Available online at http://bjas.bajas.edu.iq
https://doi.org/10.37077/25200860.2020.33.1.12
College of Agriculture, University of Basrah

Basrah Journal of Agricultural Sciences

ISSN 1814 – 5868 **Basrah J. Agric. Sci. 33(1): 159-171, 2020** E-ISSN: 2520-0860

Effect of Dietary Supplementing Cumin (*Cuminum cyminum* L.) on Meat Traits of the Broiler Chicks

Rauf H. Majid[1], Tariq Kh. M. Albashr[2], Arazu A. Hamma[1] & Zaid Kh. Khidhir[1*]

[1] Department of Animal Sciences, College of Agricultural Engineering Sciences, Sulaimani University, Iraq

[2] Department of Food Science, College of Agriculture, Tikrit University, Iraq

***Corresponding author:zaid.khzir@univsul.edu.iq**

Received 22 March 2020; Accepted 27 April 2020; Available online 27 June 2020

Abstract: This study was conducted to evaluate the dietary using of cumin as feed supplement on meat quality traits of the broiler chicken. Eight-day old broiler divided into 4 groups, 3 replicates (8 chicks/replicate) each for 45 days. Treatments included; (T1), basal diet without cumin or control, (T2), basal diet with 3 g. cumin. kg^{-1} of diet, (T3), basal diet with 6 g. cumin. kg^{-1} of diet, (T4), basal diet with 9 g. cumin. kg^{-1} of diet. At the end of this experiment after slaughtering all the chicks, samples were taken from breast and thigh meat. Results revealed that cumin supplementation did not significantly ($p<0.01$) affect moisture percentages of breast meat and protein percentages of thigh meat. Results also showed that use basal diet with 3 and 6 g.cumin. kg^{-1} of diet significantly ($p<0.01$) impact on meat water holding capacity and cooking loss percentages, while different cumin level impact on fat, ash percentages, pH value, TBA, TVB.N values, metmyoglobin, myoglobin value, copper, nickel, zinc, iron, magnesium, phosphorus and calcium concentrations of thigh meat, as well as iron, magnesium, phosphorus, sodium and calcium concentrations of breast meat. Results conclude that using cumin as feed supplement in 3, 6 and 9 $g.kg^{-1}$ level, improve most chemical and physical traits of meat.

Keywords: Cumin, feed additive, Broiler chicks, Meat traits.

Introduction

The source of cumin is the herb *Cuminum cyminum*, which grows in the eastern Mediterranean to South Asia. Ground-based, especially in India, in addition to dietary uses of cumin, it has traditional medicinal uses, especially in India, where it treats digestive disorders such as diarrhea and indigestion Srinivasan (2018). Studies conducted in several countries, including India, indicated that cumin oil has a high antioxidant effect because it contains flavonoids, especially monoterpene, apigenin and luteolin, which are found in seeds (Lassak, 1996; De Martino, *et al*., 2009). Cumin oil is used in some cases as an internal or external sterilizer, pain reliever, inflammatory control, hemolysis, cessation of enzymes, stomach stimulant, and has been widely used in ancient Iranian medicine, especially in the treatment of gastrointestinal disorders, gynecological diseases, respiratory system, toothache, diarrhea and epilepsy (Johri, 2011). The use of antibiotics to stimulate growth in poultry led to an increase in production, but the World Health Organization and for the purpose of maintaining public health and the absence of resistance to these antibiotics in the human body, has recommended to find alternatives to antibiotics, especially natural ones such as plant extracts that can add to broiler rations (Mahmood *et al*., 2015; Akyildiz & Denli, 2016; Diaz Carrasco *et al*., 2016). Some study showed that use cumin in feed effect on broiler performance (Rafiee, *et al*., 2014; Berrama, *et al*., 2017). This study was conducted to evaluate the use of cumin as feed supplement on some meat quality traits of the broiler chicken.

Material & Methods

This study was conducted at the high education lab, Department of Animal Science, College of Agricultural Engineering Sciences, Sulaimani University (the source of broiler meat sample from College farm (Ross 30), cumin source from local market, origin India, in broiler feed. Feed composition and calculated chemical composition of experiment treatments showed in table (1). Chemical composition of cumin (Moisture content: 8%, pH: 7.3, total ash: 7.5, acid insoluble ash: 18%, alcohol soluble extractive: 6.58%, water soluble extractive: 138% and ether soluble extractive: 11.44 and 12.36 % in the wet and dry fruits. Crude protein 18.40 and 19.88 %, crude fibres 21.82 and 23.57%, total carbohydrate 55.58 and 60.05% in the wet and dry fruits respectively) (Moawad, *et al.*, 2015). Eight-day old broilers divided into four groups; each group contained three replicates (8 chicks per replicate) for 45 days. Treatments included; (T1), basal diet without cumin or control, (T2), basal diet with 3 g. cumin.kg^{-1} of diet, (T3), basal diet with 6 g. cumin.kg^{-1} of diet, (T4), basal diet with 9 g. cumin.kg^{-1} of diet. At the end of this experiment after the slaughtering all the chicks, samples were taken from the breast and thigh for some chemical and physical measurements.

