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EFFECT OF DIETARY SUPPLEMENTATION OF TURMERIC POWDER ON GROWTH PERFORMANCE, BEHAVIOR AND BLOOD BIOCHEMICAL PARAMETERS OF FAYOUMI BROILERS

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ABSTRACT

The present study was undertaken to investigate the effect of dietary supplementation of turmeric (Curcuma longa) powder on the performance, carcass traits and behavior of native Fayoumi broiler. A total number of 120 one month old commercial male Fayoumi broilers with nearly similar weights were randomly distributed into three experimental groups each 40 birds in 4 replicates (10 bird/replicate). Birds in the first group were fed on standard basal diet without any addition (control T1) while, Fayoumi broilers in the second and the third groups fed on the same basal diet supplemented with 0.5 and 0.75% turmeric powder (T2&T3). Growth performance parameters, carcass traits, and behavioral parameters were assessed. The results showed that, there was a significant increased in body weight gain, feeding, drinking and sitting behavior, total protein, globulin, calcium, phosphorus and dressing percentage while, significant decrease in FCR, walking and standing behavior. Addition of turmeric powder in the second and third treatment had no significant effect on albumin level, relative weights of liver, gizzard, heart and spleen over six weeks of experimental period. Results of the current study concluded that using turmeric (curcuma longa) powder supplement in Fayoumi broiler diets improved growth performance and ingestive behavior, in addition, total serum protein, globulin, calcium, phosphorus and dressing percentage were increased significantly.

Keywords: Turmeric, Feeding behavior, Growth performance, Carcass traits, Fayoumi broilers

INTRODUCTION

In Egypt, the demand for broiler meat is increased rapidly, driven by increased income and population growth and urbanization. Thus, broiler farming seems to be a considerable part of meat production and consumption. Poultry is one of the short duration and efficient avenue to convert the agro-industrial by-products and wastes into a high quality protein for human consumption.

Native Egyptian chickens (Fayoumi breed) become a profitable and most popular income generating sector for the educated unemployed youth in rural regions. Most of the poultry farmers are interested in its production because it survive normally with farmers as a scavenger bird showed a strong inherent scavenging, also have the carcass characteristics and flavor desired by Egyptian consumers. In addition to less prone to predator attacks and can survive under harsh nutritional and environmental conditions.

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Moreover, such breed demonstrated better general disease resistance than imported breeds, because they have evolved through natural selection for a long period in the prevailing environment (Ramadan *et al.*, 2011).

Success on rearing broilers for maximum weight gain is not only depends upon the strain of the birds and management but also on high quality feed (Nazeer *et al.*, 2002). Hence, it is essential to enhance the feeding value of available feed resources so as to improve the efficiency of feed utilization and minimize the cost of feed per kilogram live weight gain (Zhang *et al.*, 2009).

The feed additives are a cluster of nutrient and non-nutrient composites which help in improving the efficiency of feed utilization and consequently dropping the high cost of feeds. These additives have established a great consideration as feed supplements for numerous purposes in poultry production throughout the recent years (Zhang *et al.*, 2009).

Phytobiotics have gained increasing interest as natural growth promoting feed additives in broiler production in recent years. These have wide range of

medicinal properties with no residual side effects (Rahman *et al.,* 2014). Beneficial effects of these substances in poultry nutrition are due to their high content of pharmacologically active compounds stimulating appetite and feed intake, improving endogenous digestive secretion and activating immune responses (Nouzarian *et al.,* 2011).

Several studies on broilers fed on phytogenic blends of coriander, turmeric, thyme and others have been indicated considerable improvement in growth performance, immune indicators and carcass characteristics in both broiler chicken and ducks (Qasem *et al.,* 2015 and Hady *et al.,* 2016). Phytogenic blends used singly or in combination as feed additives in animal feeds (Valenzuela-Grijalva *et al.,* 2017). Among the various spices turmeric (Curcuma longa L), also known as the golden spice, is of special interest owing to its wide range of beneficial pharmacological effects in supportive of the health and well-being of both animals and humans (Prasad *et al.,* 2014).

