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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

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Effect of Turmeric Rhizome Powder on the Activity of Some Blood Enzymes in Broiler Chickens

M. Emadi and H. Kermanshahi
Department of Animal Science, College of Agriculture, Ferdowsi University of Mashhad,
Mashhad, P.O. Box: 91775-1163, Iran

Abstract: In order to study the effect of turmeric rhizome powder (TRP) on the activity of some blood enzymes in broiler chicken, a 49 days experiment using corn-soybean meal based diet containing four levels of TRP (0.0, 0.25, 0.50 and 0.75%) as treatments with five replicates in a completely randomized design was conducted. 200 Ross male broiler chicken from 0-49 days were housed in 20 pens and received feed and water *ad- libitum*. At 21 and 42 days of age, one blood serum sample from each replicate of treatment was collected. Inclusion of TRP significantly increased LDH and AST enzymes ($P<0.05$). TRP in the diets also significantly decreased ALT and ALP enzymes ($P<0.05$). Under the conditions of this study, it was concluded that TRP might have some positive effects on liver enzymes that directly or indirectly reflects a healthier liver status in broiler chickens.

Key words: Turmeric, blood enzymes, broiler chickens, liver damage

Introduction

The rhizome of turmeric has a rich history in India as spice, food preservative and colouring agent and has been used for centuries in traditional medicine. Spices like turmeric played a key role as food additive from long time ago (Srimal, 1997). The continuing research indicates that turmeric and its active compound 'curcumin' are unique antioxidants, antimutagenic, anti-tumorigenic, anticarcinogenic, anti-inflammatory, anti-arthritics, antimicrobial and hypocholesterolemic properties as reviewed recently (Majeed *et al*., 1995; Miquel *et al*., 2002). No toxic effects due to feeding turmeric or curcumin was reported in rat, guinea pig, monkey and pig (Quian *et al*., 1981; Dial and Chen, 1982; Zeng *et al*., 1982; Li and Shen, 2002). Curcumin has been applied in interventional therapy administered via the hepatic artery and produced favourable effects in patients with primary liver cancer and experimentally in rats with transplanted liver tumours as well (Cheng and Liu, 1997, Han *et al*., 1998, Chen and Chang, 2001, Wu *et al*., 2000, Li and Liang, 2003). Turmeric and curcumin have been shown to protect liver against a variety of toxicants including carbon tetrachloride (CCl_4), aflatoxin B1 and cyclophosphamide in mouse, rat and duckling (Donatus *et al*., 1990; Kiso *et al*., 1983; Soudamini and Kuttan, 1992). The present study was designed to investigate the possible effect of turmeric rhizome powder (TRP) as feed additive on some liver associated enzymes presented in the blood serum of broiler chickens.

Materials and Methods

In a completely randomized design, four levels of TRP (0.0, 0.25%, 0.5% and 0.75%) with five replicates were tested in 200, day-old Ross male broiler chicken for 7 weeks during starter (0-21), grower (21-42) and finisher (42-49 days of age) periods (Table 1). A corn-soybean meal based diet was used to meet the requirements of the chickens as recommended by National Research Council (NRC, 1994). Feed and water provided *ad-libitum*. Birds were maintained under continuous light. The environmental temperature in the farm that was initially established on 31°C was gradually reduced to 20 C by week 7. Blood serum associated liver enzymes (Narasimhan and Nair, 1974), aspartate amino-transferase (AST, already named glutamic oxaloacetic transaminase, SGOT), alanine amino- transferase (ALT, already named glutamic pyruvic transaminase, SGPT), alkaline phosphatase (ALP) and lactic dehydrogenase (LDH) measured at 21 and 42 days of experiment using appropriate commercial laboratory kits with RA1000 spectrophotometer.

Data were analyzed based on a general linear model procedure of SAS (SAS, 1993) and treatment means when significant, were compared using Duncan multiple range test (Duncan, 1955).