Chemical composition:

Moisture, protein, fat and ash contents, estimated by method described by AOAC. & Helrich (1990).

Physic-chemical traits:

pH

pH of muscle sample was measured by method described by Ibrahim *et al.* (2010).

Cooking loss

Cooking loss was determined according to Murphy & Zerby (2004).

Water holding capacity (WHC)

Water holding capacity (WHC) was determined according to Wardlaw *et al.* (1973).

Total volatile nitrogen (TVB.N)

Estimated by method described by Malle & Poumeyrol (1989).

Thiobarbituric acid (TBA) value

The TBA value was determined according to the method described by Witte *et al*. (1970).

Determination of met-myoglobin percentage and myoglobin concentration

Pigment of meat extract from muscles of each treatment was estimated using a modified procedure of Krzywicki (1982).

Table (1): Feed composition and calcualted chemical composition of experiment treatments...

1-7 days	
Feed Ingredients	% 100
	T1 (Control)
Protein Conc.	6
Yellow Corn	51.7
Soybean Meal	29
Wheat	10
Sun Flower Seed Oil	3
Salt	0.3
Cumin	0
Total	100
Calcualted chemical composition	
Crude Protein	22
Energy Kcal. kg^{-1}	3151
% Methionine	0.64
% Lysine	1.22
% Fat	5.6
% Fibres	3.5
% Calcium	0.47

8 -21 days				
Feed Ingredients	% 100			
	T1 (Control)	T2	T3	T4
Protein Conc.	5	5	5	5
Yellow Corn	56.9	56.9	56.6	56.4
Soybean Meal	24.8	24.5	24.5	24.4
Wheat	10	10	10	10
Sun Flower Seed Oil	3	3	3	3
Salt	0.3	0.3	0.3	0.3
Cumin	0	0.3	0.6	0.9
Total	100	100	100	100
Calcualted chemical composition				
Crude Protein	20	20	20	20
Energy Kcal/Kg	3213	3207	3197	3188
% Methionine	0.60	0.59	0.59	0.59
% Lysine	1.07	1.06	1.06	1.05
% Fat	5.8	5.8	5.8	5.7
% Fibres	3.4	3.4	3.4	3.3

% Calcium	0.40	0.40	0.40	0.40
21 Days -Market Weight				
Feed Ingredients	% 100			
	T1 (Control)	T2	T3	T4
Protein Conc.	5	5	5	5
Yellow Corn	59.5	59.4	59.1	58.9
Soybean Meal	22.2	22.0	22.0	21.9
Wheat	10.0	10.0	10.0	10.0
Sun Flower Seed Oil	3.0	3.0	3.0	3.0
Salt	0.3	0.3	0.3	0.3
Cumin	0.0	0.3	0.6	0.9
Total	100	100	100	100
Calcualted chemical composition				
Crude Protein	19.0	19.0	19.0	19.0
Energy Kcal/Kg	3244	3236	3226	3217
% Methionine	0.59	0.59	0.58	0.58
% Lysine	1.00	0.99	0.99	0.99
% Fat	5.9	5.8	5.8	5.8
% Fibre	3.3	3.3	3.3	3.3
% Calcium	0.39	0.39	0.39	0.39

Minerals contents

Mineral concentration estimated according to methods described by Hutton *et al*. (2014) and Rajib *et al*. (2016).

Statistical Analysis

All data were statistically analyzed by the Completely Randomized Design (CRD) by the SAS (Allison, 2010) system and the differences between the means of groups were estimated by Duncan Multiple Range Test (Duncan, 1955), statements of statistical significance are basing on ($P\leq 0.01$).

Results & Discussion

The results in tables (2 and 3) revealed that supplementation with cumin did not significantly affect ($P\leq 0.01$) moisture and protein percentages of breast meat. However, moisture and protein percentages of thigh meat were significantly ($P\leq 0.01$) differed due to different treatments. Both lipids and ash percentages of were also significantly ($P\leq 0.01$) influenced by different supplement. The breast meat of chicks fed basal diet and 9 g cumin.kg^{-1} of diet recorded lowest protein percentage (15.07%), while the meat of broiler chicks fed basal diet without cumin recorded highest percentage (15.76%). The highest lipids and ash percentages recorded in breast and thigh meat of broiler chicks fed basal diet with 9 g cumin.kg^{-1} of diet (7.54, 9.39, 3.33 and 3.35% respectively) while the lowest lipid and ash percentages recorded in breast and thigh meat of broiler chicks fed basal diet without cumin (3.01, 2.75, 2.97 and 2.53%) respectively. The use of cumin not only improves the effectiveness and stimulation of bile acid production, also has led to a good increase in enzymes secreted by the pancreas and intestines such as amylase, trypsin, chymotrypsin and lipase (Rao *et al*., 2003; Muthamma *et al*., 2008). These positive secretions from the use of cumin seeds may improve the composition of carcass meat (Madhukar, 2013).

