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Effect of Turmeric Rhizome Powder on Performance and Carcass Characteristics of Broiler Chickens

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Abstract: In order to study the effect of turmeric rhizome powder (TRP) on performance and carcass characteristics of broiler chickens, an *in vivo* experiment was conducted. A corn- soybean meal based diet containing levels of TRP (0.00, 0.25, 0.50 and 0.75%) was used. In a completely randomized design with four treatments of five replicates each, and 10 chickens per replicate, 200, Ross male broiler chickens from 0-49 days were studied. For performance, feed intake and body weight gain recorded weekly. For carcass characteristics, at the end of experiment at 49 days of age, one chicken from each replicate of treatments were weighed, slaughtered and the relative weight of liver, pancreas, spleen, heart and abdominal fat pad measured. By Roche colour fan, skin colour was also measured. In all weeks the amounts of feed intake, weight gain and feed to gain ratio in broilers fed treatments were not significantly different. Addition of TRP into the diets significantly ($P<0.05$) decreased relative abdominal fat pad and heart weights to live body weight. Under the conditions of this experiment, it was concluded that TRP may improve carcass quality and leaner meat would be predictable. Use of TRP as a reducing heart weight factor, may show some improve in circulatory and respiratory systems that needs to be clarified.

Key words: Turmeric, broiler chickens, performance, carcass characteristics

Introduction

Curcuma longa, a perennial herb which is known as turmeric, is a member of the *Zingiberaceae* family. The plant grows to a height of three to five feet and has oblong pointed leaves with bears funnel-shaped yellow flowers. The rhizome that is the portion of the plant, used medicinally. The rhizome is usually boiled, cleaned and dried to yield a yellow powder, named "turmeric". The active ingredients are curcumin and tetrahydrocurcuminoids (Osawa *et al.*, 1995). Turmeric is a medicinal plant widely used and cultivated in tropical regions. Plant extracts were found to have antifungal (Wuthi-udomler *et al.*, 2000), immunomodulatory (Antony *et al.*, 1999), antioxidative (Osawa *et al.*, 1995) and antimutagenic (Soni *et al.*, 1997) activities. Some of the pharmacological activities of turmeric as nematocidal (Kiuchi *et al.*, 1993) and anti-inflammatory (Ammon *et al.*, 1993) were demonstrated. Furthermore, the plant were used predominantly for endoparasites as well as internal and external injuries (Lans and Brown, 1998). Moreover, Soni *et al.* (1997) proved the protective effect of turmeric food activities on aflatoxin-induced mutagenicity and hepatocarcinogenicity. This study was designed to investigate the possible effect of turmeric as feed additive on the overall performance and carcass characteristics of broiler chickens under the practical conditions.

Materials and Methods

In this study, 200, day-old male broiler chickens (Ross strain) were allocated to four experimental diets in a

completely randomized design with four replicates to evaluate the effect of turmeric rhizome powder (TRP) on the performance and carcass characteristics of chickens fed the commercial corn-soybean meal based diets for 49 days. Treatments were 0.00, 0.25, 0.50 and 0.75 percent of TRP added into the feeds during experiment. Feed and water were given *ad libitum*. Table 1 shows the composition of the experimental diets. All the diets were made up with essential ingredients such that they supplied the required nutrients of the birds recommended by NRC (1994). Body weight gain (BWG) and feed intake (FI) recorded weekly and then adjusted for three periods of starter (0-21 days), grower (21-42 days) and finisher (41-49 days).

At the end of the experiment, one chicken from each replicate of treatments were slaughtered and the relative weight of abdominal fat pad, heart, liver, spleen and pancreas to live body weight were measured. Data for all parameters were subjected to an analysis of variance, using the general linear model procedure of SAS (SAS, 1993). The treatments means with significant differences at $p<0.05$ were compared using Duncan's new multiple range procedure (Duncan, 1955). Values in percentage were subjected to transformation of $\text{Arc sin } \sqrt{100}$.