Results and Discussion

The effect of TRP on some associated liver enzymes is shown in Table 2. TRP significantly increased LDH of the chickens at 21 days of age ($P<0.05$) but this effect was not significant at 42 days of age. Amount of LDH release from liver and thereby into the blood is proportional by damage of the liver (Deshpande *et al*., 1998; Akila *et al*., 1998). Curcumin and turmeric have been shown to protect liver against a variety of toxicants *in vivo* as well as *in vitro* studies (Akila *et al*., 1998; Srimal, 1997). LDH is a non-especially enzyme with 5

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	0.0	30.03	-	-	-	-
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
Lys (%)	1.40	1.40	1.40	1.40	1.20	1.20	1.20	1.20	1.05	1.05	1.05	1.05
Arg (%)	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

[1]Turmeric rhizome powder ; [2]Supplied per kilogram of diet: vitamin A, 10000 IU; vitamin D_3, 9790 IU; vitamin E, 121 IU; B_{12}, 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: Effect of turmeric rhizome powder on the activity of some blood enzymes in broiler chickens

Blood Enzymes	LDH (U/l)		ALP (U/l)		AST (U/l)		ALT (U/l)	
Sampling days	21	42	21	42	21	42	21	42
TRP (%)								
0	535.0^{b}	646.4	215.0^{a}	40.3	23.8^{c}	52.8^{c}	37.80^{a}	311.0^{a}
0.25	694.8^{ab}	643.2	141.4^{b}	48.4	195.2^{a}	172.2^{b}	33.20^{b}	12.6^{c}
0.50	799.6^{a}	561.8	116.0^{c}	55.2	180.6^{a}	279.6^{a}	37.40^{a}	26.2^{b}
0.75	551.8^{b}	668.0	150.0^{b}	55.9	145.8^{b}	228.0^{ab}	34.80^{ab}	26.0^{b}
± SE	9.92	29.13	2.71	4.22	5.48	4.84	0.60	2.15
P value	0.020	0.4071	0.0008	0.4475	0.0001	0.0002	0.0249	0.0001

[a, b, c]Means in each column with different superscripts are significantly different (P<0.05). TRP, turmeric rhizome powder; LDH, lactate dehydrogenase; ALP, alkaline phosphatase; AST (SGOT), aspartate aminotransferase; ALT (SGPT), alanine aminotransferase.

isoenzymes of LDH1 to LDH5 that found in all tissues of the body and possibly is a poor index of assessing liver damage as discussed by Nazifi (1997). In this study, the level of 0.50% TRP showed the highest activity of LDH at 21 days of age and may show a protective effect of TRP in broiler chickens. Turmeric significantly decreased serum alkaline phosphatase (ALP) of the chickens at 21 days of age (P<0.05). Decreasing effect of ALP by turmeric in this experiment is similar to those of Pal *et al.* (2005). ALP is a sensitive marker of liver damage (Salli *et al.*, 1991). In hepatitis, hepatocytes start to die due to liver damage and thereby ALP concentration in the bile ducts increases. Essential oils present in turmeric (Srimal, 1997) are known to increase bile flow and bile secretion, so these two interacting mechanisms may show some positive effects of turmeric on hepatitis and a response to inhibit the accumulation of ALP in bile ducts (Srimal, 1997). Turmeric also significantly increased AST (SGOT) of the chickens at 21 and 42 days of age (P<0.05). Moderate increase in AST and normal LDH might be due to an acute skeletal or cardiac muscular injury 2 or 4 days ago or as a result of hepatic injury (Fudge, 2000). Turmeric significantly changed ALT (SGPT) of the chickens at 21 and 42 days of age (P<0.05). Fernandez *et al.* (1994) induced liver damage by aflatoxin in layers and broilers and an increase in serum ALT was observed. There are some documents clearly showing the beneficiary effect of TRP and curcumin on some enzymes including superoxide dismutase and glutathione peroxidase. Chronic administration of CCl_4 caused hepatic damage as indicated by increase in the liver thiobarbituic acid, TBARS (Akila *et al.*, 1998), an indication of lipid peroxidation. It is reported that lipid peroxidation can stimulate collagen synthesis (Geesin *et al.*, 1990). The significant reduction in the levels of TBARS in the liver by curcumin confirms that it could effectively protect liver from the free radical mediated stress by scavenging of peroxides or by the neutralization of free radicals (Akila *et al.*, 1998). The beneficial effect of curcumin as a protective agent against CCl_4-induced fibrosis is possibly due to its inhibition of lipid peroxidation (Akila *et al.*, 1998). Therefore, strengthening antioxidant activity of the cells, lipid peroxidation may decrease as we observed in this experiment by changing the enzyme profile of blood samples. As TRP improved some of the

carcass characteristics significantly ($P<0.05$), feed intake and feed to gain ratio of broiler chickens numerically (Emadi and Kermanshahi, 2006) and as the safety of TRP and curcumin was already approved (Kermanshahi and Riasi, 2006; Srinvasan, 2005), it was concluded that supplementation of diets with turmeric rhizome powder may improve health status of broiler chickens. More research is needed to clarify the effect of TRP on other blood parameters and immune system in broiler chickens.