Table (2): Effect of supplementing cumin on moisture and protein composition of broiler chicks' breast and thigh meat (Mean ± standard deviation).

Treatments	Moisture %		Protein%	
	Breast	Thigh	Breast	Thigh
T1	72.72 ± 0.07 a	67.64 ± 1.36 c	15.76 ± 0.01 a	15.71 ± 0.01 a
T2	73.99 ± 0.34 a	71.00 ± 2.92 b	15.72±0.01 a	15.68± 0.009 a
T3	74.48 ± 0.13 a	73.52 ± 0.02 a	15.54±0.004 a	15.5 ± 0.001 a
T4	74.80 ± 0.07 a	74.65 ± 0.07 a	15.07 ± 0.57 b	15.38± 0.003 a

***Mean with different letter (a, b) among columns (treatment) are significantly differ (P≤0.01).**

Table (3): Effect of supplementing cumin on lipid and ash composition of broiler chicks' breast and thigh meat (Mean ± standard deviation).

Treatments	Lipid%		Ash%	
	Breast	Thigh	Breast	Thigh
T1	3.01± 0.004 d	2.75 ± 0.02 d	2.97 ± 0.003 d	2.53 ± 0.004 d
T2	3.69± 0.02 c	3.81 ± 0.10 c	3.19 ± 0.001 c	2.86 ± 0.001 c
T3	5.72 ± 0.04 b	5.97 ± 0.05 b	3.29 ± 0.001 b	3.17 ± 0.001 b
T4	7.54±0.009 a	9.39 ± 0.13 a	3.33 ± 0.001 a	3.35 ± 0.002 a

***Mean with different letter (a, b) among columns (treatment) are significantly differ (P≤0.01).**

The results in table (4) showed that broiler chicks fed cumin impact significantly (P≤ 0.01) meat physical traits. The pH value of breast and thigh meat from broiler chicks that's fed with basal diet with 9 g. cumin.Kg^{-1} of diet recorded highest values (7.25 and 7.47 respectively), while the lowest values were recorded in meat of broiler chicks fed basal diet without cumin, control groups (6.35 and 6.50 respectively).

The water holding capacity (WHC) results in table (3) revealed that chicks fed cumin showed significantly (P≤0.01) higher WHC % of breast and thigh meat, the highest percentages recorded in breast and thigh meat of chicks from T4 groups (basal diet plus 9 g. cumin.Kg^{-1} of diet) which were (55.40 and 64.28%) respectively. The lowest percentages recorded in breast and thigh meat of chick from T1 group (fed basal diet without cumin) which were (40.17 and 40.43%) respectively.

The results of cooking loss percentages (CL) (Table 4), showed that breast and thigh meat of chicks fed feed supplement with cumin recorded lower CL%, specifically in T4 group (basal diet plus 9 g. cumin.Kg^{-1} of diet) (36.84 and 36.32%) respectively, which differ significantly with other treatment groups. The highest percentages recorded in breast and thigh meat of chicks from T1 groups (fed basal diet without cumin) (56.60 and 51.06%) respectively.

Warriss (2000) described that high pH increases the water-binding because it affects the shrinkage of the contractile fibres, which might be the case in the present study, that meat sample has higher pH causes higher water holding capacity and lower cooking loss.

Table (4): Effect of Supplementing Cumin on some physical traits of broiler chicks' breast and thigh meat (Mean ± standard deviation).

Traits		Treatment			
		T1	T2	T3	T4
pH	Breast	6.35 ± 0.09 d	6.68 ± 0.002 c	6.96 ± 0.06 b	7.25 ± 0.02 a
	Thigh	6.50± 0.006 d	6.89± 0.009 c	7.13 ± 0.02 b	7.47 ± 0.19 a
WHC%	Breast	40.17 ± 0.03 d	44.07 ± 0.42 c	50.15 ± 0.16 b	55.40 ± 2.03 a
	Thigh	40.43 ± 0.23 d	49.51 ± 0.02 c	51.69 ± 1.25 b	64.28 ± 2.20 a
CL%	Breast	56.60± 3.68 a	50.02± 0.39 b	42.52± 0.74 c	36.84± 0.19 d
	Thigh	51.06 ± 0.56 a	45.65 ± 1.13 b	39.80 ± 0.90 c	36.32 ± 0.32 d

