabolites and antioxidants stats. Broilers were reared for 5 weeks in an open house system and were offered both feed and clean drinking water *ad-libitum*. Throughout the test phase, body weight (BW), We kept track of weight gain (BWG), feed intake (FI), and feed conversion ratio (FCR). Results showed that, performance traits includes body weight, weight gain, and feed conversion ratio of broiler chicks was improved significantly (P≤0.05) by increasing the supplementation levels of allicin for (3 to 12 mg/kg diet). In addition, broilers received different supplementation levels of allicin showed significant (P≤0.05) improvement in some blood biochemical (total protein, albumin, triglyceride and low density of lipids). The same direction was observed for antioxidant indices (TAC and MDA). From the previous results it could be conducted that, allicin can be used at the level of (12 mg /kg diet) in the diet of broiler to improve performance traits and physiological status without any negative effects.

Keywords: *Allicin, broiler performance and physiological status.*

INTRODUCTION

Over the past years, there had been a significant improvement in the poultry production sector. This great development was accompanied by a significant increase in production rates, whether in terms of meat or egg production. Unfortunately, this development has undesirable effects associated with negative effects on immune- response and antioxidants status. So, many of synthetic feed additives such as drugs and antibiotics (antimicrobial agents) were used as growth promoters in poultry diets to improve the productive efficiency, modify the gut microflora and to control diseases and enhancing the immune-response (Bedford, 2000; Whitehead, 2002).

For the sustainability of the poultry sector and its primary role in providing high-quality animal protein, different approaches have been implemented can improve the return on chicken investment, and nutrition modification is an obvious technique to change the way birds behave (Akbari *et al.,* 2016, 2018; El-Senousey *et al.,* 2018 Fathi *et al.,* 2016; Abou El-Ghar and Abd El-Karim, 2016). In terms of nutrition, providing a balanced diet that covers all nutritional needs is the base of a successful production (Uniyal *et al.,* 2017; Sebola and Mlambo, 2018). Feed additives may overcome the consequences of some nutritional imbalances.

Widespread usage of numerous new technology is enhancing poultry production in terms of quantity and quality, such as the use of phytogenic compounds (phytochemicals). Plant extracts have recently been used in poultry diets as feed additives for many purposes as an antifungal, antibacterial, antioxidant and antimutagenic compounds (Wallace *et al.,* 2010). In addition, When employed in broiler diets, herbal extraction is regarded as a helpful growth enhancer with effects that are comparable to antibiotics (Elamin *et al.,* 2015). By lowering enteric pathogenic bacteria burdens, phytogenic substances' positive effects may enhance nutritional digestion and absorption (Papatsiros *et al.,* 2012).

White garlic contains allicin, a phytogenic molecule with a sulphur atom and a volatile component, which has a variety of advantageous biological effects, including antibacterial, antioxidant, and immunological properties (Salehi *et al.*, 2019). In vitro or in animal models, allicin has positive effects on inflammation, oxidative stress indicators, hypertension, hyperlipidemia, and endothelial function. (Bedford and Gong (2018). The purpose of the current study is to determine the impact of various doses of allicin supplementation on broiler performance, certain blood metabolites, and antioxidant stats (0, 3, 6, 9 and 12 mg/kg diets).

MATERIALS AND METHODS

Experimental design:

Three hundred Cobb chicks aged one day, unsexed, weighing 44.700.04 g at birth were divided into five experimental groups, each with three replicates and 20 chicks (5x3x20). They once investigated the results of several dietary supplements. levels of Allicin (0, 3, 6, 9, and 12 mg/kg diet) on broiler performance, some blood metabolites and antioxidants stats. The initial group (T1) was provided a standard diet. without any supplementation and served as control. Groups T2, T3, T4 and T5 were given a supplemented base diet. with 3, 6, 9 and 12 mg of allicine per kg diet, respectively. Broilers were raised for 5 weeks in an open house system and were offered both feed and clean drinking water *ad-libitum*. Table provided the formulation and approximate composition of the experimental diets (1). Body weight (BW), weight growth (BWG), feed intake (FI), and feed conversion ratio (FCR) were tracked weekly during the trial period. Chemical analyses of experimental diet were performed using standard methods (AOAC, 2010).

