Effect of Lycopene Compared to Vitamin C Added to Diets of Broilers Exposed to Stress and Its Impact on Physiological Performance

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Effect of Lycopene Compared to Vitamin C Added to Diets of Broilers Exposed to Stress and Its Impact on Physiological Performance

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Abstract. From July 20, 2022, to August 24, 2022, this study was done in the chicken grounds of Kosar chicken Company - Erbil. The experiment lasted for 65 days (35 field days and 30 lab days) and examined the effectiveness of lycopene and vitamin C at mitigating the negative effects of heat stress on productivity and health. for roasting. The Ross 308 broiler chicks utilized were one day old, sexless, and weighed 42 g each. The Kosar Poultry Company provided the chicks. These chicks were raised in a room with a mattress on the floor in 15-by-1-meter enclosures. Chicks were randomly assigned to one of five treatments, each with three replications and eight birds per replication, using sawdust with a thickness of 5 centimeters. The following experimental treatments were used, with repetitions spread randomly beginning on day one: Diet alone (T1) is the initial course of treatment. T2: 1 g of lycopene per kilogram of body weight. T3: 2 g of lycopene per kilogram of body weight. Fourth treatment (T4): 1 g of lycopene per kilogram of feed with 25 milligrams of vitamin C per kilogram of feed, in accordance with current recommendations. The results showed that the concentration of globulin and albumin in the addition treatments were significantly superior to the control treatment ($P \leq 0.05$), and this was especially true for the fifth treatment (T5), which was a mixture of lycopene at a rate of 2 g / kg with vitamin C according to the standard recommendations of 25 mg / kg of feed. High-density lipoprotein cholesterol, low-density lipoprotein cholesterol, glucose, and total protein levels all showed no statistically significant differences. When comparing the addition treatments to the control treatment, liver enzyme activity was found to be significantly lower in the addition treatments ($P \leq 0.05$).

Keywords. Lycopene, Vitamin C, Stress.

1. Introduction

In Iraq and other countries with hot summers, heat stress is a major factor in the economic losses suffered by the poultry sector [1]. This condition occurs when chickens are raised at temperatures higher than (30°C) and this leads to disruption of the physiological processes of the internal

environment of the bird [2]. Also, stress affects the feeding of broilers, and thus has an effect on the intake of chicken feed, the level of glucose in the blood, and liver enzymes [3].Stress conditions deplete the birds' natural antioxidant capacity, exposing cells to harmful reactive oxygen species, and thus reduce the birds' immunity.Stress conditions deplete the birds' natural antioxidant capacity, exposing cells to harmful reactive oxygen species, and thus reduce the birds' immunity [4]. As the addition of vitamin C to bird diets has a positive effect in improving the birds' resistance to heat stress (internal)[5]. On the other hand, the addition of lycopene is a red-colored carotene present in many foodstuffs such as tomatoes, red fruits and vegetables. As a result of oxidative stress (Rao et al., 2002), poultry farming in many countries of the world faces many problems, the most important of which is heat stress, which results from the inability of the bird to dissipate excess heat through radiation, and in this case it occurs when chickens are raised under temperatures higher than (30 m) and this leads to disruption of physiological processes and imbalance of the internal environment of the bird. For this reason, a plethora of studies and investigations have been carried out to learn more about the mechanisms and interacting pathways that heat stress creates within the body of the bird, with the ultimate goal of mitigating its negative effects and, on the other hand, developing countermeasures to counteract them. Vitamin C and E have been the main targets of vitamin research for inclusion in food or water [3]. Vitamin C supplementation in avian diets has been shown to improve blood characteristics and heat stress tolerance [6,7]. In the absence of previous studies on the effect of using lycopene and vitamin C in the hot Iraqi climate during the summer, this experiment was conducted.