Turmeric (Curcuma longa) is a member of Zingiberacae family and one of herbs which contained an active component named curcumin (Mashhadani, 2015). It has a multitude effects including antioxidant, anti- inflammatory, antimicrobial, and gastroprotective, (Prasad *et al.,* 2014). It also posses immune-modulatory and hepato-protective properties (Rajput *et al.,* 2013).

Accordingly, the aim of the present study was conducted to investigate the effect of dietary supplementation of curcumin powder on production performance; behavior and blood serum metabolites of Fayoumi broiler chickens.

MATERIALS AND METHODS

This research was carried out at the research unit of animal behavior and management, Veterinary medicine hospital, Assiut University, Assiut, Egypt.

Birds and housing

120 one month old male fayoumi broilers were purchased from a local commercial farm and assigned into three treated groups each of 40 birds in 4 replicates (10 birds / replicate). Birds were reared in isolated deep-litter floor pens for 42 days (from 30 to 72 days of age) and fed ad libitum on the respective diets and give free access to fresh water.

Dietary treatments

Birds were fed on commercial grower-finisher diet showed in table (1) for the 6 weeks of fattening period. In the first group, birds were fed ad libitum on basal grower-finisher diet (control diet), while fayoumi broilers in the second and third groups fed on the same diet supplemented with 0.5 or 0.75% turmeric powder.

Table1: Physical composition and energy value of the different experimental diets.

Ingredient (%)	***Turmeric powder (%)***		
	Control	**T_1 (0.5%)**	**T_2 (0.75)**
Physical composition %			
Yellow corn, ground	62.63	62.08	62.26
Soybean meal	27.95	27.60	27.93
Sunflower oil	2.87	2.80	2.43
Corn gluten meal	3.19	3.65	3.34
Turmeric (Curcuma longa)	0	0.5	0.75
Limestone, ground	1.66	1.67	1.67
Mono calcium phosphate	1.06	1.06	1.06
Methionine	0.04	0.04	0.05
Common salt	0.30	0.30	0.30
Premix*	0.30	0.30	0.30
Chemical composition (%)			
Crude protein	20	20	20
Ether extract	5.76	5.76	6.34
Methionine	0.38	0.38	0.38
Calcium	0.90	0.90	0.90
Phosphorus, available	0.35	0.35	0.35
Crude fiber	3.20	3.25	3.26
Energy value:			
ME (kcal/kg)	3100	3100	3100

Per 3 kg including: Vit. A, 1200000 IU; Vit. D_3, 300000 IU; Vit. E, 700 mg; Vit. k_3, 500 mg; Vit. B_1, 500 mg; Vit. B_2, 200 mg; Vit. B_6, 600 mg; Vit. B_{12}, 3 mg; Vit. C, 450 mg;Niacin, 3000 mg; Methionine, 3000 mg; Pantothenicacid, 670 mg ; Folicacid 300 mg; Biotin, 6 mg; Choline chloride, 10000 mg; Magnesiumsulphate, 3000 mg; Copper sulphate, 3000 mg; Ironsulphate, 10000 mg; Zinc sulphate, 1800 mg; Cobalt sulphate, 300 mg.

Management and data collection:

Growth and feed efficiency traits

Body weights of the birds were recorded weekly throughout the experiment period using a digital scale. Feed intake (FI) was calculated as the difference between the feed weighed in and unconsumed weighed back at the end of each period. Feed conversion ratio (FCR) was weekly calculated by dividing the feed intake by the weight gain.

Behavioral parameters

Behavior of 40 birds per treatment (10 bird x 4 replicate) were observed according to a predefined ethogram (Table 2) using instantaneous scanning sampling method (Altmann, 1974), twice a day in morning from 0800 to 0900 and late afternoon from 1400 to 1500, for 3 days weekly (Monday–Wednesday) during the entire experiment (from 30 to 72 days of age). The 12 pens were divided into 3blocks, and each block contains all treatments. Behaviors of all birds in one block (i.e. 4 pens) were scored every min during 4 min. After sampling one block, moved to another block to repeat the same behavioral observation. In total, behavior of each treatment was scanned 12 times on each day (3 replicate X 2 cycle per period scored 6 times/hour). Data are presented as the proportion of each behavioral frequency (number of scans out of the total number possible) (Kristensen *et al.*, 2006).

