



## THE EFFECT OF DIETARY SUPPLEMENT OF TOMATO SEED MEAL IN BROILER RATION ON SOME BLOOD PHYSIOLOGICAL AND HEALTH TRAITS

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### ABSTRACT

This study was conducted at the poultry farm of Public Health department, College of Veterinary Medicine at University of Baghdad. The aim of this study was to investigate the effect of dietary supplement of tomato seed meal in broiler ration on some blood physiological and health traits. A total of 160 birds were used in this study. The birds were randomly distributed into four equal groups. Birds were fed during the whole period and tomato seed meal was added to the diets of birds at the percentages of 0, 5, 10 and 15%, respectively. Results revealed that dietary supplementation with different levels of tomato seed meal resulted in significant ( $P < 0.05$ ) improvement regarding blood physiological and health traits and adding 15% of tomato seed meal was the best among other dietary supplementation levels of tomato seed meal.

**KEYWORDS:** tomato seed, broiler, ration, CBC, aminotransferases.

### INTRODUCTION

Tomato seeds are considered as a major source of the red lycopene. Its quantity depends on the type and maturity of the fruit (Sies and Stahl, 1995; Stahl and Sies, 1996; Gerster, 1997; Rao and Agarwal, 1999; Markovic *et al.*, 2006). Lycopene is a natural derived carotene, synthesized by plants during photosynthesis to protect it from photosensitivity (Rao *et al.*, 2003) and imparts red color to vegetables and fruits (Shi and Maguer, 2000). Lycopene is a strong antioxidant that afford protection against free radicals which incriminated in cell corruption. The role of antioxidants such as carotenoids in health and disease has widely increased due to large interests of these dietary compounds and its great importance in fighting free radicals generated as a result of oxidative stress and protects cells from damage (Nierenberg *et al.*, 1997; Leal *et al.*, 1999). Many studies referred that supplementation of tomato dried residues contribute to improving health and productivity (Calislar and Uygur, 2010). Elloit *et al.* (1981) argued that tomato remnants (seeds and skin) of tomatoes contain a high level of excellent dietary vegetable protein. In this study using tomato remnants at rates ranged between 8-15% improved the yellow color of the yolk (Yannakopoulos *et al.*, 1992; Mansoori *et al.*, 2008), without affecting the productive performance of laying hens (Yannakopoulos *et al.*, 1992; Dotas *et al.*, 1999; Calislar and Uygur, 2010). Mansoori *et al.* (2008) found that dried tomato remnants can be a viable and economic alternative of grain in the ration of laying hens. Tomatoes are rich with high quality protein, similar to Soybean meal. The effect of such supplementation in broiler meat ration could increase the living body weight and feed consumption up to 21 of continuous feeding (Persia *et al.*, 2003). On the other hand argued that adding

5, 10 and 15% of dried residue of tomato to the diets of laying hens contributed significantly to mass improvement and egg production at 2.7 and 4.1 respectively, comparable with controls (Jafari *et al.*, 2006). Supplementation of lycopene to the diets of female geese led to a noticeable progress in the biochemical characteristics of serum in female domestic geese, including the concentration of cholesterol, glucose, protein and triglycerides (Al-Darraji and Al-Janabi, 2015). Moreover, this supplementation to the diets of laying hens showed a significant decrease ( $p < 0.05$ ) in the level of liver enzymes; glutamateoxaloacetate transaminase (GOT), glutamatepyruvate transaminase (GPT) and Malonaldehyde (MDA) concentration which expresses low oxidative stress with a significant improvement in the level of the enzyme alkaline phosphatase (AP) in serum treatment as compared to the controls (Ali *et al.*, 2015). Due to scarce thorough studies in Iraq, the present research aimed to study the effect of adding different levels of tomato seeds to the ration of broiler meat and some health blood indicators.

### MATERIALS & METHODS

This research was conducted in the poultry field, Department of Public Health in the College of Veterinary Medicine / University of Baghdad to study the effect of supplement different levels of tomato seeds to the ratio on the physiological components of blood and some other meat broiler health indicators. The broilers were distributed randomly into four groups, 40 each. Birds were free feed for the entire study period as in Table (1).

### Nutritional Treatment

1. The first treatment "T1": 0% tomato seeds (control treatment).

- 2- The second treatment "T2": 5% earners tomato seeds.
- 3- The third treatment "T3": 10% tomato seeds.
- 4- The fourth treatment "T4": 15% tomato seeds.