2. Materials and Method

From 7/20/2022 to 8/24/2022, we conducted this study in the poultry fields at Kosar Poultry Company – Erbil and laboratories in Mosul Ethical approval No. um.VET.2021.5. To examine the efficacy of lycopene and vitamin C in mitigating the physiological effects of heat stress on broiler chickens, researchers ran a long-term experiment lasting 65 days (35 field days and 30 lab days). Ross 308 broiler chickens were utilized, and each of the 120 day-old chicks used weighed 42 g and was unsexed. Kosar Poultry Company's hatchery provided the baby chicks. These chicks were raised in a room with a (1 x 1) meter mattress on the floor using Pens 15. The chicks were fed a 5 cm layer of sawdust in five different treatments, each with three repetitions of 8 birds each: T1: diet without any addition. T2: 1 gm/kg lycopene feed, which is the second therapy. T3: 2 gm/kg lycopene in the meal is the third and final treatment. T4 is the fourth and final therapy, which combines the recommended amount of vitamin C (25 milligrams per kilogram of feed) with 1 gram per kilogram of lycopene. T5, the fifth treatment, combines the recommended amount of 25 milligrams of vitamin C per kilogram of feed with 2 grams of lycopene.Number crunching: And Duncan's multiple range test was used to compare the means [8].

Table 1. Kosar Poultry Company's computed chemical composition of the feed components included in the composition of the diets utilized in the experiment.

Feed materials %	Starter ration 1-10 kg day	Feed materials %	Growth ration 11-24 days kg	Feed materials %	The final ration is 25-42 days, kg
Wheat	377.35	wheat	372.25	wheat	588.85
Bran	100	bran	100	bran	100
Soya	320	soya	272	soya	165
yellow corn	150	yellow corn	200	yellow corn	100
Oil	10	oil	16	Oil	10
Permix%0.1B-S	10	B-G-0.8% Premix	8	Between Finisher	7
Lysine	1.3	methionine	0.25	methionine	1
Colin	1	Lysine	1.2	Lysine	2
Threonine	1	Colin	1	Colin	0.5
Enzyme	0.5	threonine	1.2	threonine	0.8
Toxbond fort	1	enzyme	0.5	Enzyme	0.5
Limestone	18.25	Anticoccidia	0.5	Anticoccidia	0.25
Mono Calcium	8	Toxbond fort	1	Toxbond fort	1
table salt	1.6	limestone	17	Genex	0.5

Feed materials %	Starter ration 1-10 kg day	Feed materials %	Growth ration 11-24 days kg	Feed materials %	The final ration is 25-42 days, kg
		Mono Calcium	7	limestone	15.25
		Sodium bicarbonate	0.4	Mono Calcium	5.5
		table salt	1.7	Sodium bicarbonate	0.25
				table salt	1.6

3. Results

Total protein content did not differ significantly between groups, as seen in Table 2. In addition, we see that the albumin concentration rose to a maximum of 2.04 in the fifth treatment and fell to a minimum of 1.50 in the first. When comparing the globulin levels in the addition therapies to those in the control treatment, significant variations can be seen.

Table 2. Effect of using lycopene and vitamin C to the diet on serum proteins (g/100 ml) of broiler chickens (mean ± standard error).

Treatment	Total Protein	Globulin	Albumin
T1	2.82±0.10	b 1.32± 0.31	c 1.50± 0.71
T2	2.76±0.07	c1.25b ±0.39	c 1.51 ±0.73
T3	2.92± 0.47	b 1.30± 0.24	b 1.62± 0.77
T4	3.2±0.11	a1.49±0.29	b 1.71± 0.66
T5	3.54±0.13	a 1.50± 0.31	a 2.04 ±0.67
Moral level	N S	*	*

N S - no significant differences.

There are significant differences at the probability level (P≤ 0.05).

*- Control treatment T1 without any addition, T2, T3 with lycopene powder added at a rate of 1.2 g/kg feed, respectively, T4 and T5 added vitamin C at a rate of 25 mg/kg feed with lycopene powder at a rate of 1.2 g/kg feed respectively.

Table 3. Shows that across all experimental treatments, there were no discernible variations in the concentrations of cholesterol, glucose, low-density lipoproteins, or high-density lipoproteins.