Table 2: behavior Ethogram

Behavior	Definition
Ingestive behavior	
a) Feeding	Bird's head is located inside feeder
b) Drinking	Bird's beak is in contact with drinker.
Movement activity	
a) Standing	Both feet are in contact with the floor; no other body part is in contact with floor.
b) Sitting	Most of the ventral region of the bird's body in contact with floor. No space is visible between the floor and the bird.
c) Walking	Bird is in the process of taking at least 2 steps, including scratching the litter.

Relative weights of internal organs

At the end of the experiment at 72 day of age, 3 birds from each replicate were randomly selected and weighed then, killed by cutting the neck. After bleeding for few minutes, scalding, defeathering and evisceration was performed manually. The weights of liver, gizzard, proventriculus, heart, spleen were recorded then relative weights were calculated as a percentage of live weight of the birds and the dressed carcass were recorded for each bird.

Blood samples:

Total 36 blood sample was collected (3 birds/replicate) were collected at the end of experiment. These samples were collected from cutting jugular vein during stunting in 5 ml sterilized syringes and pooled from each replicate, and 12 blood samples were analyzed.

After collecting blood the syringes were kept in slanted position then centrifuged (3,000 ×g for 10 min) and serum was separated, then stored at -20 ^{o}C until assayed for measuring biochemical parameters (total protein, albumin, calcium and phosphorus) using appropriate laboratory kits (Gowenlock *et al.*, 1988).

Statistical Analysis

The results were subjected to statistical analysis using One-way ANOVA for completely randomized design. Treatment means were compared by Duncan test through SPSS (1999).

RESULTS

Data present in tables (3-5) cleared that, addition of turmeric powder increased significantly body weight, feed intake, body weight gain, total protein, globulin, calcium, phosphorus, FCR, and dressing percentage while, there are non significant effect in albumin level, relative weights of liver, gizzard, heart and spleen over six weeks of experimental period.

Table 3: Growth performance parameters of broilers fed different experimental diets.

Groups / weeks	*Turmeric powder (%)*		
	Control 0 %	T_1 0.5 %	T_2 0.75 %
Initial body weight, g	326.7 ± 7.3	324.3±6.5	322±5.3
Final body weight, g	881.6 ± 6.7 [b]	1036.7±2.5 [a]	1055±15.3 [a]
Body weight gain, g	554.9 ± 4.3[b]	712.4 ± 3.50[a]	733±5.36[a]
Feed intake, g	1687±6.3 [b]	2006.5±8.3 [a]	2052.4±4.3 [a]
Feed conversion ratio	3.04 ± 0.9 [a]	2.8 ±0.11 [b]	2.8±0.18 [b]

Values are expressed as means ± standard error (SE).
Means within the same row of different litters are significantly different at (P <0.05).

Table 4: Carcass traits of broilers fed different experimental diets.

Parameters	***Turmeric powder (%)***		
	Control 0 %	**T1 0.5 %**	**T2 0.75 %**
Dressing %	69 ± 0.79 [b]	73 ± 0.29 [a]	74 ±0.9 [a]
Proventriculus %	0.43 ± 0.09	0.44±0.05	0.44 ±0.06
Gizzard %	1.41 ± 0.09	1.43 ± 0.3	1.44 ± 0.2
Liver %	2.1 ± 0.07	2.2 ± 0.04	2.3 ± 0.07
Heart %	0.58 ± 0.043	0.56 ± 0.008	0.59 ±0.004
Spleen %	0.19 ± 0.07	0.21±0.03	0.22 ± 0.03

Values are expressed as means ± standard error (SE).
Means within the same row of different litters are significantly different at (P <0.05)

Table 5: Blood biochemical parameters of broilers fed different experimental diets.