**Blood Collection and tests performed**

At age of 8 weeks, blood was collected from 9 broilers from the jugular vein by disposable 1mL syringe into anticoagulant and test tubes. Concentration of hemoglobin (Varley *et al.*, 1980), total RBC and WBC counts (Natt and Herrick, 1952), differential WBC (Burton and Guion, 1968; Shen and Patterson, 1983), total serum protein

concentration (Biomaghreb<sup>®</sup> kit; Wotton and Freeman 1982), concentration of cholesterol (French Reactifs Biolabo<sup>®</sup> kit; Ed, 2006), uric acid concentration (Biomaghreb<sup>®</sup> kit; Henry *et al.*, 1982), and measurements of GPT, GOT (Randox<sup>®</sup>), AP (bioMerieux French<sup>®</sup>) activities were adopted.

**Statistical analysis**

Complete random designs were applied. Data were analyzed using Statistical Analysis System (SAS, 2001). Significant differences were compared between the averages using Duncan test (Duncan, 1955).

**TABLE 1:** Rations used and components

Components	Control	Ration		
		1	2	3
Earners tomato seeds	0.0	5.0	10.0	15.0
yellow corn	60.0	58.0	55.0	53.0
SBM	38.7	35.7	33.7	30.7
Limestone	0.7	0.7	0.7	0.7
Salt	0.3	0.3	0.3	0.3
Vitamins and minerals mixture	0.3	0.3	0.3	0.3
Total	100	100	100	100
Protein	22.3	22.1	22.3	21.9
Energy represented	2895	2890	2890	2893

**TABLE 2.** The chemical composition of Earners tomato seeds

Chemical analysis	Percentage %
Protein	23.8
Ash	3.2
Lipid	20.5
Fiber	35.2
Carbohydrate	17.3
Total	100

**RESULTS & DISCUSSION**

**Tests of complete blood count**

Supplementation tomatoes seeds to broiler meat ration showed significant increment (P 0.05) in Hb, PCV and RBC values at the age of 28 days (Table 3). At day 56, PCV, Hb and RBC values increased proportionally with the rate of tomato seeds supplanted, particularly in T4 (Table 4).

**Biochemical tests of blood:**

Table (5) showed that supplementation tomato seeds have contributed to increasing the concentration of serum protein to 4.33 , 4.53 , 4.60 and 4.70 g / 100 ml in the T1, T2 , T3 and T4, respectively, at day 28 days. Significance (P 0.05) was seen in all treatments compared to controls. No significant increase was shown between T3 compared to T2 and T4, although the later groups (T2 and T4) revealed significant (P 0.05) variation. At the same time, significant (P 0.05) decrements were obvious in cholesterol and uric acid in the blood serum, reaching 188, 187, 184, 183 gm and 3.60, 3.56 , 3.43 and 3.30 gm per 100ml serum for cholesterol and uric acid in T1, T2 , T3 and T4, respectively. Best treatment was recorded in T4. Similar variations were seen at day 56 (Table 6).

**Activity of blood enzymes**

Table (7) showed that supplementation tomato seeds have contributed significantly (P 0.05) to increasing the activity of enzymes GPT, GOT and AP in the blood serum of broiler in comparison with control at the age of 28 days. Supplementation of 15 % tomato seeds (T4) was recorded

as a best result reached 104.6, 13.0 and 36.0 units enzyme /ml for GPT, GOT and AP, respectively. These enzymes continued significant (P 0.05) increasing compared to controls, reaching 107.3, 16.0 and 36.3 units enzyme / ml serum for GPT, GOT and AP, respectively, at day 56 (Table 8).

**White blood cell count and differentiation:**

Tables 9 and 10 showed T3 and T4 were contributed significantly (P 0.05) to increasing the total number of white blood cells the age of 28 days, while this alteration was not significant at day 56 in all treatments. Regarding differential WBC, significant decrease (P 0.05) in T3 and T4 heterophils was noted at day 28 and tends to more decrement at day 56. On the contrary, lymphocytes increased significantly (P 0.05) at day 28 and 56 in T3 and T4. No significant alterations were observed during the entire period of the experiment, except the increment of basophils at day 28. There were significant increments in the ratio of lymphocyte to heterogeneous cells (L/H) at day 28 and 56 in both T3 and T4. Many studies have indicated that there is a positive effect of tomato meal and lycopene in the productive performance and the quality of meat and eggs in poultry (Botsoglou *et al.*, 2004; Sahin *et al.*, 2006) as the lycopene is a potent antioxidant effectively enhances the protection against oxidative damage in living cells, including the different blood cells. This role is effective in alleviating oxidative stress in broilers under highly growth performance and feed conversion ratio (Sevcikova *et al.*, 2008). Another positive

impact of different levels supplementation of lycopene in the diet was to increase growth and improve the efficiency of feed conversion in birds by increasing protein concentration in the blood serum due to the antioxidant activity of lycopene that protects the protein from oxidation and reduces the risk of free radicals (Rao and

