

# Effect of Dietary Inclusion of Turmeric and Thyme powders on performance, blood parameters and immune system of broiler chickens

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## Abstract

This study was conducted to investigate the effects of dietary inclusion of turmeric and thyme powders on performance, blood parameters and immune system of broiler chickens. In this study, 300, one-day old broiler chickens of the commercial Ross 308 strain were used in a randomized design with four treatment (five replicated in each treatment and 15 birds/replicated) and reared on the floor pens for 42 days. The dietary treatments were: (1) control diet (no supplement), (2) basal diet supplemented with 5 g/kg turmeric powder, (3) basal diet supplemented with 5 g/kg thyme powder and (4) basal diet supplemented with 2.5 g/kg turmeric powder + 2.5 g/kg thyme powder in diet. The results indicated that addition of different levels of turmeric and thyme powders increased chicks body weight in comparison to the control groups at 42 days of age ( $p>0.05$ ). Further results showed no significant difference in feed intake among control and other treatment groups. Broilers receiving different levels of turmeric + thyme powders had highest feed intake and lowest FCR in compare to other groups. Broilers receiving turmeric and thyme powders had lower uric acid, total cholesterol, HDL, LDL and triglyceride concentrations compared to the control groups. The results showed that addition of turmeric and thyme powders were increased anti body newcastle and Influenza titres.

**Key words:** broiler; blood parameters; immune; performance; Turmeric; Thyme.

## Introduction

Phytogenic products have been used as food spices and traditional remedies for many centuries, but their use in feed industry is relatively new. Phytogenic products have received more interest to be used as feed additives after the ban on antibiotic growth promoters in animal feed industry by European Union in 2006 (Hertrampf, 2001). As a result of this ban in Europe and increasing pressure on livestock producers in other parts of the world, alternative substances and strategies for animal growth promotion and disease prevention are being investigated, among which phytogenic and herbal products have received increased attention as they gained more acceptance among consumers as natural additives. Phytogenic feed additives are characterised by natural features, multiple functions, minimize side effects, no-resistance and no residues, therefore they are expected to become new alternative to antibiotics (Jin, 2010).

Turmeric is a member of Zingiberaceae family and contains curcumin, demethoxycurcumin, bisdemethoxycurcumin and tetrahydrocurcuminoids as active constituents (Kiuchi et al., 1993). Antioxidant, anti-inflammatory and nematocidal activities of turmeric and their relative compounds have been demonstrated (Kiuchi et al., 1993; Ammon et al., 1993; Osawa et al., 1995). Studies have shown that addition of turmeric powder in broilers diets enhance their performance (Al-Sultan, 2003; Durrani et al., 2006). However, Mehala and Moorthy (2008) showed that 0.1 and 0.2% turmeric powder used as feed additive had no significant effects on the performance and carcass yield of broiler chickens. Another investigation showed that growth performance parameters of broilers fed turmeric rhizome powder (TP) were improved (Suvanated et al., 2003; Zeinali et al., 2009). Birds fed Turmeric powder had lower feed intake and feed conversion ratio (FCR) (Wuthi-Udomler et al., 2000; Samarasinghe et al., 2003; Durrani et al., 2006).

Thyme (*Thymus vulgaris*), cinnamon (*Cinnamomum verum*) and turmeric (*Curcuma longa*) are herbs commonly used as spices in human food and have received considerable attention as additives in poultry nutrition. Several studies have reported the beneficial effects of thyme in poultry nutrition (Al-Kassie, 2009; El-Ghousein and Al-Beitawi, 2009; Najafi and Torki, 2010). Canan Bölükba and Kuddusi Erhan (2007) also showed that supplementation of layer diets with 0.1 and 0.5% thyme improved feed conversion and egg production and also reduced *E. colifecal* content. Cross et al. (2007) studied the effects of five herbs (10 g/kg) or their essential oils (1 g/kg) on broiler growth, digestibility, and intestinal microflora and showed that dietary thyme oil or yarrow herb had positively effects on broiler performance. Ocaik et al. (2008) reported that the inclusion of 0.2 % dry thyme leaves in broiler diets from 7 to 42 days of age had no significant effects on feed efficiency, growth performance, relative weight of internal organs and the relative length of the whole gut. However, the relative weight of abdominal fat was reduced. The purpose of this study was to investigate the effects of Dietary Inclusion of Turmeric and Thyme powders on performance, blood parameters and immune system of broiler chickens.