***Mean with different small letter (a, b) among rows (treatment) are significantly differ ($P \leq 0.01$).**

The results of thiobarbuteric acids (TBA) and total volatile basic nitrogen (TVB.N) showed in table (5), Results revealed that fed broiler chicks feed supplemented with cumin significantly affect ($P \leq 0.01$) TBA and TVB.N values. Results of TBA showed that breast and thigh meat from treatments contain cumin recorded lowest values particularly meat from T4 group (basal diet plus 9 g. cumin.kg^{-1} of diet) which were 0.47 and 0.56 mg MDA.kg^{-1} muscle in breast and thigh meat respectively., Breast and thigh meat from broiler chicks fed basal diet (T1 group) recorded highest TBA values (0.70 and 0.81 mg MDA.kg $muscle^{-1}$) respectively. The results of TVB-N values in table (5), revealed that breast and thigh meat of treatments contain cumin recorded better TVB-N values than meat from T1 (control group), the TVB-N values in meat from T4 group were (14.04 and 12.58 mgN.100^{-1} g muscle) in breast and thigh meat TVB-N were 19.26 and 18.10 mg N.100^{-1} g muscle respectively. Gagandeep *et al.* (2003) mentioned that uses of cumin seed (2.5 and 5% of diet) in mice tended to increase superoxide dismutase, catalase and reduced glutathione. Foods containing respectively, while in breast and thigh meat of chicks fed basal diet (T1 group) the

biologically active compounds that specialize in action against free radicals' help protect against cancer and may also help reduce cardiovascular and brain diseases in human (Miraliakbari & Shahidi, 2008).

Table (5): Effect of Supplementing Cumin on some chemical traits of broiler chicks breast and thigh meat (Mean ± standard deviation).

Treatment	TBA (mg MDA.kg^{-1} muscle)		TVN (mg N.100^{-1} g muscle)	
	Breast	Thigh	Breast	Thigh
T1	0.70 ± 0.03 a	0.81 ±0.005 a	19.26 ± 0.06 a	18.10 ± 0.26 a
T2	0.63 ± 0.001 b	0.64 ± 0.001 b	16.00 ± 0.009 b	15.74 ±0.01 b
T3	0.55 ± 0.1 c	0.57 ± 0.006 c	15.28 ± 0.30 c	14.91 ± 0.02 c
T4	0.47 ± 0.008 d	0.56 ± 0.03 c	14.04 ± 0.84 d	12.58 ± 0.58 d

***Mean with different letter (a, b) among columns (treatment) are significantly differ ($P\leq 0.01$).**

The results of metmyoglobin and myoglobin represented in table (6). Results demonstrated that the use of cumin in chicks diet effect ($P\leq0.01$) met-myoglobin percentages and myoglobin values. The highest met- myoglobin percentage recorded in breast and thigh meat of broiler chicks from T1 group (basal diet) which were (49.64 and 58.65%) respectively. In contrast the lowest percentages recorded in breast and thigh meat of chicks from T4 group (basal diet plus 9 g. cumin.kg^{-1} of diet) which were (30.82 and 36.16%) respectively.

The results of myoglobin value in table (6), displayed that breast and thigh meat of chicks fed basal diet plus 9 g. cumin.kg^{-1} of diet (T4 group) recorded highest value, which were (4.67 and 4.39 mg.g^{-1} muscle) respectively, in contrast the lowest value recorded in breast and thigh meat of chicks from T1 group (basal diet) which were 3.16 and 2.90 mg.g^{-1} muscle) respectively. The colour of the product is very important in the purchase, especially when trading singular, and the colour of meat comes from the pigment of myoglobin which resulting from the oxidation of metaglobin (Hernández *et al.,* 2015). Adding cumin as feed additive improved pigment stability compared with the control which may be due to their antioxidant activity and presence of some

Table (6): Effect of supplementing cumin on metmyoglobin and myoglobin value of broiler chicks' breast and thigh meat (Mean ± standard deviation).

Treatments	Metmyoglobin %		Myoglobin ($mg.g^{-1}$ muscle)	
	Breast	Thigh	Breast	Thigh
T1	49.64 ± 0.70 a	58.65 ± 0.99 a	3.16 ± 0.05 d	2.90 ± 0.07 d
T2	44.69 ± 0.20 b	46.97 ± 0.24 b	3.65 ± 0.05 c	3.57 ± 0.04 c
T3	39.44 ± 0.54 c	43.00 ± 1.50 c	3.99 ± 0.007 b	3.89 ±0.01 b
T4	30.82 ± 0.60 d	36.16 ± 0.33 d	4.67 ± 0.16 a	4.39 ± 0.05 a