Shen, 2002). Also, lycopene stimulates the liver to increase produce the growth I Insulin-like Insulin growth factor concentration (IGF-I) which increases protein production in cells which resulted in improving the productive performance of the broilers (Alina *et al.*, 2007; Englmaierová *et al.*, 2011).

**TABLE 3:** the effect of supplement proportions of Earners tomato seeds in certain cellular characteristics of broiler meat at the age of 28 days

Treatment	PCV (%)	Hb (gm%)	RBC (mm) <sup>6</sup>
Control	B	c	b
	34.28 ±0.050	7.28 ±0.05	35.22 ±0.05
5%	a	b	a
	34.53 ±0.033	7.55 ±0.06	35.53 ±0.06
10%	a	b	a
	34.58 ±0.030	7.58 ±0.03	35.60 ±0.06
15%	a	a	a
	34.60 ±0.026	7.72 ±0.03	35.62 ±0.03

Means with different letters in the same column significantly different (P<0.05)

**TABLE 4:** the effect of supplement proportions of Earners tomato seeds in certain cellular characteristics of broiler meat at the age of 56 days

Treatment	PCV (%)	Hb (gm%)	RBC (mm) <sup>6</sup>
Control	b	b	c
	35.17 ±0.12	7.53 ±0.03	36.67 ±0.082
5%	ab	a	b
	35.33 ±0.03	7.76 ±0.04	37.33 ±0.071
10%	ab	a	a
	35.40 ±0.06	7.80 ±0.06	37.50 ±0.06
15%	a	a	a
	35.50 ±0.01	7.87 ±0.02	37.67 ±0.033

Means with different letters in the same column significantly different (P<0.05)

**TABLE 5:** the effect of supplement proportions of Earners tomato seeds in some biochemical characteristics of broiler meat at the age of 28 days

Treatment	Protein (gm/L)	Cholesterol (mg/100ml)	Uric acid (mg/Dl)
Control	c	a	a
	4.33 ±0.07	188.33 ±0.003	3.60 ±0.001
5%	b	b	ab
	4.53 ±0.03	187.00 ±0.003	3.50 ±0.030
10%	ab	c	ab
	4.60 ±0.06	184.00 ±0.000	3.43 ±0.030
15%	a	d	b
	4.70 ±0.00	182.00 ±0.007	3.30 ±0.001

Means with different letters in the same column significantly different (P<0.05)

**TABLE 6:** the effect of supplement proportions of Earners tomato seeds in some biochemical characteristics of broiler meat at the age of 56 days

Treatment	Protein (gm/L)	Cholesterol (mg/100ml)	Uric acid (mg/Dl)
Control	b	a	a
	5.10 ±0.06	193.33 ±0.88	4.06 ±0.031
5%	a	ab	a
	5.27 ±0.05	191.0 ±0.58	4.07 ±0.033
10%	a	bc	a
	5.30 ±0.03	188.67 ±0.88	4.00 ±0.01
15%	a	c	a
	5.37 ±0.034	187.0 ±1.00	4.00 ±0.01

Means with different letters in the same column significantly different (P<0.05)

Low serum concentration of cholesterol in broilers fed on diet supplemented by tomato seeds may be attributed to the effect of lycopene in inhibiting 233hydroxyl methyl glutaryl CoA reductase (HMG), the enzymes responsible for a cholesterol manufacturing in the liver (Laker, 1996; Amany *et al.*, 2009). The supplementation of tomatoes remnants to diet reduces the concentration of fat in the blood serum by inhibiting cholesterol and triglycerides manufacturing process in the liver by lycopene. Moreover, the antioxidant activity of lycopene led to reducing the level of fat and strengthening the immune system and this explains the rise in white blood cells, particularly the proportion of lymphoid cells as well as a decline in the proportion of lymphoid cells differentiated percentage index, one of the immune indicators in poultry.