Treatment	Glucose	Cholesterol	High-density lipoproteins (HDL)	Low-density lipoproteins (LDL)
T1	241.1±9.62	110.0±11.21	49.1±11.72	69.5±8.42
T2	247.2±6.13	103.6±11.75	45.0±1.13	71.6±2.35
T3	250.7±12.14	113.7±9.09	50.5±1.49	75.1±5.04
T4	253.6±10.07	113.4±13.39	49.9±2.14	69.2±6.24
T5	248.8±6.01	107.0±5.32	47.9±0.75	72.1±2.45
Moral level	N S	N S	N S	N S

N S - no significant differences.

There are significant differences at the probability level (P≤ 0.05).

*- Control treatment T1 without any addition, T2, T3 with lycopene powder added at a rate of 1.2 g/kg feed, respectively, T4 and T5 added vitamin C at a rate of 25 mg/kg feed with lycopene powder at a rate of 1.2 g/kg feed respectively.

In table (4), we can see that there are statistically significant differences in AST, with the control and second treatments performing best (41.5 and 40.2, respectively), while the addition treatments T5, T4, and T3 performed worst (38.7, 34.6, and 32.4%). We also see substantial variations in ALT, with the control treatment doing better than the additive therapies. The control treatment had the highest percentage (8.5) and the lowest percentage (5.7) of all the treatments.

Table 4. Mean SD of liver stress enzyme levels (AST and ALT) in broiler chicken blood serum after supplementation with lycopene liquid and vitamin C in the feed.

Treatment	AST U/L	ALT U/L
T1	a 41.5 ±11.29	a 8.5 ± 0.57
T2	a 40.2 ±10.56	c 6.4 ±0.48
T3	b 38.7 ±13.45	c 6.5 ± 0.25
T4	b 34.6 ±11.96	b 7.2 ± 0.75
T5	c 32.4 ±16.65	d 5.7 ± 0.31

N S - no significant differences.
There are significant differences at the probability level ($P \leq 0.05$).
*- Control treatment T1 without any addition, T2, T3 with lycopene powder added at a rate of 1.2 g/kg feed, respectively, T4 and T5 added vitamin C at a rate of 25 mg/kg feed with lycopene powder at a rate of 1.2 g/kg feed respectively.

4. Discussion

Tables 2, 3, and 4 show that when liquid lycopene and vitamin C were added, both colobin and albumin levels rose significantly. For glucose, cholesterol, and low-density lipids, there was no statistically significant change, but there was an arithmetical rise; for high-density lipids, there was a mathematical drop, but no arithmetical increase. distinct dissimilarity. There were no significant variations in the levels of the liver stress enzymes AST and ALT. Since vitamin C has a protective effect on the liver against the effects of heat, the considerable rise in colobin and albumin levels may be attributable to the general rise in blood total protein. pressure. Because vitamin C is a powerful antioxidant, it was used to treat the experimental birds so that they could counteract the harmful effects of heat stress on their internal organs [9]. Finally, it's important to note that a bird's cholesterol level in the blood serum is highly influenced by its diet, genetics, sex, age, and environmental factors. Increased concentrations of protein, glucose, and cholesterol in the blood [10], are supported by increased secretion of the gastrointestinal tract, including digestive enzymes (increased secretion of digestive enzymes increases the digestibility of carbohydrates and fats). that this hormone increases glucose consumption by breaking down protein for energy production, and that vitamin C has a vital role in Resistance to heat stress and modulation of corticosterone (corticosterone) secretion from the adrenal cortex. In the second therapy, plasma cholesterol levels dropped below those seen in the placebo group. This finding agrees with those of [7]. The plasma cholesterol levels of broiler chickens grown in hot conditions and their mothers were found to be significantly reduced after vitamin C was added to their diets. If vitamin C reduces production of corticosterone in the adrenal cortex, this should be reflected in a rise in thyroxine secretion from the thyroid gland, leading to an increase in total thyroid hormone production. Improves cholesterol use and assimilation, resulting in reduced cholesterol levels [1]. Because AsPartat Amino Transferase and Alanine Amino Transferase are found in tissues, do their work inside the cell, and are transmitted throughout the body, the activity of these enzymes was significantly reduced by the antioxidant treatments compared to the control treatment. These enzymes are added to the serum, and their concentration increases after the destruction of cells and tissues due to the formation of free radicals, especially for active oxygen species, which occur due to stress [11] and that the addition of lycopene and vitamin C caused the decrease in the activity of these enzymes in the addition treatments, and this may be due to the ability of the treatments In addition to reducing the transport of the amine group and raising the antioxidants due to the balance of the internal environment of the body. On the other hand, these treatments increased the ability to cool the body temperature by cooling the temperature through the peripheral blood vessels to maintain a relatively constant temperature [12].