Results

Results of FI, BWG and feed to gain ratio (F/G) are shown in Table 2. In all periods the values of FI, BWG and F/G among treatments were not significantly different. Although F/G was not significantly changed

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Table 1: Composition of experimental diets of broiler chickens during 0-49 days of age

Ingredients (%)	Starter (0-21 days)				Grower (21-42 days)				Finisher (42-49 days)			
Corn	56.77	56.77	56.77	56.77	63.81	63.81	63.81	63.81	71.52	71.52	71.52	71.52
Soybean meal	32.06	32.06	32.06	32.06	30.13	30.13	30.13	30.13	24.33	24.33	24.33	24.33
Fish meal	4.47	4.47	4.47	4.47	-	-	-	-	-	-	-	-
Turmeric (TRP) ¹	0.00	0.25	0.50	0.75	0.00	0.25	0.50	0.75	0.00	0.25	0.50	0.75
Wheat bran	0.75	0.50	0.25	0.00	0.75	0.50	0.25	0.00	0.75	0.50	0.25	0.00
Dicalcium phosphate	0.93	0.93	0.93	0.93	1.03	1.03	1.03	1.03	0.81	0.81	0.81	0.81
Limestone	1.09	1.09	1.09	1.09	1.24	1.24	1.24	1.24	1.16	1.16	1.16	1.16
Vit. Min. Premix ²	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Salt	0.34	0.34	0.34	0.34	0.31	0.31	0.31	0.31	0.23	0.23	0.23	0.23
Veg. oil	3.00	3.00	3.00	3.00	2.20	2.20	2.20	2.20	0.69	0.69	0.69	0.69
DL- Methionine	0.09	0.09	0.09	0.09	0.03	0.03	0.03	0.03	-	-	-	-
Calculated analysis												
ME (kcal/kg)	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900
CP (%)	20.84	20.84	20.84	20.84	18.12	18.12	18.12	18.12	16.31	16.31	16.31	16.31
Ca (%)	0.91	0.91	0.91	0.91	0.82	0.82	0.82	0.82	0.72	0.72	0.72	0.72
Avail. P (%)	0.41	0.41	0.41	0.41	0.32	0.32	0.32	0.32	0.27	0.27	0.27	0.27
Na. (%)	0.18	0.18	0.18	0.18	0.14	0.14	0.14	0.14	0.11	0.11	0.11	0.11
Arg. (%)	1.40	1.40	1.40	1.40	1.20	1.20	1.20	1.20	1.05	1.05	1.05	1.05
Lys. (%)	1.24	1.24	1.24	1.24	0.98	0.98	0.98	0.98	0.85	0.85	0.85	0.85
Met. + Cys. (%)	0.82	0.82	0.82	0.82	0.65	0.65	0.65	0.65	0.57	0.57	0.57	0.57

¹Turmeric rhizome powder. ²Supplied per kilogram of diet: vitamin A, 10000 IU; vitamin D₃,9790 IU; vitamin E, 121 IU; B₁₂, 20 µg; riboflavin, 4.4 mg; calcium pantothenate, 40 mg; niacin, 22 mg; choline, 840 mg; biotin, 30 µg; thiamine, 4 mg; zinc sulphate, 60 mg; manganese oxide, 60 mg.

Table 2: Effects of turmeric rhizome powder (TRP) on performance of broiler chickens from 0-49 days of age

TRP (%) / day	Feed intake (kg)				Body weight gain (kg)				Feed to gain ratio			
	0-21	21-42	42-49	0-49	0-21	21-42	42-49	0-49	0-21	21-42	42-49	0-49
0	0.819	1.388	1.509	3.377	0.483	0.741	0.804	2.028	1.848	1.400	1.975	1.721
0.25	0.851	1.049	1.566	3.478	0.466	0.733	0.771	1.962	1.781	1.486	1.900	1.669
0.50	0.837	1.024	1.518	3.311	0.471	0.749	0.797	2.023	1.814	1.421	1.965	1.724
0.75	0.859	1.049	1.521	3.421	0.460	0.730	0.790	1.988	1.762	1.386	1.953	1.697
± SEM	0.0432	0.0272	0.1023	0.1404	0.0210	0.0219	0.0570	0.0880	0.0912	0.0363	0.1327	0.0703
P value	0.1286	0.0890	0.3988	0.1414	0.0692	0.1232	0.4035	0.1491	0.1128	0.0744	0.3906	0.1275

during the experimental period but numerically 0.75% TRP improved it. The results of organ weights (relative to live body weight) are shown in Table 3. Organ weights (spleen, liver, pancreas) were not significantly affected by adding TRP into the diet. Birds consumed TR, had significantly ($P < 0.05$) lower heart weight and abdominal fat pad than those seen in control group. The lowest relative heart weight was seen in %0.75 TRP treatment ($P < 0.05$). Adding %0.50 TRP also significantly decreased relative heart weight ($P < 0.05$). This effect in comparison to control and %0.25 TRP treatments was seen (Table 3). As TRP inclusion increased, relative heart weight decreased. The same trend for decreasing relative abdominal fat pad was seen as TRP inclusion into the diet increased. The lowest value was seen in %0.75 TRP inclusion into the diets. Carcass colour index was not significantly affected by supplementing TRP into the diets.