***Mean with different letter (a, b) among columns (treatment) are significantly differ (P≤ 0.01).**

bioactive principles in cumin (Madhukar, 2013). As seen in table (7), the cumin supplementation affect (P≤0.01) copper, nickel, zinc, iron, magnesium, phosphorus and Calcium concentrations in thigh meat. It also affect iron, magnesium, phosphorus, sodium and calcium concentrations in breast meat. For copper concentration, the highest concentration (0.099 ppm) recorded in thigh meat fed cumin (9 g. $cumin.kg^{-1}$ of diet), while the lowest concentration recorded by T1 (control, 0.085 ppm). Iron metabolism depends on the presence of copper and its deficiency leads to anaemia (McDowell, 2003). The highest nickel concentration recorded in thigh meat from broiler chicks of T4 (9 g. $cumin.kg^{-1}$ of diet) treatment, 0.099 ppm, While the lowest concentration recorded in meat from broiler chicks of T1 (control, 0.085 ppm), zinc concentration recorded in thigh meat from broiler chicks of T4 (9 g. $cumin.kg^{-1}$ of diet) highest concentration (3.150 ppm), in contrast the meat from chicks of T2 (3 g. $cumin.kg^{-1}$ of diet) recorded lowest concentration (2.850 ppm), protein and carbohydrate metabolism, cell growth, and cell division in cell need Zinc (Lo *et al.*, 2020). The highest iron concentration recorded in breast and thigh meat from chicks of T4 (9 g. $cumin.kg^{-1}$ of diet, 0.625 and 0.600 ppm) respectively, and lowest concentration recorded in breast and thigh meat of T2 (3 g $cumin.kg^{-1}$ of diet, 0.505 and 0.405 ppm) respectively, the iron is important element for health, and iron deficiency is the common medicinal diseases (Abbaspour, *et al.*, 2014). The highest magnesium concentration recorded in T2 (3 g $cumin.Kg^{-1}$ of diet) breast meat and T1 (control) thigh meat (17.64 and 19.23 ppm) respectively, and lowest concentration recorded in T3 (6 g $cumin.kg^{-1}$ of diet) breast meat and T2 (3 g $cumin.kg^{-1}$ of diet) thigh meat (14.01 and 12.54 ppm ppm) respectively. The highest phosphorous concentration recorded in T2 (3 g $cumin.kg^{-1}$ of diet) breast meat and T4 (9 g. $cumin.kg^{-1}$ of diet) thigh meat (22.95 and 22.73 ppm) respectively and lowest concentration recorded in T1 (control) breast and thigh meat (16.12 and 14.48ppm) respectively. The highest breast sodium concentration recorded in meat of T1 (control, 83.23 ppm), while the lowest concentration recorded in T2 (3 g $cumin.kg^{-1}$ of diet, (55.03 ppm). Calcium concentration recorded in breast and thigh meat from broiler chicks of T4 (9 g cumin.kg^{-1} of diet) highest concentration (9.26 and 8.27 ppm) respectively. In contrast the meat from chicks of T1 (control) recorded lowest concentration (4.45 and 4.17 ppm) respectively. The bone formation and neuromuscular function need calcium and phosphorus, blood clotting depends on calcium, while phosphor play important role in some function of blood (Zomrawi, 2013). Cumin consists of minerals such as potassium, sodium, calcium, iron, phosphorous and nutritional vitamins like thiamine, riboflavin, niacin, vitamins A and C (Moawad *et al.*, 2015), this may causes different minerals concentration in meat from broiler feed with cumin in contrast to control groups.

Table (7): Effect of Supplementing cumin on mineral concentration (ppm) of broiler chicks breast and thigh meat (Mean ± standard divation).

