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Effect of Turmeric (*Curcuma longa*) powder on growth performance, carcass traits, meat quality, and serum biochemical parameters in broilers

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ABSTRACT

The objective of the present study was to investigate the effect of dietary levels Turmeric (Curcuma longa) powder (TP) supplementation on growth performance and some blood parameters of broiler chickens. Two hundred forty (Ross) one day old broiler chicks were randomly allotted into 4 groups (60 per each) of mixed sex. Levels (TP) was supplemented to the basal diet at 0.0 (control), 5, 7, and 9 g/kg diet (groups 2-4), respectively and the trail was lasted for 6 weeks. The analysis of variance of the data indicated that of levels (TP) supplementation at 7 g/kg of diet (groups 3) significantly ($p < 0.05$) improved body weight, body weight gain, Liver, Gizzard, and Proventriculus performance index and relative growth rate of broiler chicken, while had significantly ($p > 0.05$) effect on feed intake, feed conversion ratio and when compared with the control. Also significantly ($p > 0.05$) decreased in all treatments (groups 2,3and 4) respectively in Abdominal fat compared with the control. On the other hand (TP) supplementation at 7 g/kg (group 3) of broiler diet reduced serum concentration of cholesterol and triglycerides when compared with the control.

Keywords: *curcuma longa, meat quality, broiler chicken.*

1. Introduction

The interest in feed additives grew over the last decade of the past century .These additives have received a high attention as feed supplements for various purposes in poultry production during the recent years (Zhang et al. 2009). Beneficial effects of bioactive plant substances in animal nutrition may include the stimulation of appetite and feed intake, the improvement of endogenous digestive enzyme secretion ,activation of immune responses and antibacterial ,antiviral and antioxidant action (Dorman and Deans, 2000; Brugalli, 2003; Hosseini_Vashan et al. 2012) . Turmeric rhizome (*Curcuma longa*) is an extensively used spice ,food preservative and coloring material that has biological actions and medicinal applications (Chattopadhyay et al. 2004, Akbarian et al. 2012). Curcumin is the main important bioactive ingredient responsible for biological activity of curcuma longa (Nouzarian et al. 2011). Curcumin has been shown to have several biological effects, exhibiting

antifammatory (Holt et al. 2005) antioxidant (Hosseini_Vashan et al. 2012; Karami et al. 2011).It is used in gastrointestinal and respiratory disorders (Anwarul et al. 2006). A number of studies have been conducted to evaluate its effect on the performance of broiler chickens ,laying hens and rabbits,(Suvanated et al. 2003; Samarasinghe et al. 2003; Durrani et al. 2006; Emadi and Kermanshahi, 2007; Zeinali et al. 2009; Nouzarian et al. 2011; Hosseini_Vashan et al. 2012).However ,the results have not been consistent. The purpose of this research was to investigate the effect of adding different level of turmeric powder ,on performance ,growth , carcass traits ,and relative weight of organs , meat quality, and some biochemical serum parameters of broiler Chickens.

2. Materials and Method

Two hundred and forty, one day old broiler chicks (Ross.308) and mean mass of (39 ± 1.5g) were randomly allocated to one of four treatments groups (three replicates each).Each replicates consisted of 20 chicks. Between day, 1 and 21 the chicks fed a starter diet followed by a finisher diet between day 22 and 42 (Table 1). The four dietary treatments consisted of control (basal diet) , basal diet + 5 g turmeric powder (TP) / Kg diet , basal diet +7g TP / Kg diet ,and basal diet + 9 g TP / kg diet. Chickens were raised in floor pens (10 birds / m^2) litter by wood shavings. Feed and water provided *ad libitum* throughout the experiment. All diets were formulated to cover the nutrient requirements of chicken (NRC, 1994).Chicks were vaccinated for infections Bronchitis on the first day, Newcastle Disease and Avian influenza on 7 and inflammatory Bursal Disease on day 14 of age .The initial house temperature was set at 32 C° and gradually decreased by 2 C° per week .A lighting schedule of 23 h light and 1 h darkness was used for the entire period. Body weight (BW), body weight gain, (BWG), feed intake (FI) and feed conversion ratio (FCR) was measured at 42 day of age. Mortality was weighted and recorded daily. At 42 d of age, four birds from each pen was randomly chosen, were weighted, slaughtered and organs such as breast, thigh, back, drumstksics, neck, wings, heart, liver, pancreas, gizzard, proventriculus, and small intestine. The abdominal fat were weighted and calculated as percentage of live body weight. Three pieces of meat from each left breast and thigh were removed for proximate analysis dry matter, crude protein, ether extract, and crude ash content. The samples were collected in plastic trays, weighed and stored in air tight plastic bags in a freezer until they were required for analysis. They were then homogenized using a blender and analyzed. The dry matter (DM) contents breast, and thigh samples were determined by oven-drying at 105°C for18 h. The ether extract (EE) content of breast and thigh samples was obtained by the Soxhlet extraction method, using anhydrous diethyl ether. The Kjeldahl method was used for the analysis of the total nitrogen content of feed, breast, and thigh samples, and crude protein(CP) was expressed as nitrogen ×6.25 (AOAC, 1984). The crude ash content was determined after heating the samples in a muffle furnace at 550°C for 16 h. All values are expressed on a dry matter basis. During six weeks experimental period. Blood was collected from the neck the blood and vessel was cut at slaughter. Five ml without anticoagulant to obtain serum, blood sample were allowed to clot and centrifuged for 20 min at 1500 rpm to separate the sera. The sera sample was stored at -20C^{o} for the analysis of Serum to cholesterol, triglyceride, Gamma Pyruvic Transferees (GPT) and Glulamic Oxalocetic Transferees (GOT). Using commercially