Parameters	***Turmeric powder (%)***		
	Control 0 %	**T1 0.5 %**	**T2 0.75 %**
Total protein (g/dl)	3.2 ±0.31[b]	3.9 ±0.07[a]	4.4±0.19[a]
Albumin (g/dl)	1.9±0.02	1.8 ±0.0.3	2.1 ±0.03
Globulin (g/dl)	1.3±0.29[b]	2.1 ±0.04[a]	2.3 ±0.22[a]
Calcium (mg/dl)	9.8 ± 0.29 [b]	11.6 ± 0.39 [a]	11.9 ±0.43 [a]
Phosphorus (mg/dl)	7.8 ± 0.37[b]	8.7 ±0.12[a]	8.9 ±0.23[a]

Values are expressed as means ± standard error (SE).
Means within the same row of different litters are significantly different at (P <0.05)

Figures 1,2,3 and 4 showed that, there a significant increase in feeding, drinking and sitting behavior in treated group compared with control one while, a significant decrease in walking and standing behavior.

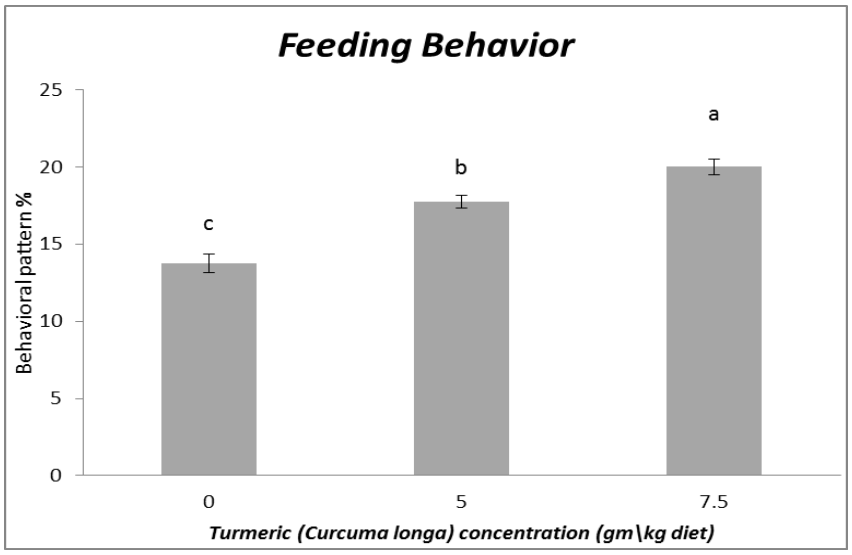

Fig. (1): Shows feeding behavior of broilers fed different experimental diets.

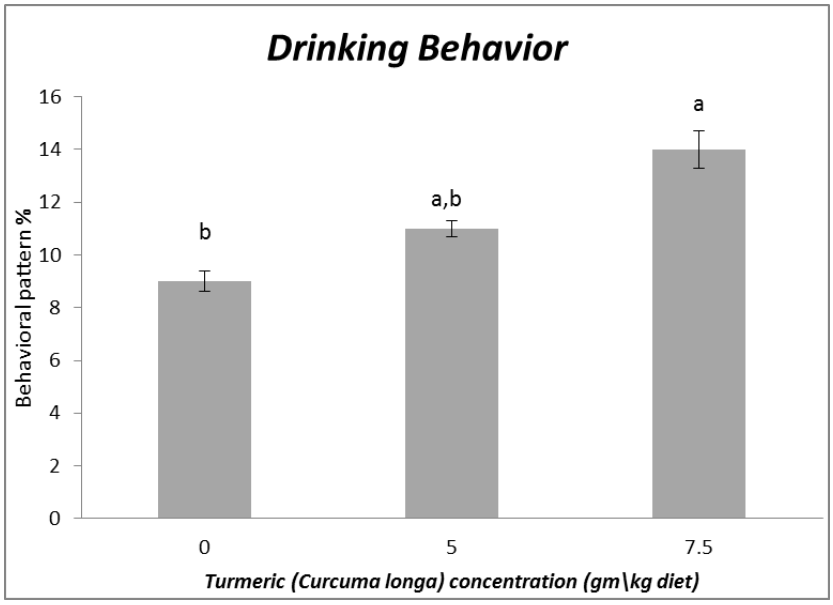

Fig. (2): Shows drinking behavior of broilers fed different experimental diets.