## Method and Materials

### Birds and housing

In this study, 300, one-day old broiler chickens of the commercial Ross 308 strain were used in a randomized design with four treatment (five replicated in each treatment and 15 birds/replicated) and reared on the floor pens for 42 days. Feed and water were supplied *ad libitum*. Brooding temperature in the first week of life was 32°C and decreased to 25°C until the end of the experiment. During the first week, 23 h of light was provided with a reduction to 20 h afterward.

### Dietary treatments

The dietary treatments were: (1) control diet (no supplement), (2) basal diet supplemented with 5 g/kg turmeric powder, (3) basal diet supplemented with 5 g/kg thyme powder, and (4) basal diet supplemented with 2.5 g/kg turmeric powder + 2.5 g/kg thyme powder in diet. The chicks were fed with the starter diets from day 1 to 21 and grower feed from day 22 to 42 (Table-1). Diets formulated and considered as control according to the recommendation of National Research Council (NRC, 1994). All floor-pens measured 1.3 × 2.5 m and had about 5 cm of built-up litter top-dressed with new wood shaving. Birds were vaccinated routinely against infectious bronchitis, Newcastle and Gambaro diseases, but no medication was administered during the entire experimental period.

### Management and data collection

Chickens were individually weighed weekly and final body weight for each bird was calculated. Feed consumption was measured throughout the experiment and feed conversion ratio (FCR; feed intake/weight gain) were calculated weekly.

**Table 1: Composition of experiment diets (as percent of dry matter)**

Ingredient	Starter (1-21 days)	Grower (22-42 days)
Corn	61	58.7
Soybean meal	29	30
Wheat barn	5	5
Fish meal	-	2
Soybean oil	2	1
Oyster shell meal	1	1.5
DCP	1.07	1
Vitamin and mineral premix <sup>1</sup>	0.5	0.5
DL-Methionine	0.13	0.10
L- lysine	0.15	0.25
Salt	0.25	0.10
Cocciostate	-	0.05
Total	100	100
<b>Nutrient content</b>		
ME (kcal/kg)	2850	2950
Crude protein (%)	20.48	18.44
Crude fiber (%)	3.89	3.81

1-Vitamin and mineral provided per kilogram of diet: vitamin A, 3600 Iu; vitamin D3, 800000 Iu; vitamin E, 7200 Iu; vitamin K3, 800 mg; vitamin B1, 720mg; vitamin B9, 400mg; vitamin biotin, 40mg; vitamin B2, 2640mg; vitamin B3, 400mg; vitamin B5, 12000mg; vitamin B6, 1200mg; vitamin B12, 6mg; choline chloride, 200000mg; Mn, 40000mg; Fe, 20000mg; Zn, 40000mg; Cu, 4000mg; I, 400mg; Se, 80mg

### Serum biochemical parameters

In 42 day-old, 2 mL of blood was collected via the wing vein from 2 birds in each treatment, blood samples were centrifuged (2,000 ×g for 10 min) and serum was separated and then stored at -20 °C until assayed for measuring biochemical parameters (glucose, triglycerides, total protein, uric acid, total cholesterol, HDL and LDL) using appropriate laboratory kits (Pars Azmoon, Tehran, Iran) (Gowenlock et al., 1988).

### Immune system

Two 18 and 28 day-old birds per replicate were randomly chosen and blood samples were collected from the brachial vein and centrifuged for 20 min at 1500 rpm to obtain serum. Antibody titers against Newcastle and influenza viruses were measured using Hemagglutination inhibition test.

### Statistical analysis

All data were analyzed using the one-way ANOVA procedure of SAS (SAS, 2004) for analysis of variance. Differences between means were analyzed with Duncan's multiple range test. The significant difference statements were based on the probability of  $p < 0.05$ , unless explained in another way.