Minerals	Meat type	T1	T2	T3	T4
Cr	Breast	0.085 ± 0.007 a	0.099 ± 0.001 a	0.099 ± 0.001 a	0.120 ±0.029 a
	Thigh	0.085 ± 0.007 a	0.099 ± 0.001 a	0.099 ± 0.001 a	0.099 ± 0.001 a
Cu	Breast	0.085 ± 0.007 a	0.099 ± 0.001 a	0.099 ± 0.001 a	0.099 ± 0.001 a
	Thigh	0.085 ± 0.007 b	0.099 ± 0.001 a	0.099 ± 0.001 a	0.099 ± 0.001 a
Cd	Breast	0.045 ± 0.007 a	0.049 ± 0.000 a	0.049 ± 0.001 a	0.049 ± 0.001 a
	Thigh	0.045 ± 0.007 a	0.049 ± 0.001 a	0.049 ± 0.001 a	0.049 ±0.001 a
Pb	Breast	0.10 ± 0.0 a	0.099 ± 0.001 a	0.110 ±0.014 a	0.099 ± 0.001 a
	Thigh	0.130 ± 0.028 a	0.103 ± 0.011 a	0.105 ± 0.008 a	0.120 ± 0.014 a
Ni	Breast	0.085 ± 0.007 a	0.099 ± 0.001 a	0.115 ± 0.021 a	0.099 ± 0.001 a
	Thigh	0.085 ± 0.007 b	0.099 ± 0.001 a	0.099 ± 0.001 a	0.099 ± 0.001 a
Zn	Breast	3.250 ± 0.212 a	3.40 ± 0.424 a	3.100 ±0.566 a	2.800 ± 0.424 a
	Thigh	3.00 ±0.282 ab	2.850 ±0.707 b	3.050 ± 0.495 a	3.150 ± 0.919 a
Fe	Breast	0.535± 0.077 ab	0.505± 0.120 b	0.520 ± 0.085 a	0.625± 0.064 a
	Thigh	0.425 ± 0.028 ab	0.405 ± 0.078 b	0.590 ± 0.099 a	0.600 ± 0.007 a
Mg	Breast	14.26 ±0.89 bc	17.64±0.79 a	14.01± 0.06 c	15.85± 0.28 bc
	Thigh	19.23± 0.43a	12.54± 0.65c	16.42± 0.87ab	14.71± 2.19bc
P	Breast	16.12± 1.03 b	22.95± 1.91a	19.73± 2.01ab	17.83± 0.37b
	Thigh	14.48± 0.02 c	18.57± 1.23b	19.48± 0.12b	22.73± 0.79a
Na	Breast	83.23± 0.94a	55.03± 1.34b	77.88±8.51 a	77.94± 5.71a
	Thigh	90.92± 4.27a	68.59± 13.43a	73.78± 6.03a	79.03± 4.17a
Ca	Breast	4.45± 0.79 b	6.45± 1.80 ab	7.39± 1.01ab	9.26± 0.78a
	Thigh	4.17± 0.29b	4.53± 0.62b	8.18± 0.1.71a	8.27± 1.84a
K	Breast	285.0± 80.61a	261.0± 39.60a	284.5± 2.12a	315.0± 24.04a
	Thigh	317.0± 21.21a	286.0± 8.48.a	269.5± 55.86a	299.0± 14.14a

***Mean with different small letter (a, b) among rows (treatment) are significantly differ (P≤ 0.01).**

Conclusion

Cumin supplementation did not significantly affect moisture and protein percentages, and negatively effect on fat percentage and pH value, while impact positively on meat ash, water holding capacity and cooking loss percentages, TBA, TVB.N values, metmyoglobin, myoglobin value, copper, nickel, zinc, iron, magnesium, phosphorus and calcium concentrations of thigh meat and iron, magnesium, phosphorus, sodium and calcium concentrations of breast meat.

Acknowledgements

We would like to extend our special thanks to head and staff of Deprtment of Animal Sciences, College of Agricultural Engineering Sciences, Sulaimani University, for their supports and helps in this research.

References

Abbaspour, N.; Hurrell, R. & Kelishadi, R. (2014). Review on iron and its importance for human health. J. Res. Med. Sci.: Off. J. Isfahan Univ. Med. Sci., 19(2): 164-174.

Akyildiz, S. & Denli, M. (2016). Application of plant extracts as feed additives in poultry nutrition. SCI Papers, Ser. D. Ani. Sci.: LIX: 71-74.

Allison, P.D. (2010). Survival Analysis Using SAS: A Practical Guide, 2nd ed. SAS Press, Cary, N. Carolina: 337 pp.

Association of Official Analytical Chemists & Helrich, K. (1990). Official Methods of Analysis of the Association of Official Analytical Chemists. Arlington, V.A.: 771pp.

Berrama, Z.; Temim, S.; Souames, S. & Ainbaziz, H. (2017). Growth performance, carcass and viscera yields, blood constituents and thyroid hormone concentrations of chronic heat stressed broilers fed diets supplemented with cumin seeds (*Cuminum cyminum* L.). Kafkas Univ Vet Fak Derg, 23(5): 735-742. https://doi.org/10.9775/kvfd.2017.17663.

De Martino, L.; De Feo, V.; Fratianni, F. & Nazzaro, F. (2009). Chemistry, antioxidant, antibacterial and antifungal activities of volatile oils and their components. Nat. Prod. Commun., 4(12): 1741-1750. https://doi.org/10.1177/1934578X0900401226

Diaz Carrasco, J.M.; Redondo, L.M.; Redondo, E. A.; Dominguez, J. E.; Chacana, A.P. & Fernandez Miyakawa, M.E. (2016). Use of plant extracts as an effective manner to control *Clostridium perfringens* induced necrotic enteritis in poultry. BioMed. Res. Int., 2016: 1-15. https://doi.org/10.1155/2016/3278359

Duncan, D. (1955). Multiple Range and Multiple F Tests. Biometrics, 11(1): 1-42. https://doi.org/10.2307/3001478. https://www.jstor.org/stable/3001478