available kit (Bro;abo SA, 02160, Mazaiy France).All data were subjected to ANOVA using the General Linear Models Procedure of SAS software (SAS, 2002). Treatment means were tested using the Duncan's multiple range test, and statistical differences declared at $P<0.05$.

Table 1: Composition of the broiler diet (for 100 kg feed)

Ingredients	Starter	Finisher
Wheat	55.1	66.1
Soybean meal (40%)	30.0	21.0
Meat meal	10.0	8.0
Sunflower oil	2.0	4.0
Limestone	1.0	1.0
Dicalcium phosphor	1.0	1.0
Vit + Min mix*	0.3	0.3
Salt	0.3	0.3
DL-Methionine	0.15	0.15
Lysine	0.15	0.15
Total	100.0	100.0
Calculated composition**		
Crude protein	25.31	21.7
ME (kcal/kg)	2819.32	3035.3
Lys.	2.814	2.545
Meth + Cyc.	0.416	0.373
Ca (%)	0.115	0.094
P (%)	0.403	0.378

*Vitamins and minerals mixture provide per kilogram of diet: Vitamin A (as all-trans-retinly acetate); 12000 IU; vitamin E; 10 IU; k3 3 mg; Vit. D3, 2200 ICU; riboflavin, 10 mg; Ca pantothenate, 10 mg; niacin, 20 mg; choline chloride, 500 mg; vitamin B12, 10 Ug; vitamin B6, 105 mg; thiamine (as thiamine mononitrate), 2.2 mg; folic acid, 1 mg; D-biotin, 50 ug. Trace mineral (milligrams perkilogram of diet): Mn, 55; Zn, 50; Fe, 30; Cu, 10; Se, 1 and Ethoxyquin 3 mg.
**Calculated composition was according to NRC (1994).

3. Results & Discussion

3.1 Body weight changes: Data of broiler chicks body weight, body weight gain and feed conversion ratio are presented in Table 2. Chicks fed diet supplemented with 7 g TP/ kg diet had significantly ($p<0.05$) higher weight and body weight gains compared to other treatment groups, followed by group 2 that received a diet with 5 g TP/ kg diet. This is agreement with the finding of (Al-Sultan, 2003; Durrani et al. 2006; Suvanated et al. 2003; Zeinali et al. 2009 ; Wuthi-Udomler et al. 2000; Samarasinghe et al. 2003) . In spite of the low consumption compared with other groups, the fact that this herb plant may provide some compounds that enhance digestion and absorption of some nutrients in the diet Also that may be due to the active materials (curcuminoids and Curcumin) found in turmeric, causing greater efficiency in the utilization of feed, resulting in enhanced growth. Turmeric has been reported to exhibit antimicrobial properties and ethanol turmeric extract demonstrated high potential to inhibit some pathogenic bacteria of chickens (Miquel et al. 2002; Ong-ard et al. 2010). Thus alike