Table (1): The composition and calculated analysis of experimental starter and grower diets.

Ingredient	Starter diets	Grower diets
Yellow corn	56	60
Soya been meal (44%)	30.16	30.16
Gluten	6.84	3.82
Wheat	2.98	1
Oil	1	0.8
Dicalcim	0.8	1.8
Limestone	1.8	0.8
Primex	0.4	0.4
Salts	0.3	0.3
Dl-methionine	0.14	0.14
Total	100	100
Proximate composition (dry matter)		
Crude protein (%)	22.81	20.50
Crude fiber (%)	3.56	3.42
Ether extract (%)	3.73	3.38
Calcium (%)	1.03	1.04
Available Phosphoru(%)	0.45	0.45
Methionine (%)	0.5	0.5
Lysine (%)	1.10	1.2
Metabolize Energy (Kcal/Kg)	3210.75	3302.98

**premix: vitamin premix: vit A 13,000I.U, D3 5,000,00 I.U, E 80,00mg, K3 2000mg, B2 500mg, B6 1500mg, Biotin 50mg pantothenic 10,000mg, Niacin 30,000mg. carbonate calcium 250mg, mg sulfate 125 mg, Zi oxide 75mg, Fe sulfate60 mg, Cu sulfate 25mg, Pot 80mg.*

Five birds from each treatment were randomly chosen at the conclusion of the feeding session and weighed, fasted for 12 hrs prior to slaughter by slitting the jugular vein. Ten ml of blood were obtained from each birds in a sterile centrifuge tube containing heparin (20 IU/ml) for determine some blood constituents. Plasma was obtained immediately by centrifugation of heparinized blood for 10 min. at 3000 rpm and frozen rapidly in ependorf tubes until the time of analysis. All plasma parameters were determined using commercial kits (Transasia Bio-Medicals, India). Plasma albumin and total protein were determined using colorimetric method according to Gornall *et al.* (1949) and Doumas *et al.* (1971) and globulin was then calculated by subtracting albumin value from corresponding total protein value for the same sample. Triglycerides concentration was determined according to recommended method of Richmond (1973). Aspartic amino transfers (AST) and alanine amino transfers (ALT) were detected according to Reitman and Frankel (1957). Determination of cholesterol, HDL, and LDL were performed according to Watson (1960), Herrmann *et al.* (1983), and Okada and Ishida (2001), respectively. Plasma total antioxidant capacity was determined by total antioxidant kits according to Koracevic *et al.* (2001). Plasma lipid peroxides (MDA) was determined by total antioxidant kits according to satoh et al 1979).

RESULTS AND DISCUSSION

Dietary allicin's impact on growth capacity:

Table summarizes the effects of dietary allicin on body weight, weight increase, feed consumption, and feed conversion ratio (2). During the trial period, significant changes (P0.05) were seen for the aforementioned metrics between all treatments. Broilers fed feed at the conclusion of the study period supplemented with 12 mg allicin /Kg diet had significantly the highest body weight, followed by those received 9 mg allicin /Kg diet then those treated with 6 mg allicin/Kg diet then those treated with 3 mg allicin /Kg diet by (8.94, 5.28, 1.36, and 0.22%), respectively in contrast to the control group.

Table (2): Effect of allicin supplementation levels on performance traits.

Items	Dietary treatment					Sig.
	T1 control	T2 (3mg allicin)	T3 (6mg allicin)	T4 (9mg allicin)	T5 (12mg allicin)	
Initial body weight (IBW) (one-day of age)	44.85 ±0.19	45.11 ±0.06	44.92 ±0.07	44.62 ±0.24	44..55± 0.16	NS
Final body weight (FBW) (35 days of age)	1895.80 ±67.74[b]	1900.14 ± 25.03[b]	1921.74 ±29.59[b]	1996.07 ±9.42[ab]	2065.36 ±45.60[a]	*
Body weight gain (BWG) (0-35 days)	1850.95 ±35.17[b]	1855.03 ±67.61[b]	1876.82 ±9.47[b]	1954.45 ±45.58[ab]	2020.81 ±25.06[a]	*
Total feed intake (TFI) (035 days)	3539.7 ±43.03[a]	3308.3 ±101.03[ab]	3368.7 ±58.42[ab]	3341.3 ±108.91[ab]	3410 ±31.48[ab]	*
Feed conversion ratio (FCR) (0-35 days)	1.91[a] ±0.03	1.78[b] ± 0.02	1.79[b] ±0.04	1.71[c] ±0.03	1.68[d] ±0.05	*

