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RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

Performance, cholesterol profile and intestinal microbial population in broilers fed turmeric extract

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Abstract

The aim of this study was to evaluate the effect of turmeric extract on performance of broiler chicks. A total 180 one day broiler chicks with an average weight of 40±11 g were randomly divided into 3 treatments. Each treatment was further divided into 5 replicates. Chicks were fed a basal diet as control group and 100 mg/kg, 200 mg/kg of turmeric extract in other two treatments (T1, T2). At the end of trial (42 days), 4 birds form each treatment were weighed and slaughtered at 42 day of the experiment was evaluated. Data showed that feed intake (FI) increased significantly in T1, T2 in comparison to control ($P<0.05$). Body weight gain (BWG) and total body weight were also significantly higher in treated groups. Triglyceride and cholesterol level decreased significantly in T1, T2 group. Low density lipoprotein (LDL) level decreased significantly and high density lipoprotein (HDL) levels increased in all of the treated groups. Antibody titre increased significantly by using turmeric in the diet compared to the control. Data of microbial population showed that *E .coli* population decreased and lactobacillus increased by using the two treatments levels. We concluded that the use of turmeric extract at the present levels enhanced body performance, cholesterol profile, antibody titre and some useful microbial population in broiler chicks.

Keywords: Turmeric extract; performance; intestinal microbial population; broilers

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Introduction

Turmeric (*Curcuma longa*), is an important tropical spice, which is a member of the ginger family Zingiberaceae (Abdeldaiem, 2004). In spite of synthetic drugs such as tartrazine and carmoisine that may impair liver function and cause oxidative stress, turmeric is used not only as food colouring, but also as a substance that promotes health and well being by preventing or even healing diseases (Ahmed et al., 2001). Turmeric and its extract have many beneficial effects on animal and human health (Namagirilakshmi et al., 2010). Turmeric, a medicinal plant native to the Asian subcontinent, is known to possess antimicrobial and antioxidant properties. The curcuminoids, yellowish pigments present in turmeric powder, have shown protective effects against aflatoxin B1 (Mehala and Moorthy, 2008). It has antimicrobial effects against many microorganisms, such as against *Bacillus subtilis*, *Escherichia coli* and *Staphylococcus aureus* (Egan et al., 2004). In addition, it can inhibit the growth of *Bacillus typhi* and *Bacillus dysenteriae* (Liang et al., 2007). Keeping in view the medicinal attributions of turmeric, the object of this study was carried out to determine the effect of turmeric extract on broiler performance, cholesterol profile and some microbial populations of their gastrointestinal tract.

Materials and Methods

The experiment was carried out at the Poultry Farm of Veterinary College, Islamic Azad University, Shahrekord branch, Iran. A total of 180 days old broiler chicks with an average weight of 40±11 g were divided

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into 3 treatment groups and were further subdivided into 5 replicates. The turmeric extract was purchased from local market and mixed with the drinkable water. The treatments were divided as basal diet with no herbal plant extract kept as control, and for other treatments 100 mg/kg and 200 mg/kg (T_1 and T_2) of turmeric ethanolic extract were used in the water. The chemical composition of the experimental basal diets is shown in Table 1. Feed and fresh water were provided *ad libitum* during this experiment. Chicks were vaccinated against Newcastle disease and infectious bronchitis. The live body weight gains of birds were measured individually and feed consumption and feed conversion efficiency were calculated weekly. At the end of experimental period, 2 birds from each replicate (total 30 birds) were slaughtered by cervical dislocation.

Evaluation of blood parameters

Blood samples were taken from the brachial vein from two birds per replicate and stored at refrigerator at +4°C. Blood samples were subjected to biochemical analysis for cholesterol and triglycerides. Serum samples were isolated by centrifugation at 2000 g for 10 min. Individual serum samples were analyzed for total cholesterol, high density lipoprotein (HDL) and low density lipoprotein (LDL) cholesterol and triglyceride, by an automatic biochemical analyzer following the instructions of the corresponding reagent kit (Pars Azmoon Co., Teheran, Iran). In addition to assess the systemic antibody response to Newcastle blood samples were collected from brachial vein of vaccinated (2 birds per replicate), on d 42 of the experiment. Blood samples were centrifuged at 2000 g for 10 min to obtain serum (SIGMA 4-15 Lab Centrifuge, Germany). Serum was isolated and stored at -80°C. Antibody titres against Newcastle and influenza viruses were measured using Haemagglutination Inhibition Test.