antibiotics, turmeric could control and limit the growth and colonization of numerous pathogenic and non- pathogenic species of bacteria in the chicken's gut resulting in balanced gut microbial ecosystems that lead to better feed utilization reflected by improved feed conversion ratio. The effect of (TP) supplementation of basal diet on digestive organs of broiler chicken is showed in (Table 3). There was significant difference ($p<0.05$). Higher values of liver and gizzard and Proventriculus (% BW) were obtained from birds on 7 g TP/ kg diet. However, birds on 5gTP/ kg diet and 9 g TP/ kg diet not different significantly. These results were in disagreement with (Ashayerizadeh et al. 2009). The heart, Small intestine and pancreas relative weight (%BW) of birds in different treatments and control group found really the same. Whereas the abdominal fat relative weight (%BW) was reduced significantly ($p<0.05$) in broilers supplemented with 5 gTP/ kg diet , 7 g TP/ kg diet , 9 g TP/ kg diet than those of non-supplemented group. These results was in agreement with other study performance (Al-Sultan, 2003; Zeinali et al. 2009; Emadi and Kermanshahi, 2007; Emadi and Kermanshahi, 2006). The effects of different levels of (TP) on carcass traits of broilers are in Table 4. Application of different levels of (TP) significantly affected the carcass traits ($P<0.05$). The highest percent of breast and thigh was observed in 7 g TP/ kg diet. This is agreement with findings of (Osawa et al. 1995). The increasing of breast and thighs weight may be due to optimum antioxidant activity of Turmeric (Curcuma longa) that stimulate protein synthesis by bird enzymatic system. The back, Drumstksics, neck and wings relative weight (%BW) of birds in different treatments and control group found really the same. In the present study, the dietary treatments did not affect dry matte, or crude ash, of breast and thigh meats of broiler (Table 5). Significantly increased of crude protein % ($P<0.05$) in breast meat and significantly decreased of Ether extract (%) ($P<0.05$) in thigh meat in broilers supplemented with turmeric powder 7 g TP/ kg diet than (5, 9 g TP/ kg diet) and non-supplemented group. The cause of decreased of Ether extract (%) in thigh meat may due to Curcumin that enhance bile production and hence fat digestion (Al- Sultan and Gameel, 2004), and the cause of increasing of crude protein % in breast meat and increasing of breast and thigh weight because the (Curcumin) stimulated the digestion system in poultry, by improving the utilization of digestive products(Hernandez et al. 2004). Table 6 shows the effect of (TP) on serum biochemistry of broiler chickens. No significant difference with respect to, GPT and GOT concentration were detected due those traits. The cholesterol and triglyceride concentration was significantly ($p<0.05$) lower at 7 g TP/ kg diet, but the mean effect of 5 g TP/ kg diet and 9 g TP/ kg diet was not significant compared with control group. This was in agreement with other studies performed on animal (Kermanshahi and Riasi, 2006; Abbas, 2009) have been clearly demonstrated that (TP) has a progressive metabolic control on mechanism involved in elimination of lipids from body.

Table 2: The effect of added Turmeric Powder(*Curcuma longa*) to the diet on broiler performance for 6 weeks

	Dietary Treatments			
Parameters	Control	5gTP/ kg diet	7 g TP/ kg diet	9 g TP/ kg diet
Body weight (g)	2119.5 ± 39.1^{c}	2253.1 ± 36.7^{ab}	2257.5 ± 40.3^{a}	2207.7 ± 33.2^{b}
Body weight gain(g)	2174.8 ± 38.7^{c}	2108.3 ± 37.1^{ab}	2364.1 ± 34.1^{a}	2213.6 ± 38.4^{b}
Feed consumption (g/bird/day)	4283.4 ± 0.91^{a}	4278.7 ± 1.02^{b}	4217.8 ± 0.86^{b}	4229.4 ± 1.42^{a}
Feed conversion ratio	1.97 ± 0.03^{a}	2.03 ± 0.02^{b}	1.78 ± 0.02^{b}	1.91 ± 0.01^{a}

Means with different superscripts in the same row differ significantly ($P<0.05$)

Table 3: The effect of added Turmeric Powder(curcuma longa) to the diet on organ weight for 6 weeks

	Dietary Treatments			
Parameters	Control	5gTP/ kg diet	7 g TP/ kg diet	9 g TP/ kg diet
Dressing percent (%)	68.9 ± 2.5^{b}	75.6 ± 1.9^{a}	77.4 ± 1.3^{a}	70.3 ± 1.8^{b}
Abdominal fat	1.76 ± 0.13^{a}	1.25 ± 0.09^{b}	1.29 ± 0.12^{b}	1.68 ± 0.18^{b}
Liver	2.17 ± 0.21^{b}	2.19 ± 0.23^{b}	2.33 ± 0.15^{a}	2.17 ± 0.19^{b}
Gizzard	1.35 ± 0.03^{b}	1.45 ± 0.02^{b}	2.44 ± 0.06^{a}	1.86 ± 0.02^{b}
Proventriculus	0.32± 0.009^{b}	0.34± 0.013^{b}	0.94± 0.015^{a}	0.35± 0.011^{b}
Heart	0.591± 0.029^{a}	0.588± 0.013^{a}	0.601±0.025^{a}	0.544 ± 0.048^{a}
Small intestine	4.082± 0.031^{a}	4.06± 0.022^{a}	4.146± 0.031^{a}	4.089± 0.152^{a}
Pancreas	0. 253 ± 0.009^{a}	0.243± 0.013^{a}	0.250± 0.011^{a}	0.244± 0.015^{a}

Means with different superscripts in the same row differ significantly (P<0.05).