[a, b, c] means with in same row with different superscripts were significant different. Sig.- Significance, * ($P \leq 0.05$). NS- no-Significant.

The same direction was found for body weight gain, broilers received dietary 12 mg allicin /Kg diet archived significantly ($P \leq 0.05$) the highest of body weight gain followed by those received 9 mg allicin /Kg diet then those treated with 6 mg allicin /Kg diet then those treated with 3 mg allicin /Kg diet by (9.17, 5.59, 1.39, and 0.22) respectively compared with the control groups. The conclusion of the trial phase broilers received 12, 9, and 6 mg allicin /Kg diet had no significant effect on feed intake compared with broilers in control groups. Feed conversion ratio was improved by using different levels of allicin. Group fed diet supplemented with 12 mg allicin /Kg diet had significantly ($P \leq 0.05$) the best FCR. Researchers have observed that garlic has many benefits of Garlic has been shown by researchers to offer a wide range of biological effects, including anti-microbial, anti-inflammatory, anti- atherosclerotic, anti-diabetic, anti-mutagenic, anti-carcinogenic, antioxidant, and immune-modulating actions. biological functions, such as anti-microbial, anti- inflammatory, anti-atherosclerotic, anti-diabetic, anti-mutagentic, anti-carcinogenic, antioxidant and immune-modulation activities (Salehia *et al.*, 2019, Kim, 2016; Cullen *et al.*, 2005;). Allicin breaks down into 2-propene sulfenic acid, which has the ability to bind free radicals and act as an anti-stress substance. Bacterial growth was being hampered by allicin. (Cavallito *et al.*, 1994) and reduce oxidative stress (Lindsey *et al.*, 2005). Lewis *et al*. (2003) Allicin supplementation has been found to have some notable effects on broiler chicks' intestinal microbial activity and growth performance. According to Cho *et al.* (2006), allicin affects broilers' immunological responses. According to Demir et al. (2003), the bioactive components of garlic as well as sulfur- containing substances like alliin and allicin are principally responsible for the powerful stimulating effect of garlic on the immune system of broilers. Allicin is a strong agonist for the transient receptor potential ankyrin-1 (TRPA1), a significant member of the family of transient receptor potential straits, according to Kosugi *et al.* (2007). For instance, allicin may impact gut processes including enhanced gut balance by acting on gastro-intestinal TRPA1 receptors (Penuelas *et al.,* 2007). hence, increased. Broiler growth performance, feed conversion ratio, and feed intake were all increased by using garlic as a natural feed addition. Hassan and Tollba (2003). Garlic powder supplementation to diets has been shown to improve broiler performance, according to Demir *et al.* (2003). Ahmad (2005) discovered that broilers given rations with added garlic experienced the best weight increase. These outcomes may be attributable to the birds' healthy condition, which may have been improved by the addition of garlic, as well as to the chemical makeup of garlic. Fadlalla *et al.* (2012) and Onibi *et al.* (2010). According to Windisch *et al.* (2008) research on the demonstrated benefits of phytobiotic feed additives in several chicken species, feed intake was decreased and feed conversion was improved.