(Agarwal and Rao, 1989). The enzymes, GPT and GOT, carrying amino groups work as an indicator of the efficiency and activity of the liver to convert protein into glucose vehicles (Sturkie, 2000). They are good indicators of the health status of the broiler meat at days 28 and 56. The enzyme AP contributes to bone formation and any increase in this is enzyme reflects its increase in the skeletal, kidney and intestine. Several studies indicated the existence of a positive significant correlation between the concentration of serum alkaline phosphatase with calcium and phosphorus concentration in the serum, the rate of egg production and egg weight, and thickness of the egg shell in laying hens. AP enzyme is highly related to the productivity of eggs (Al-Obeidi *et al.*, 2007).

**TABLE 7:** the effect of supplement proportions of Earners tomato seeds in certain blood enzymes of broiler meat at the age of 28 days

Treatment	GOT (IU)	GPT (IU)	AP (IU/L)
Control	b 85.00 ±0.17	b 11.00 ±0.004	b 26.20 ±0.050
5%	a 104.00 ±0.002	a 12.00 ±0.003	ab 32.33 ±0.002
10%	a 105.17 ±0.003	a 12.67 ±0.003	ab 34.17 ±0.003
15%	a 104.67 ±0.003	a 13.00 ±0.002	a 36.00 ±0.002

Means with different letters in the same column significantly different (P<0.05)

**TABLE 8:** the effect of supplement proportions of Earners tomato seeds in certain blood enzymes of broiler meat at the age of 56 days

Treatment	GOT (IU)	GPT (IU)	AP (IU/L)
Control	b 103.0 ±1.73	b 12.67 ±0.30	b 32.0 ±1.73
5%	ab 105.0 ±0.58	b 13.67 ±0.33	b 32.33 ±0.36
10%	a 107.0 ±0.58	a 15.66 ±0.34	ab 34.67 ±0.38
15%	a 107.33 ±0.67	a 16.0 ±0.58	a 36.33 ±0.30

Means with different letters in the same column significantly different (P<0.05)

**TABLE 9:** The effect of supplement proportions of Earners tomato seeds in the white blood cells and differentiated white blood cells and the percentage of lymphocyte cells of broiler meat at the age of 28 days

Treatment	WBC (mm)3	Heterph %	Lymph %	Mono %	Eoso %	Boso %	L / H %
Control	b 24.08 ±0.03	a 30.00 ±0.005	b 65.33 ±0.002	a 2.00 ±0.05	a 1.67 ±0.002	b 1.00 ±0.030	c 2.18 ±0.04
5%	b 24.17 ±0.04	a 29.33 ±0.002	b 65.33 ±0.002	a 2.00 ±0.05	a 2.00 ±0.060	ab 1.33 ±0.002	c 2.22 ±0.02
10%	a 24.33 ±0.02	b 27.00 ±0.004	a 68.17 ±0.017	a 2.00 ±0.06	a 1.67 ±0.002	ab 1.50 ±0.002	b 2.53 ±0.02
15%	a 24.27 ±0.02	c 25.67 ±0.002	a 68.17 ±0.017	a 2.00 ±0.08	a 2.00 ±0.000	a 1.83 ±0.017	a 2.66 ±0.03

Means with different letters in the same column significantly different (P<0.05)

**TABLE 9:** The effect of supplement proportions of Earners tomato seeds in the white blood cells and differentiated white blood cells and the percentage of lymphocyte cells of broiler meat at the age of 56 days

Treatment	WBC (mm) <sup>3</sup>	Heterph %	Lymph %	Mon o %	Eosoph %	Basoph %	L /H %
Control	a 24.36 ±0.030	a 29.67 ±0.33	b 65.33 ±0.30	a 2 ±0.11	a 1.67 ±0.33	a 1.33 ±0.3	b 2.20 ±0.02
5%	a 24.37 ±0.070	a 28.67 ±0.34	b 67.70 ±0.34	a 2 ±0.14	a 2.0 ±0.00	a 1.67 ±0.36	b 2.29 ±0.03
10%	a 24.40 ±0.060	b 26.33 ±0.34	a 68.33 ±0.57	a 2 ±0.17	a 1.67 ±0.32	a 1.67 ±0.36	a 2.60 ±0.04
15%	a 24.37 ±0.066	b 25.33 ±0.34	a 68.66 ±0.58	a 2 ±0.00	a 2.0 ±0.01	a 2.00 ±0.09	a 2.71 ±0.05

Means with different letters in the same column significantly different (P<0.05)

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