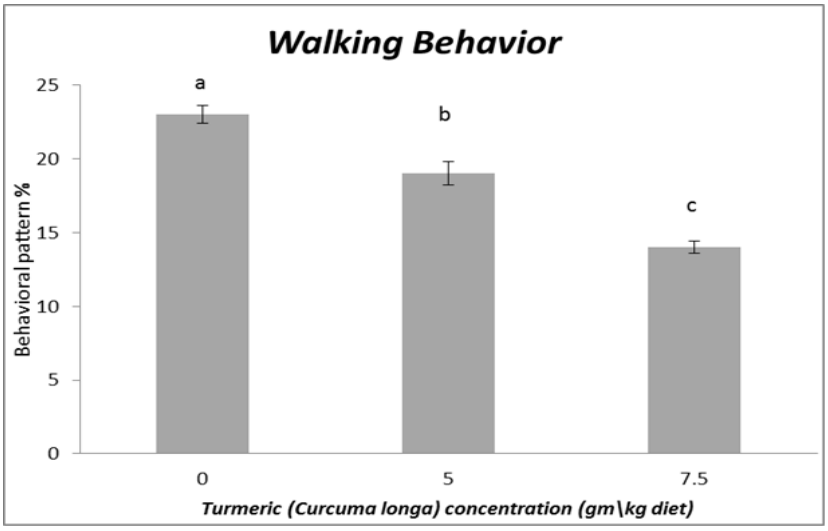

Fig. (3): Shows waking behavior of broilers fed different experimental diets.

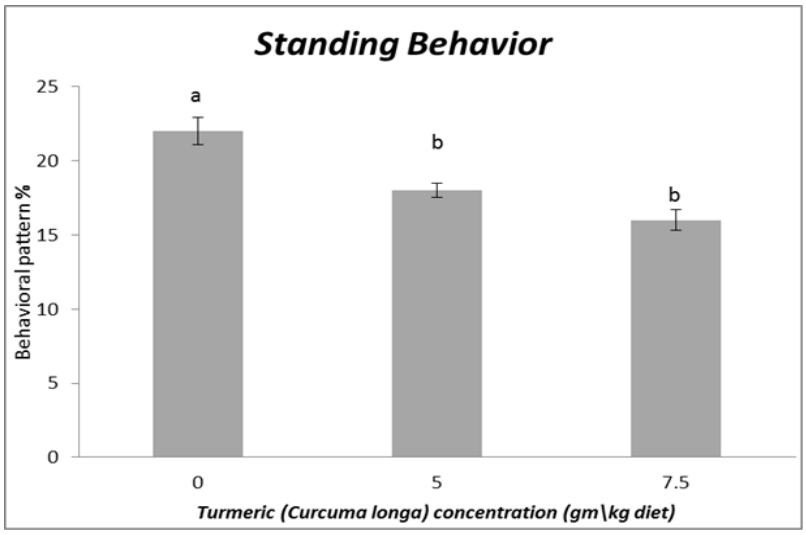

Fig. (4): Shows standing behavior of broilers fed different experimental diets.