Effect of dietary allicin on blood parameters:

On the other hand, hematological parameters of broilers chicks affected by allicin are listed in table (3). The findings revealed that there were no significant differences between the treatments. for globulin (g/dl), Cholesterol (mg/dl), HDL (mg/dl), ALT (U/L), AST (U/L) and SOD when compared with control one while broilers which fed diets containing with allicin had a significant effect for total protein and albumin. At the end of the experimental period, broilers fed diet supplemented with 6 and 9 mg allicin /Kg diet had significantly the highest total protein, followed by those received 12 mg allicin /Kg diet then those treated with 3 mg allicin /Kg diet by (11.37, 9.58 and 4.43%), respectively compared with the control group. The best value of albumin noticed in broilers which fed with 3 mg allicin per Kg diets compared with the control group. Broilers fed diet supplemented with 6 and 9 mg allicin /Kg diet had significantly decreased in triglyceride by (26.7 and 33.2%) respectively compared with control. No significant observed in cholesterol on plasma for broilers in experimental groups while cholesterol levels were decreased with different levels of allicin.

Table (3): Effect of allicin supplementation levels on blood biochemical parameters.

Items	Dietary treatment					Sig
	Control	**(3mg allicin)**	**(6mg allicin)**	**(9mg allicin)**	**(12mg allicin)**	
Total protein (g/dl)	3.34±0.10 [b]	3.49±0.07 [ab]	3.72±0.12[a]	3.72±0.11 [a]	3.66±0.13 [ab]	*
Albumin (g/dl)	1.47±0.09 [b]	1.68±0.05 [a]	1.62±0.05 [ab]	1.57 ± 0.03 [ab]	1.60±0.07 [ab]	*
Globulin (g/dl)	1.86±0.12	1.80±0.08	2.09±0.13	2.15±0.10	2.06±015	N.S
Triglycerides (mg/dl)	76.77±10.45[a]	66.55±3.18 [ab]	56.22±2.77 [b]	51.22±2.20 [b]	60.44±5.16 [ab]	*
Cholesterol (mg/dl)	167.88±8.10	165.00±9.77	161.11±4.85	160.66±10.11	138.22±14.05	N.S
HDL (mg/dl)	63.55±4.11	63.00±5.27	62.66±2.38	64.11±3.55	61.33±3.50	N.S
LDL (mg/dl)	59.66±8.34 [b]	99.22±8.43 [a]	85.56±3.53 [a]	86.77±6.32 [a]	93.11±5.00 [a]	*
ALT (U/L)	22.66±2.15	20.88±1.49	20.33±2.69	23.77±3.80	18.66 ± 1.75	N.S
AST (U/L)	323.00±30.28	345.66±37.27	322.88±20.18	356.00±17.39	376.33± 25.92	N.S
TAC (m mol/l)	1.83±0.11 [a]	1.02±0.07 [c]	1.35±0.6 [b]	1.00±0.06 [c]	1.17±0.06 [bc]	*
SOD (m mol/l)	1.54±0.13	1.05±0.07	1.30±0.10	1.50±0.11	1.31±0.12	N.S
MDA (m mol/l)	1.50±0.12 [b]	1.23±0.05 [bc]	0.97±0.08 [c]	1.42±0.07 [b]	1.89±0.13 [a]	*

Values were means ± standard deviation. Values in the same row with some superscripts are significant. P ≤0.05.

On the other hand broilers in control had the lowest value in LDL. Broilers fed diets containing 12 mg allicin per Kg diet had the best value of MDA which recorded 1.89. Broilers fed diets containing with allicin had a significant decreased on total antioxidant capacity. No significant effect on maloneldhyde (MDA) in broilers fed diets containing 3, 6, and 9 mg allicin per Kg diets compare with control groups. While there was a significant effect on broilers fed diets containing with 12 mg allicin per kg diets compared with control groups. Ao *et al.* (2010) observed that garlic powder decreased cholesterol in blood. (Lee, 2018) Addition garlic in water decreased serum cholesterol. Although dietary allicin had been led to promote antioxidative capacity and reduce blood lipid level in chickens (Yang *et al.,* 2015). Supplementation of garlic as feed additives for broiler diet can enhance antioxidative activity and lower cholesterol levels in blood serum (Jang *et al.,* 2018). Garlic powder supplementation in broiler food decreased cholesterol content in egg yolk as well as serum triglyceride levels in laying hens (Yalcn *et al.,* 2006). Benin et al. (2016) Garlic consumption may reduce the development of cholesterol-induced experimental atherosclerosis and has direct anti- atherogenic effect. Garlic supplementation reduces cholesterol in hepatocytes and triglyceride levels in blood, limits the synthesis and secretion of very low density lipoproteins, and alters the fatty acid profile of pig meat fat, all of which are good for its nutritional value (Grela *et al.,* 2013). Samoli nska and colleagues (2020). Garlic's ability to lower cholesterol levels may be due to decreased hepatic production of the chemical.