## Results

The results of adding different levels of turmeric and thyme powders on the growth performance of broiler chickens at 42 days of age are presented in Table-2. Diet supplementation with different levels of turmeric and thyme powders increased chicks body weight in comparison to control chicks at 42 days of age ( $p > 0.05$ ). Treatment with adding turmeric + thyme powders had the highest total body weight (2590), and the lowest total body weight was observed in the control groups (2480). This investigation showed significant differences in feed intake among control and other treatment groups at 42 days of age. Broilers receiving different levels of turmeric + thyme powders had highest feed intake in compare to other groups. Treatment with adding turmeric + thyme powders had the lowest FCR (1.74) and the highest FCR was observed in the groups fed with turmeric powder (1.78). The further results showed no significant differences ( $p > 0.05$ ) in FCR among control and other treatment groups.

The results in (Table-3) showed no significant differences in blood glucose, total protein, uric acid and triglycerides concentrations ( $p > 0.05$ ) among different treatment groups. Broilers receiving turmeric and thyme powders had lower uric acid, total cholesterol, HDL, LDL and triglyceride concentrations compared to the control groups. Further results showed that the lowest glucose concentration (251.28) was shown in the groups fed with Turmeric powder, and the highest glucose concentrations (275.47) was shown in turmeric + thyme powders group.

The highest total protein (7.85) were observed in turmeric + thyme powders group and the lowest total protein (7.23) was observed in control groups. Further results showed that birds received Turmeric + Thyme powders had lowest total cholesterol, HDL and LDL concentrations. There were significant effect in total cholesterol, HDL and LDL concentrations between control and other treatment groups. The highest triglycerides was shown in control groups (105.78) and the lowest triglycerides was shown in Turmeric + Thyme groups (102.38).

**Table 2: Effect of different Levels of Turmeric and Thyme powders on the growth performance of broiler chickens at 42 days old ( means± SEM)**

Parameter	Control	Turmeric	Thyme	Turmeric + Thyme
Final body weight (g)	2480 ±114.5	2510 ±118.6	2560 ±125.5	2590 ±128.2
Feed intake (g)	4410 ±358.6 <sup>a</sup>	4480 ± 368.3 <sup>a</sup>	4510 ±353.5 <sup>b</sup>	4530 ± 362.7 <sup>b</sup>
Feed conversion Ratio (FCR)	1.77 ± 0.02	1.78 ± 0.03	1.76 ± 0.04	1.74 ± 0.05

<sup>abc</sup>means on the same row with different superscripts are significantly different (p<0.05); SEM: Standard Error Means

The results in (Table-3) showed no significant differences in blood glucose, total protein, uric acid and triglycerides concentrations (p>0.05) among different treatment groups. Broilers receiving turmeric and thyme powders had lower uric acid, total cholesterol, HDL, LDL and triglyceride concentrations compared to the control groups. Further results showed that the lowest glucose concentration (251.28) was shown in the groups fed with Turmeric powder, and the highest glucose concentrations (275.47) was shown in turmeric + thyme powders group. The highest total protein (7.85) were observed in turmeric + thyme powders group and the lowest total protein (7.23) was observed in control groups. Further results showed that birds received Turmeric + Thyme powders had lowest total cholesterol, HDL and LDL concentrations. There were significant effect in total cholesterol, HDL and LDL concentrations between control and other treatment groups. The highest triglycerides was shown in control groups (105.78) and the lowest triglycerides was shown in Turmeric + Thyme groups (102.38).