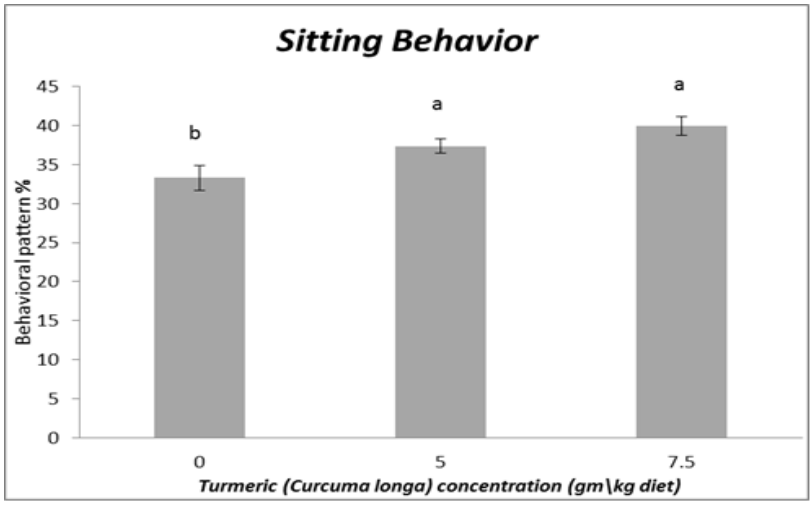

Fig. (5): Shows Sitting behavior of broilers fed different experimental diets

[a,b,c] Means within the same row with different superscripts are significantly different (P < 0.05)

DISCUSSION

The significant increase (P<0.05) in feed intake and feeding behavior was observed in treated groups and the lowest was recorded in control group which mean that the supplementation of turmeric powder at 0.5 and 0.75% improved feed intake. Similar findings with respect to improvement of feed intake were observed by several workers (Malekizadeh *et al.*, 2012; Sharma *et al.*, 2015 and Hady *et al.*, 2016). In contrary to the present observations, Nouzarian *et al.* (2011), Al-Jaleel, (2012) and Rajput *et al.* (2013) reported no significant difference, also, Hilal and Canan, (2017) and Arslan *et al.* (2017) reported a reduced in feed consumption. The increased feed intake might be due to addition of turmeric powder possesses appetite stimulant, stomachic and carminative properties (Platel and Srinivasan, 2004 and Chakraborty *et al.*, 2011), also the activity of turmeric as an antioxidant that stimulated protein synthesis (Osawa *et al.*, 1995) by birds' enzymatic system. Moreover, the significant increase in sitting behavior with decrease of walking and standing behavior of a bird accompanied with an increase in feed intake that, might be leading to heavy body weight of bird which reduce the chicken's activity (Weeks *et al.*, 2000).

Body weight and body weight gain differed significantly (P<0.05) among the different treated groups. Groups (1&2) achieved significantly higher body weight as compared to control one. Similar observations were reported by Mashhadani, (2015) and Sethy *et al.* (2016). Contrary to the present finding, Mehala and Moorthy, (2008) and Nouzarian *et al.* (2011) reported that body weight was not affected by dietary supplementation of turmeric powder in broiler chicken. On other hand, the improvement of body gain was reported by previous work of Mondal *et al.* (2015), Sharma *et al.* (2015),

Sethy *et al.* (2016) and Arslan *et al.* (2017). Moreover, improvement of FCR was agreed with the finding of several workers of Hilal and Canan, (2017) and Arslan *et al.* (2017).

While, our result disagreed with (Mehala and Moorthy, 2008, Vashan *et al.,* 2012 and Fallah and Mirzaei, 2016) who reported non significant finding in FCR due to using of turmeric powder. The wide range of performance results may be attributed to the dose, form, duration of processing of medicinal plants and experimental condition.

The improvement in body weight and body weight gain of the broiler chickens may due to several causes as appetizer effects of turmeric increasing gastric digestion liquor (William and Losa 2001), increased villus length and width in the duodenum, jejunum and caeca of broiler chickens (Rajput *et al.,* 2013); enhanced production of the bile, which improves the digestion of fats (Al-Sultan and Gameel, 2004); increase pancreatic lipase activity, increased amylase, trypsin and chemotrypsin (Chattopadhyay *et al.,* 2004); stimulate the intestinal sucrose and maltase activities (Platel and Srinivasan, 1996); forming more balanced intestinal flora due to their antimicrobial effects (Erhan *et al.,* 2012); decreased the intestinal microbes' population and selectively increased Lactobacillus count (Sieo *et al.,* 2005 and Namagirilakshmi *et al.,* 2010). The reduction in microbial load of broiler chickens could be due to the antibacterial effect of turmeric on intestinal microbial (Faghani *et al.,* 2014) which reflected mainly to more feed intake and more digestion.