Salman and Hissany (2020) The addition of Allicin to broiler diet at the age of 42 days resulted in a significant decrease in the value of maloneldhyde and the value of peroxide, but no significant differences in the lipid profile of broiler at the age of 21 days and 42 days when Allicin was added to broiler diet in all treatments.

Allicin is a type of reactive sulphur that has oxidising properties and is able to oxidise thiol in cells such as glutathione and cysteine residues in proteins, and a high concentration of oxidised glutathione increases the possibility of cellular oxidation, oxidation of protein thiol ability leads to changes in a protein that are thought to be required for its biological activity (Gruhlke and Slusarenko, 2012), (Lindsey *et al.,* 2005 and Choudhary *et al.*, 2008).

MDA is the end product of the lipid peroxide process, which converts peroxyl radicals into 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 discovered that using Allicin in the supplementation parameters decreased malaldehyde while increasing GSH because it has been shown that Allicin possesses significant antioxidant activity attributable to it. (Chung, 2006; Lee-Larungrayub *et al.,* 2006 and Okada *et al.,* 2005). Garlic boosts protein production in damaged tissues, which improves the cell's functional status. Afsharmanesh *et al.* (2008) discovered that the inclusion of garlic decreased lipid peroxide and increased cellular antioxidant enzymes, which might skew the results.

Garlic extract, which may produce cell membrane stabilisation and protect the liver from harmful substances and free radical-mediated toxic damage to liver cells. This is indicated in a decrease in liver enzymes. This data is consistent with those obtained by Kumar *et al.* (2013), who discovered that serum glutamate oxaloacetate transaminase (SGOT) and serum glutamate pyruvate transaminase (SGPT) concentrations of broiler chicken decreased significantly (P0.05) due to A. sativum supplementation in different treatment groups as compared to the control group at 28th and 42nd days.

CONCLUSION

From the previous results it could conducted that, allicin can used at level with (12 mg/kg diet) in broiler diet without any negative effects.

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إضافة الأليسين كداعم للأداء الإنتاجي والحالة الفسيولوجية لدجاج التسمين

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كان الهدف من البحث هو دراسة تأثير إضافة الأليسين كداعم للأداء الإنتاجي والحالة الفسيولوجية لدجاج التسمين حيث تم إستخدام عدد ثلاثمائة كتكوت من سلالة الكاب غير مجنسين بمتوسط وزن 44 جرام تم توزيعهم بصورة عشوائية إلي خمس معاملات تجريبية في كل معاملة ثلاثة مجاميع بكل مجموعة عشرون طائر وذلك لدراسة تأثير إضافة الأليسين بنسب (صفر% و 3 و 6 و9 و12 ملي جرام لكل كيلوجرام عليقة) لقياس الأداء الإنتاجي والحالة الفسيولوجية والمناعية وبعض خصائص الدم وحالات مضادات الأكسدة أستمرت التجربة حتي عمر خمس أسابيع وأثناء التجربة تم قياس معدلات الزيادة الوزنية وكمية العلف المستهلك ومعدل التحويل الغذائي وأوضحت النتائج حدوث تحسن معنوي في كلا من وزن الجسم وكمية العلف المستهلكة ومعامل التحويل الغذائي بزيادة إضافة الأليسين من 3 وحتي 12 ملي جرام لكل كيلو جرام من العليقة وكذلك حدوث تحسن في بعض قياسات الدم في كلا من البروتين الكلي والألبيومين والدهون الثلاثية وكذلك تحسن في بعض قياسات الدم لإنزيمات الأكسدة بإضافة الأليسين حتي 12 ملي جرام لكل كيلوجرام من العليقة لتحسين الحالة الإنتاجية والفسيولوجية بدون أي أثار جانبية.