Gagandeep, Dhanalakshmi, S.; Mendiz, E.; Rao, A.R. & Kale, R.K. (2003). Chemopreventive effects of *Cuminum cyminum* in chemically induced forestomach and uterine cervix tumors in murine model systems. Nutr. Cancer, 47(2): 171-180. https://doi.org/10.1207/s15327914nc4702_10

Hernández, B.; Sáenz, C.; Alberdi, C. & Diñeiro, J.M. (2015). Comparison between two different methods to obtain the proportions of myoglobin redox forms on fresh meat from reflectance measurements. J. Food Sci. Technol., 52(12): 8212-8219. https://doi.org/10.1007/s13197-015-1917-x

Hutton, L.A.; O'Neil, G.D.; Read, T.L.; Arest, Z.J.; Newton, M.E. & Macpherson, J.V. (2014). Electrochemical X–ray fluorescence spectroscopy for trace heavy metal Analysis: Enhancing X-ray fluorescence detection capabilities by four orders of Magnitude. Anal. Chem., 86(9): 4566-4572. https://doi.org/10.1021/ac500608d.

Ibrahim, H.M.; Abou-Arab, A.A. & Salem, F. M.A. (2010). Addition of some natural plant extracts and their effects on lamb patties quality. J. Food Technol., 8(3): 134-142. https://doi.org/10.3923/jftech.2010.134.142.

Johri, R. K. (2011). *Cuminum cyminum* and *Carum carvi*: An update. Pharmacogn. Rev., 5(9): 63-72. https://doi.org/10.4103/0973-7847.79101

Krzywicki, K. (1982). The determination of haem pigments in meat.Meat Sci., 7(1): 29-36. https://doi.org/10.1016/0309-1740(82)90095-X

Lassak, E. (1996), Encyclopedia of common natural ingredients used in food, drugs and cosmetics. Flavour Fragr. J., 11: 373-373. https://doi.org/10.1002/(SICI)1099-1026 (199611)11:6<373::AID-FFJ628>3.0.CO;2-5

Lo, M.N.; Damon, L.J.; Tay, J.W.; Jia, S. & Palmer, A.E. (2020). Single cell analysis reveals multiple requirements for zinc in the mammalian cell cycle. Elife, 9: 1-24. https://doi.org/10.7554/eLife.51107

Mahmood, S.; Rehman, A.; Yousaf, M.; Akhtar, P.; Abbas, G.; Hayat, K. & Shahzad, M.K. (2015). Comparative efficacy of different herbal plant's leaf extract on haematology, intestinal histomorphology and nutrient digestibility in broilers. Adv. Zool. Bot., 3(2): 11-16. https://doi.org/10.13189/azb.2015.030201

Madhukar, C. (2013). Phytochemical screening of cumin seeds extract. Rep. Opin., 5(1): 57-58. https://doi.org/10.7537/marsroj050113.10

Malle, P. & Poumeyrol, M. (1989). A new chemical criterion for the quality control of fish: Trimethylamine/total volatile basic nitrogen (%). J. Food Prot., 52(6): 419-423. https://doi.org/10.4315/ 0362-028X-52.6.419

McDowell, L.R. (2003). Minerals in Animal and Human Nutrition. 2nd ed., Amsterdam, Elsevier Sci. 660pp.

Miraliakbari, H. & Shahidi, F. (2008). Antioxidant activity of minor components of tree nut oils. Food Chem., 111(2): 421-427. https://doi.org/10.1016/j.foodchem.2008.04.008

Moawad, S.A.; El-Ghorab, A.H.; Hassan, M., Nour-Eldin, H. & El-Gharabli, M.M. (2015). Chemical and microbiological characterization of Egyptian cultivars for some spices and herbs commonly exported abroad. Food Nut. Sci., 6(07): 643-659. https://doi.org/10.4236/fns.2015.67068

Murphy, M.A. & Zerby, H.N. (2004). Pre-rigor infusion of lamb with sodium chloride, phosphate, and dextrose solutions to improve tenderness. Meat Sci., 66(2): 343-349. https://doi.org/10.1016/S0309-1740(03)00109-8

Muthamma, M.K.S.; Dholakia, H.; Kaul T.P.; & Vishveshwaraiah, P. (2008). Enhancement of digestive enzymatic activity by cumin (*Cuminum cyminum* L.) and role of spent cumin as a bionutrient. Food Chem., 110: 678- 683. https://doi.org/10.1016/j.foodchem.2008.02.062

Rafiee, A.; Kheiri, F.; Rahimian, Y.; Faghani, M.; Valiollahi, M.R. & Miri, Y. (2014). The effect of ginger root (*Zingiber officinale*) and cumin (*Cuminum cyminum*) powder on performance, some haematological traits and intestinal morphology of broiler chicks. Res. Opin. Anim. Vet. Sci., 4(2): 96-100