**Table 3: Effect of different Levels of Turmeric and Thyme powders on blood parameters of broiler chickens at 42 days old (means± SEM)**

Parameters	control	Turmeric	Control	Thyme	Turmeric + Thyme
Glucose (mg/dl)	257.56±15.47	251.28±15.86		268.84±15.32	275.47±15.78
Total protein (g/dl)	7.23 ± 0.18	7.65 ±0.16		7.58 ±0.15	7.85 ±0.16
Uric acid (mg/dl)	58.67 ± 3.78	55.35 ± 3.58		53.86 ±3.62	52.74± 3.68
Total cholesterol (mg/dl)	143.78 ± 8.48 <sup>a</sup>	138.58 ± 8.15 <sup>b</sup>		135.73 ± 8.40 <sup>b</sup>	132.84± 8.68 <sup>b</sup>
HDL (mg/dl)	68.38 ± 3.45 <sup>a</sup>	63.17 ± 5.16 <sup>b</sup>		63.58 ± 5.38 <sup>b</sup>	62.36± 5.17 <sup>b</sup>
LDL (mg/dl)	37.25± 3.68 <sup>a</sup>	34.53 ± 3.59 <sup>b</sup>		33.57 ± 3.89 <sup>b</sup>	33.25± 3.48 <sup>b</sup>
Triglycerides (mg/dl)	105.78 ± 15.52	103.68 ± 15.66		103.85 ± 15.68	102.38± 15.46

<sup>abc</sup>means on the same row with different superscripts are significantly different (p<0.05); SEM: Standard Error Means

**Table 4: Effect of different Levels of Turmeric and Thyme powders on immune system of broiler chickens (means± SEM)**

Anti body titres - Newcastle (log2)	Control	Turmeric	Control	Thyme	Turmeric + Thyme
18 days	4.2± 0.42	4.5±0.46		4.6±0.49	4.8±0.45
28 days	5.3±0.25	5.8±0.28		5.7±0.29	5.9±0.27
Anti body titres - Influenza (log2)					
18 days	5.8± 0.65	6.4±0.68		6.3±0.63	6.7±0.68
28 days	5.2± 0.32	5.9±0.36		6.2±0.35	6.8±0.38

<sup>abc</sup>means on the same row with different superscripts are significantly different (p<0.05)

The results in (Table-4) showed that the highest Anti body Newcastle titres in 18 and 28 days were observed in chicks receiving turmeric + thyme powders in diet and the lowest of these were observed in control groups. However, there was no significant difference in Anti body Newcastle titres between control and other groups in 18 and 28 days. Birds receiving turmeric + thyme powders had the highest Anti body Influenza titres in 18 and 28 days compared to the other groups, and the lowest Anti body Influenza titres was observed in control group. There was no significant effect in Anti body Influenza titres between control and other groups in 18 and 28 days.

## Discussion

The results of this study indicate that the use of different levels of turmeric and thyme powders increased chicks body weight, feed intake and improved FCR in comparison to control groups at 42 days of age. This is not consistent with Ocak et al. (2008), who reported that addition of 0.2% thyme leaves powder in broiler diets had no effects on body weight gain, feed intake or feed conversion ratio. Mehala and Moorthy (2008), who reported that diets supplemented with 0.1 and 0.2% turmeric had not significant effect on broiler performance. In contrast to this study, Durrani et al. (2006) reported that adding 0.5% turmeric to broiler diets resulted in worse feed intake and FCR both during the starter and finisher periods, but weight gain decreased only during the finisher period. Al-Sultan (2003) showed that the feed conversion ratio of birds received 0.5% turmeric (*Curcuma longa*) in diets were the best. Al-Sultan and Gameel (2004) reported higher BWG in broilers fed diet supplemented with 2.5, 5, and 10 g/Kg of turmeric powder. Similar to our findings, Durrani et al. (2006) reported a significant improvement in BWG and FCR with addition of 5 g per Kg turmeric in diet. In various studies, the rates of thyme added to diet were variable from 20 to 200 ppm. When the volatile oils have a positive effect on performance, weight gain and feed consumption has been increased but the ratio of feed consumption to weight gain was lower compared with control group (Lee et al., 2003). The studies of Abd El-Hakim et al. (2009) showed that thyme has an important role in weight gain until 21st day-old compared with control groups. However, the study conducted by Vogt and Rauch (1991) also shows that adding 0, 20, 40, 80 ppm of thyme volatile oils to broilers' diet have no positive effect on growth performance.