Microbial count

After slaughtering, the internal organs were removed. Then about 7 cm from the length of the ileum were sampled. To determine the microbial population, 1 g ileum contents were used to make 10 fold dilution using buffered peptone water and then 0.1 ml of the appropriate ileum dilution were spread on MRSA plates to detect lactic acid bacteria and VRBA to detect coli forms. The culture of lactic acid bacteria and *E. coli* bacteria were made anaerobically. The plates were incubated at 37.5°C for 48 h. After counting the number of colonies in each plate, the number so obtained was multiplied by inverse of the dilution on the result stated as the number of colony forming unit (CFU) in l g of the sample (Downes et al., 2008).

Data analysis

Data were collected and analyzed using the General linear model procedure of SAS (2001). Differences between means were analyzed by Duncan's multiple ranges test and P value less than 0.05 was considered as significant.

Results

Data showed in Table 2 that use of turmeric extract increased feed intake significantly in comparison to control ($P<0.05$). Body weight gain and total body weight at the end of the experiment were also significantly higher in treated groups compared to the control ($P<0.05$).

Data from this study showed that the triglyceride, cholesterol and LDL level decreased significantly in the treated groups while HDL level increased significantly in T1, T2 groups (Table 3).

The antibody titre and intestinal microbial population in control and treated groups is given in Table 4. Antibody titre were significantly higher when broilers were fed by T1 and T2 ($P<0.05$). Data showed that *E. coli* population decreased in treatment groups, while Lactobacillus population increased significantly in T1 and T 2 ($P<0.05$).

Discussion

We found that the use of turmeric extract in the diet of broiler chicks had beneficial effects regarding the performance traits, blood cholesterol profile and balancing the intestinal microbial population in the positive direction. In agreement with our results, previously it was reported that the inclusion of turmeric at the levels of 0.5% in the diets improved body weight and feed conversion ratio (Abd Al-Jaleel, 2012). Nayaka et al. (2013) indicated that addition of either neem alone or in combination with turmeric and vitamin E in broiler diets induced significant growth depression in birds as compared to birds fed with control diet. Result of this study is in agreement with Al-Sultan. (2003) and Kumari et al. (2007) who observed a significant increase in body weight of broilers fed with turmeric powder but is not in agreement with Nayaka et al. (2003).

Nouzarian et al. (2011) showed that triglyceride levels in serum was markedly reduced by turmeric powder in the diet in comparison with the control with no statistical impact on the LDL, HDL and total cholesterol in broilers. Ahmad et al. (2001) reported that curcuma had a lowering effect on serum triglyceride in animals fed high cholesterol diet but showed no effect on serum cholesterol and phospholipids. Nouzarian et al. (2001) and Emadi and Kermanshahi (2007) showed that turmeric supplemen-tation into the basal diets of broiler chickens significantly increased total cholesterol and HDL cholesterol and decreased LDL cholesterol, but did not affect total triglyceride at 42 days of age.

Table 1: Composition of the experimental diets for broiler chicks

Ingredients %	0-21 day	21-42 day
Corn grain	53.65	62.88
Soybean meal	40.7	32.8
Vegetable oil	21.7	12.6
Dicalcium phosphate	14.4	10.7
Calcium carbonate	12.1	12.8
DL Methionine	1.3	0.2
NaCl	2.5	2.5
Vitamin Premix	2.5	2.5
Mineral Premix	2.5	2.5
Calculated nutrient content		
ME (Kcal/Kg)	2900	2950
CP (g/kg)	208.4	189.9
Ca (g/kg)	9	8.28
Available Phosphorus (g/kg)	4.05	3.22
Lysine (g/kg)	9.2	9.2
Methionine+Cystine (%)	8.1	6.6

Vitamin premix per kg of diet: mg: vit. A, 2.7 vit. D3 0.05; vit. E, 18; vit. K3 2; thiamine 1.8; Ribofavin 6.6; Panthothenic acid 10; Pyridoxine 3; Cyanocobalamin 0.015; Niacin 30; Biotin 0.1; Folic acid 1; Choline chloride 250; Mineral premix per kg of diet: mg: Fe 50; Mn 100; Zn 100; Cu 10; I 1mg; Se 0.2.