Rajib, A., SaifulIslam, A.T.M.; Ahmed R.; Rahman, T.; Rahman, A. & Ismail A.B. (2016). Detection of chromium (Cr) using X-ray fluorescence technique and investigation of Cr propagation from poultry feeds to egg and chicken flesh. Am. J. Eng. Res., 5(7): 243-247. http://www.ajer.org/papers/v5(07)/ZF050702430247.pdf

Rao, R.R.; Platel, K. & Srinivasan, K. (2003). *In vitro* influence of spices and spice-active principles on digestive enzymes of rat pancreas and small intestine. Die Nahrung, 47(6): 408-412. https://doi.org/10.1002/food.200390091

Srinivasan K. (2018). Cumin (*Cuminum cyminum*) and black cumin (*Nigella sativa*) seeds: traditional uses, chemical constituents, and nutraceutical effects, Food Qual. Saf., 2(1): 1-16. https://doi.org/10.1093/fqsafe/fyx031

Wardlaw, F.B.; McCaskill, L.H. & Acton, J.C. (1973). Effect of postmortem muscle changes on poultry meat loaf properties. J. Food Sci., 38(3): 421-423. https://doi.org/10.1111/j.1365-2621.1973.tb01444.x

Warriss, P.D. (2000). Meat Science. An Introductory Text. New York: Cabi. Publ. Inc.: 312 pp. https://doi.org/10.4102/jsava.v71i4.731

Witte, V.C.; Krause, G.F. & Bailey, M.E. (1970). A new extraction method for determining 2-thiobarbituric acid values of pork and beef during storage. J. Food Sci., 35(5): 582-585. https://doi.org/10.1111/j.1365-2621.1970.tb04815.x

Zomrawi, W.B. (2013). Response of broiler chicks and laying hens to dietary ginger (*Ziangbir officinal*) root powder. Ph.D. Thesis Univ. Khartou:. 147pp.

تأثير إضافة الكمون (*Cuminum cyminum* L.) في بعض صفات لحوم افراخ دجاج اللحم

رؤوف حسين مجيد[1]، طارق خالد محمود البشر[2]، ارازو عبدالله حمة[1]، زيد خلف خضر [1]

[1]قسم علوم الحيوان، كلية علوم الهندسة الزراعية، جامعة السليمانية، العراق

[2]قسم علوم الأغذية، كلية الزراعة، جامعة تكريت، العراق

المستخلص: أجريت هذه الدراسة لتقييم استعمال الكمون كمكمل غذائي في بعض صفات جودة لحم دجاج اللحم. في عمر ثمانية أيام ، تم تقسيم الافراخ بالتساوي على 4 مجموعات ، تحتوي كل مجموعة على 3 مكررات (8 افراخ/ لكل منها). تم تقسيم المعاملات إلى (المعاملة الاولى باستعمال نظام غذائي أساسي خالٍ من الكمون (معاملة مقارنة)، المعاملة الثانية، باستعمال نظام غذائي أساسي بالإضافة إلى 3 غم كمون / كغم من النظام الغذائي، المعاملة الثالثة ، باستعمال النظام الغذائي الأساسي بالإضافة إلى 6 غم كمون / كغم من النظام الغذائي، المعاملة الرابعة ، باستعمال النظام الغذائي الأساسي بالإضافة إلى 9 غم كمون/كغم من النظام الغذائي. في نهاية هذه التجربة بعد ذبح الدجاج ، تم أخذ العينات من لحوم الصدر والفخذ. أوضحت النتائج أن مكملات العلف بالكمون لم تؤثر بشكل معنوي ($p < 0.01$) في نسب الرطوبة في لحوم الصدر، ونسب البروتين في لحوم الفخذ، كما أظهرت النتائج أن تغذية دجاج التسمين على الكمون بسمتويات النظام الغذائي الأساسي بالإضافة إلى 3 و 6 غم كمون / كغم من النظام الغذائي) اثر بشكل معنوي ($p < 0.01$) في نسب قابلية حمل الماء والفقدان اثناء الطبخ، واثرت المستويات المختلفة للكمون في نسب الدهن، الرماد، قيمة الاس الهديدروجيني، قيم حامض الثايوبربوتريك ، والنتروجين الكلي المتطاير، قيمة ميتميكلوبين والميكلوبين، تركيزات النحاس، النيكل، الزنك ، الحديد، المغنيسيوم، الفوسفور والكالسيوم في لحم الفخذ، أثر أيضًا في تركيزات الحديد والمغنيسيوم والفوسفور والصوديوم والكالسيوم في لحم الصدر. خلصت النتائج إلى أن استخدام الكمون كمكمل غذائي بمستويات 3 و 6 و 9 غم/كغم يحسن معظم الصفات الكيميائية والفيزيائية للحوم.

الكلمات المفتاحية: الكمون، اضافة غذائية، افراخ اللحم، صفات اللحم.