The other investigation showed that addition of thyme essential oil to broilers' diet can improve feed conversion rate and growth performance (Mathlouthi et al., 2012; Weber et al., 2012; Garcia et al., 2007). Suvanated et al. (2003) reported that broiler chicks fed dietary turmeric powder had a higher body weight gain, energy efficiency ratio, yield of production and lower FCR than the basal diet ( $P < 0.05$ ). Emadi and Kermanshashi (2006) reported that at an inclusion rate of 2.5, 5 and 7.5 g/kg of diet, turmeric had not significant effect on weight gain of broiler chickens. However, Durrani et al. (2006) reported that though at 2.5 and 10 levels, turmeric had no effect on body weight but at an inclusion of 5 g/kg turmeric, body weight was significantly higher in treated groups in comparison of control groups. Wenk (2006) indicated that many herbs and botanicals can increase feed intake and improve growth rate; however, Windisch et al. (2008) reviewed the topic and found no clear evidence of the effects of herbs and spices on improvement and palatability in farm animals. Corresponding to our results on feed efficiency, Durrani et al. (2006) also reported that chickens receiving diets supplemented with 5 g/kg turmeric powder had better feed conversion ratio than 2.5 and 10 g/kg supplementation level. Also, Ahmadi (2010) reported that inclusion of turmeric (0.3 and 0.6 g/kg) to the aflatoxin contaminated diets had no effect on feed intake, but significantly increased weight gain and improved feed conversion when compared with birds fed contaminated diets alone. Blood biochemical indices directly express the status of metabolism, nutrition and health of the animals. In this study, the serum total protein of broilers fed with different levels of turmeric and thyme powders was increased ( $p > 0.05$ ). This shows that these essential oil can improve protein metabolism of broiler chickens. This effect can be probably explained by two reasons. Firstly, these medicinal plants can promote protein deposition in broilers in vivo, maintain a stable colloid osmotic pressure, improve the transportation of metabolic products in vivo, improve feed conversion rate and promote growth.

In our experiment HDL of broilers was significantly ( $P \leq 0.05$ ) improved on day 42 in the groups fed with an addition of turmeric and thyme powders, thus showing that thyme and turmeric powders can enhance lipid catabolism and reduce fat deposition. This is probably due to an anti-oxidant effect of these medicinal plants and its ability to regulate and control levels of some hormones in vivo, inhibit the activities of some lipases in vivo, promote protein deposition in the body and decrease fat deposition. The results reported by Ali et al. (2007) showed that adding thyme to hen's rations significantly decreased plasma HDL and total cholesterol. The reduction of cholesterol noticed by thyme in animal studies has been attributed to the lowering effect of thymol or carvacrol on HMG-Co A reductase the rate limiting enzyme of cholesterol synthesis (Lee et al., 2003b). The reduction of serum triglyceride by addition of turmeric and thyme powders observed in the present study might be due to the reduction of synthetic

enzymes activities. Previous studies showed that an ether extract of turmeric have hypolipemic action in rats (Rao et al., 1970). The results of this experiment show that birds receiving turmeric + thyme powders had the highest Anti body Newcastle and Influenza titres in 18 and 28 days compared to the other groups. However, Al-Ankari et al. (2004) reported that mint powder had no effects on antibody titers to NDV vaccine. Furthermore, turmeric and thyme powders have demonstrated to be a potent immunomodulatory agent that can modulate the activation of T cells, B cells, macrophages, neutrophils, natural killer cells and dendritic cells (Ganesh and Bharat, 2007). However, Emadi and Kermanshahi (2007b) reported that serum immunoglobulins of broilers were also affected by inclusion of turmeric powder into the diets, correspondingly, IgA and IgM at 21 days of age and IgG at 21 and 42 days of age significantly increased in birds fed different turmeric levels.

## Conclusion

Considering the results obtained in the current study it could be concluded that dietary inclusion of turmeric and thyme powders increase body weight, feed intake and improve FCR of broiler chickens at 42 days of age. In addition, turmeric and thyme powders had decreased serum triglyceride, HDL and LDL concentration, and enhance antibody titer production of broiler chickens at 18 and 28 days of age.

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