Discussion

Weight gain and feed intake were not significantly affected by adding TRP into the diets. This result is not in agreement with the study of Al-Sultan (2003). Al-Sultan

(2003) showed that addition of TRP into the diet increased weight gain but Deshpande *et al.* (1998) showed that supplementation of TRP into the diet of mice decreased weight gain. Conversely, Asai and Miyazawa (2001), Okada *et al.* (2001) showed that turmeric and curcumin had no negative effect on weight gain and feed intake of broiler chickens. Use of turmeric rhizome powder had no significant effect on feed to gain ratio although numerically a positive trend was observed as TRP level in the diet increased. This result is also obtained by Al-Sultan (2003) who showed turmeric feed additive has no effect on feed conversion efficiency. Organs weights of broiler chickens were not significantly affected by treatments who fed levels of TRP. The result of this study is confirmed by Okada *et al.* (2001) and Asai and Miyazawa (2001). Relative abdominal fat pad of broilers was significantly decreased by supplementation of TRP into the diet of chickens ($P < 0.05$). Abdominal fat pad decreased as addition of TRP into the diets increased. Ammon and Wahl (1991) showed an increase in pancreas secretion and a decrease in abdominal fat pad as a physiological effect of curcumin that stimulate lipid metabolism. This result was similar

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Table 3: Effect of turmeric rhizome powder (TRP) on relative carcass characteristics of broiler chickens at 49 days of age

TRP (%)	Liver weight	Pancreas weight	Spleen weight	Heart weight	Abdominal Fat pad weight	Carcass colour index
0	1.829	0.190	0.121	0.499 ^a	2.078 ^a	2.6
0.25	1.894	0.239	0.109	0.455 ^{ab}	1.822 ^b	3.2
0.5	1.866	0.217	0.101	0.430 ^b	1.400 ^b	2.4
0.75	1.841	0.222	0.126	0.404 ^c	1.177 ^c	2.6
± SEM	0.0203	0.0251	0.0634	0.0128	0.0042	0.042
P value	0.684	0.384	0.678	0.0001	0.0001	0.362

^{a,b,c} Means in each column with different superscripts are significantly different (P<0.05).

to those of Asai and Miyazawa (2001), Al-Sultan (2003), and Al-Sultan and Gameel (2004).

TRP as a feed additive into the diets of broilers was also decreased relative heart weight (P<0.05). This effect on heart weight might be a good index to assume TRP may improve the incidence of some metabolic disorders such as ascites and sudden death syndrome (SDS) in birds suffering from heart dysfunction due to the genetic manipulation, poor environmental and nutritional management in commercial strains of broilers.

The result of skin colour index in this study was not significant although in one study by Awang *et al.* (1992), they showed that skin colour intensity; that evaluated visually by 0 (nil), + (mild), ++ (Medium) and +++ (high); was highest in broilers fed 10 mg curcumin per kilogram of feed and the second highest in birds receiving 100 mg of the colorant. It is possible that the amount of curcumin in TRP in this study has been low , or the TRP levels used has not been enough to change the skin colour.

In spite of the fact that spices have been extensively used as feed additives for centuries, occasional doubts have been expressed regarding the safety of some of them. Fortunately the safety of turmeric and its yellow colouring agent, curcumin, are approved by many researchers (Hallagan *et al.*, 1995; Srinivasan, 2005). No visible sign of toxicity was found in mice when they fed 3g/kg *Curcuma longa* rhizome (Qureshi *et al.*, 1991). Under the conditions of this study, it was concluded that use of turmeric rhizome powder may improve some of the parameters in performance and carcass traits. More research is needed to clarify whether or not the smaller relative heart weight seen in TRP treatments is related to better efficiency of heart and lungs in relation to some metabolic disorders seen in fast growing broiler chickens.

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