Table 2: The effect of added experimental diets on broilers performance

Treatments	FI (g/d)	BWG (g/d)	FCR	TFI (g)	TBW (g)
Control	79.18^{c}	38.74^{c}	2.06^{c}	3321^{c}	1627^{c}
T_1	80.12^{b}	40.16^{b}	1.98^{c}	3365^{b}	1686^{b}
T_2	81.74^{a}	41.34^{a}	1.94^{b}	3415^{a}	1746^{a}
Pooled SEmM	0.320	0.247	0.101	0.333	0.568

Means within column with no common letter are significantly different (P<0.05). Control: Basal diet; T1: basal diet with 100 mg tyrmeric, T2: basal diet with 200 mg turmeric; FI: feed intake, BWG: body weight gain; FCR: Feed conversion ratio, TFI: total feed intake; TBW: total body weight

Table 3: The effect of added experimental diets on some blood parameters

Treatments	Triglyceride (mg/dl)	Cholesterol (mg/dl)	HDL (mg/dl)	LDL (mg/dl)
Control	72.65^{a}	135.21^{a}	59.44^{b}	72.98^{a}
T_1	69.21^{b}	132.17^{b}	62.30^{b}	69.34^{b}
T_2	67.20^{c}	129.45^{c}	64.42^{c}	67.61^{c}
Pooled SEM	0.14	0.37	0.53	0.33

Means within a column with no common letter are significantly different (P<0.05). Control: Basal diet; T1: basal diet with 100 mg turmeric, T2: basal diet with 200 mg turmeric.

Table 4: The effect of experimental diets on antibody titres against New castle vaccine and intestinal microbial population

Treatments	*E. coli* (Cfu/g)	Lactobacillus (Cfu/g)	$HI_{(42\ days)}$ (log_2)
Control	7.67^{a}	5.11^{c}	4.11^{c}
T_1	7.18^{b}	5.94^{b}	4.48^{b}
T_2	6.80^{c}	6.31^{a}	5.21^{a}
Pooled SEM	0.18	0.36	0.16

Means within column with no common on letter are significantly different (P<0.05). Control: Basal diet; T1: basal diet with 100 mg turmeric, T2: basal diet with 200 mg turmeric.

In the present study, the antibody titre improved significantly in treated groups. Al-Sultan (2003) showed that 0.5% turmeric increased the weight of bursa and thymus in broilers which are the organs of primary immune response. Abdeldaiem (2004) indicated the immunostimulatory activity of curcumin which is the active ingredient extracted from turmeric.

Curcumin has been reported to possess several pharmacological properties including anti inflammatory, antimicrobial, antiviral, antifungal, antioxidant and wound healing activities (Aggarwal et al., 2005; Khalaf et al., 2008). In the present study, the turmeric levels improved the lactobacillus population and decreased the *E. coli.* Turmeric extracts has been found to have antimicrobial and antioxidant activities. Namagirilakshmi et al. (2010) showed turmeric powder up to 1% of diet may be used as an alternative to antibiotic for improving gut health in broiler chickens. The findings of the present study agrees with Nayaka et al. (2013) who observed that inclusion of turmeric at 1g/kg diet lowered microbial colony in the illeal content of broiler chickens. This reduction in microbial load of broiler chickens could be due to the antibacterial effect of turmeric on intestinal microbiota. Our findings are in agreement with Namagirilakshmi et al. (2010) but are differed from Araujo and Leon (2001) who found that alcoholic extract of turmeric inhibited the growth of lactobacilli *in vitro*.

Conclusion

The results showed the use of turmeric extract improved performance and haematological parameter and microbial population in the intestines.

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