Table 4: The effect of added Turmeric Powder(*Curcuma longa*) to the diet on carcass traits for 6 weeks

	Dietary Treatments			
Parameters	Control	5gTP/ kg diet	7 g TP/ kg diet	9 g TP/ kg diet
Breast (g)	315.8± 12.06^{b}	324.5± 11.16^{ab}	354.7±13.72^{a}	335.1± 10.71^{ab}
Thighs (g)	208.9 ± 8.02^{b}	207.6 ± 8.07^{b}	226.2 ±7.22^{a}	218.9 ± 6.19^{ab}
Back (g)	281.1 ± 11.05^{a}	286.6± 11.14^{a}	295.5± 7.91^{a}	301.8 ± 8.95^{a}
Drumstksics(g	232.3 ± 8.99^{a}	238.7 ± 8.96^{a}	244.3 ± 6.87^{a}	250.2 ± 7.84^{a}
Neck (g)	100.2 ± 3.88^{a}	103.4 ± 3.52^{a}	107.2 ± 2.86^{a}	110.5 ± 3.24^{a}
Wings (g)	92.8 ± 3.55^{a}	93.3 ± 3.48^{a}	96.9 ± 2.83^{a}	99.2 ± 3.30^{a}

Means with different superscripts in the same row differ significantly (P<0.05)

Table 5: The effect of added Turmeric Powder(curcuma longa) to the diet on breast and thigh meat composition for 6 weeks

	Dietary Treatments			
Parameters	Control	5gTP/ kg diet	7 g TP/ kg diet	9 g TP/ kg diet
Breast meat				
Dry matter (%)	25.35 ± 0.445^{a}	25.10 ± 0.310^{a}	25.67 ± 0.421^{a}	25.96 ± 0.413^{a}
Crude ash (%)	1.40 ± 0.310^{a}	1.68 ± 0.178^{a}	1.32 ± 0.204^{a}	1.06 ± 0.214^{a}
Crude protein (%)	23.62 ± 0.557^{ab}	23.17 ± 0.508^{b}	24.62 ± 0.406^{a}	24.05 ± 0.423^{ab}
Ether extract (%)	0.331 ± 0.045^{a}	0.340 ± 0.032^{a}	0.303 ± 0.025^{a}	0.285 ± 0.023^{a}
Thigh meat				
Dry matter (%)	23.49 ± 0.209^{a}	23.81 ± 0.580^{a}	24.55 ± 0.622^{a}	25.01 ± 0.583^{a}
Crude ash (%)	1.37 ± 0.124^{a}	1.66 ± 0.135^{a}	1.85 ± 0.221^{a}	1.98 ± 0.308^{a}
Crude protein (%)	21.64 ± 0.157^{a}	21.68 ± 0.506^{a}	22.29 ± 0.465^{a}	22.66 ± 0.389^{a}
Ether extract (%)	0.48 ± 0.031^{a}	0.47± 0.037^{ab}	0.37 ± 0.029^{b}	0.41 ± 0.033^{ab}

Means with different superscripts in the same row differ significantly (P<0.05)

Table 6: The effect of added Turmeric Powder to the diet on biochemistry parameters of broiler (42 days age)

	Dietary Treatments			
Parameters	Control	5gTP/ kg diet	7 g TP/ kg diet	9 g TP/ kg diet
Cholesterol (mg/100 ml)	85.33±3.71^{a}	79.00±3.61^{ab}	73.33±2.03^{b}	78.67±1.20^{b}
Triglyceride (mg/100 ml)	127.00±5.03^{a}	123.00±4.16^{a}	101.33±4.91^{b}	121.33±5.24^{ab}
GPT (IU/mol)	78.33±1.53^{a}	80.33±1.45^{a}	80.67±1.45^{a}	79.33±1.53^{a}
GOT (IU/mol)	165.00±8.00^{a}	167.67±9.33^{a}	166.67±6.77^{a}	165.67±3.53^{a}

Means with different superscripts in the same row differ significantly (P<0.05).

4. Conclusion

Turmeric powder (7g TP / kg diet) have a positive effect on broiler's performance and lowering effect on blood serum cholesterol, triglycerides, compared with the control group or other dietary treatments.

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