Relative weights and biochemical parameters

The inclusion of turmeric powder into fayoumi broilers increased significantly dressing percentages, while did not affect significantly on relative weights of liver, gizzard, heart and spleen. These results agreed with Durrani *et al.* (2006) and Al-Jaleel (2012) while disagreed with the finding of Mashhadani (2015); Kafi *et al.* (2017) and Hilal and Canan, (2017).

The significant increase in total protein, globulin, calcium and phosphorus level with no effect on albumin level, agreed with the results reported by Rao *et al.* (1970) who found that, serum total protein of broilers fed turmeric powders can improve protein metabolism of broiler chickens. This effect can be probably explained by these medicinal plants can promote protein deposition in broilers "in vivo" maintain a stable colloid osmotic pressure, improve the transportation of metabolic products, improve feed conversion rate and promote growth. Moreover, Zhu *et al.* (2014) found an increase in seric globulins; protective effects on cells via enzymatic and non-enzymatic mechanisms, while, disagreed with Abou-Elkhair *et al.* (2014) who found no significant effect on total protein and albumin.

CONCLUSION

Using turmeric (curcuma longa) powder supplement in fayoumi broiler diets improved body weigh gain, FCR, and Ingestive behavior. In addition, total protein, globulin, calcium, phosphorus and dressing percentage were increased significantly.

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تاثير تغذيه مسحوق الكركم على الاداء الانتاجى والسلوك والقياسات البيوكيميائيه فى الدجاج الفيومى

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اجريت هذه الدراسة لتقييم تغذية مسحوق الكركم على كفاءة الاداء وخصائص الذبائح والسلوك في بدارى الدجاج الفيومى المحلى. تم استخدام عدد ١٢٠ طائر من الدجاج الفيومى المحلى فى عمر شهر حيث كانت الاوزان متماثلة تقريباً وتم تقسيم الطيور عشوائياً الى ثلاثة مجموعات بكل منها ٤٠ طائر وكل مجموعة بها اربعة مكررات بكل مكررة منها١٠ طيور. تم تغذية طيور المجموعة الاولى على العليقة الضابطة الاساسية بدون اضافات فى حين تم تغذية الطيور فى المجموعة الثانية والثالثة على نفس العليقة الضابطة الاساسية مضافاً اليها ٠,٥، ٠,٧٥% من مسحوق الكركم. تم تقييم كفاءة الاداء وكذلك خصائص الذابئح والسلوك الغذائي فى الطيور. اظهرت النتائج انه كانت هناك زيادة معنوية فى معدل زيادة وزن الجسم وسلوك التغذية والشرب والجلوس وفى مصل البروتين الكلى والجلوبيولين والكالسيوم والفسفور ونسبة التصافى فى حين حدث انخفاض معنوى ملحوظ فى معدلات التحويل وكذلك فى سلوك المشى والوقوف للطيور. لم يكن لأضافة مسحوق الكركم على علائق الدجاج الفيومى المحلى فى المجموعتين الثانية والثالثة اى تأثير معنوي على مستوى الزلال في مصل الدم وكذلك لم يظهر له اى اثر على الاوزان النسبية للكبد والقلب والطحال خلال فترة التجربة التى استمرت لمدة ستة اسابيع. نستخلص من هذه الدراسة ان استخدام مسحوق الكركم فى علائق الدجاج الفيومى المحلى يحسن من كفاءة الاداء والسلوك الغذائى والهضمى بالاضافة الى زيادة نسبة البروتين الكلى والجلوبيولين والكالسيوم والفسفور وكذلك نسبة التصافي للذبائح بشكل معنوى ملحوظ.