Conclusion

This study found that when vitamin C and lycopene were added to the diet, the proportion of albumin and globulin increased, but the percentage of liver enzymes decreased.

References

[1] Al-Daradji, Hazem Jabbar, 1995. A study of some physiological characteristics and thermal resistance of Wubro broilers and its comparison with some commercial broiler crosses. Master's thesis. College of Agriculture - University of Baghdad.
[2] Sahin, N., M. Tuzcu, C.Orhan, M. Onderci, Y. Eroksuz, K. Sahin.,2009. the effects of vitamin C and E supplementation on heat shock protein 70 response volume 50, Number 2 PP. 259-265.
[3] Roch, G., M., Boulianne, and L. De Roth., 2000. Effects of dietary vitamin E and selenium source on incidence of ascites, growth performance and blood parameters cold-stressed broilers. Poultry Science, 79(Suppl 1): 41.
[4] Al-Tamimi1, M.S. Ammar, Q. S. Mohsin, O. M (2013a). Spraying with local anemone coronaria flower extract and isoflurane and its effect on the physiological characteristics of broiler chickens transported during different seasons Agricultural Sci, Vol. 14, No. 1, 2023 (53-72)
[5] Sahin, N., M. Tuzcu, C.Orhan, M. Onderci, Y. Eroksuz, K. Sahin.,2009. the effects of vitamin C and E supplementation on heat shock protein 70 response volume 50, Number 2 PP. 259-265.
[6] Usman ,B.A.;Mani.AU; O.B.Muyiwa., 2008. Effect of dietary treatments of ascorbic acid on the blood parameters egg production and quality in quail. Iintemational Journal of Poultry Science 7 (4) 344-349.
[7] Al-Obeidi, Nawfal Nazim Ahmed, 2018. The effect of adding glucose to drinking water on the productive and physiological performance of broiler chickens during the summer season in Iraq. Master's thesis - College of Agriculture - University of Diyala
[8] Ferit Gursu ,M .;M. Onderi ; F.Gulcu ; K. Sahin,2004. Effects of vitamin C and supplementation on serum paraoxonase activity and metabolites induced by heat stress in vivo . Nutrition Research 24: 157-164.
[9] Al-Obeidi, I. T. M. (2010). The effect of heat stress on meat poultry and ways to treat it. A study to obtain a higher diploma. College of Veterinary Medicine - University of Al-Qadisiyah.
[10] Baines,B.S,1996. The Role of vitamin c in stress management. World Poultry Sci.12(4): 38-41.
[11] Al-Tamimi1, M.S. Ammar, Q. S. Mohsin, O. M (2013b) Effect of spraying with the extract of the local anemone coronaria flowers and isoflurane in reducing the economic losses caused by stress of transporting broiler. Agricultural Sci, Vol. 14, No. 1, 2023 (1-16)
[12] Al-Obeidi, A. H. Ammar Q. S. Al-Hasani,D. H. (2020). The effectiveness of salicylic and ascorbic acids to reduce the effect of transport stress on live weight and some blood characteristics and intestinal villi of broiler chickens. Iraqi Journal of Agricultural Sciences: 51 (4): 1074-1081