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References

Akila, G., V. Rajakrishjnan, P. Viswanathan, K.N. Rajashekaran and V.P. Menon, 1998. Effect of curcumin on lipid profile and lipid peroxidation status in experimental hepatic fibrosis. Hepatology Research, 11: 147-157.

Chen, J.H. and G. Chang, 2001. A controlled clinical study between hepatic arterial infusion with embolized curcuma aromatic oil and chemical drugs in treating primary liver cancer. Zhonggho Zhongxiyi Jiehe Zazhi, 21: 165-167.

Cheng, G. and L.H. Liu, 1997. Advanced in research of primary liver cancer treatment with Chinese herbal medicine embolization. Zhonggho Zhongxiyi Jiehe Zazhi, 17: 187-190.

Deshpande, U.R., S.G. Gadre, A.S. Raste, D. Pillai, S.V. Bhide and A.M. Samuel, 1998. Protective effect of turmeric (*Curcuma longa L.*) extract on carbon tetrachloride-induced liver damage in rats. Ind. J. Exp. Biol., 36: 573-77.

Dial, M. and M.Z. Chen, 1982. The therapeutic effect of the Chinese drug (curcuma aromatica) on experimental allergic encophalomylilits of the guinea pig. Yaoxue Xuebao, 17: 692-695.

Donatus, I.A., J. Sardjoko and N.P.E Vermeulen, 1990. Cytotoxic and cytoprotective activities of curcumin: effects on paracetamol-induced cytotoxicity, lipid peroxidation and glutathione depletion in rat hepatocytes. Biochem. Pharmacol., 39: 1869-1875.

Duncan, D.B., 1955. Multiple range test and F-test. Biometrics, 11: 1-42.

Emadi, M. and H. Kermanshahi, 2006. Effect of turmeric rhizome powder on performance and carcass characteristics of broiler chickens. Int. J. Poult. Sci., 5: 1069-1072.

Fernandez, A., M.T. Verde, M. Gascon, J.J. Ramos, J. Gomez, D.F. Luco and G. Chavez, 1994. Variation of clinical biochemical parameters of laying hens and broiler chicks fed aflatoxin containing feed. Avian Pathology, 23: 37-47.

Fudge, 2000. Laboratory medicine. Avian and exotic pets, pp: 47-54.

Geesin, J.C., J.S Gordon and R.A. Berg, 1990. Retinoids affect collagen synthesis through inhibition of ascorbate induced lipid peroxidation in cultured human fibroblasts. Arch. Biochem. Biophys., 278: 350-355.

Han, M.J., K. Renk, Z.C. Zhao and X.T. Zhang, 1998. Oleum curcuma compound used in hepatic arterial embolization to treat hepatocellular carcinoma: follow up report of 84 cases. Linchuang Fangshexue Zazhi, 17: 112-114.

Kermanshahi, H. and A. Riasi, 2006. Effect of turmeric rhizome powder (*Curcuma longa*) and soluble NSP degrading enzyme on some blood parameters of laying hens. Int. J. Poult. Sci., 5: 494-498.

Kiso, Y., Y. Suzuki and N. Watanbe, 1983. Antihepatotoxic principles of Curcuma longa rhizomes. Planta Med., 49: 185-87.

Li, B. and N. Liang, 2003. Advances in the clinical application and experimental study of curcuma zedoaria oil preparations. Zhongyaocia, 26: 68-71.

Li, G.D. and A.J. Shen, 2002. Research progress of curcuma aromatica oil. Zhonggho Zhongxiyi Jiehe Zazhi, 37: 806-809.

Majeed, M., V. Badmaev., U. Shivakamar and R. Rajendran, 1995. Curcuminoids antioxidant phytonutrients Nutriscience Publisher Inc., Piscata way, Newjersy.

Miquel, J., A. Bernd., J.M. Sempere and R.A. Dias-Alperi, 2002. Curcuma antioxidants: pharmacological effects and prospects future clinical use. A review. Arch.Gerontol. Geriaty, 34: 37-46.

Narasimhans, T.R. and S.G. Nair, 1974. Comparative activity of some liver enzymes of ducks and chickens and the effects of hepatotoxicity induced by CCl_4 on the levels of few of them. Ind. J. Anim. Sci., 44: 53-59.

National Research Council, 1994. Nutrient requirement of poultry. National academy press.

Nazifi, S., 1997. Hematology and biochemical birds. University of Shiraz, Iran, 217-222.

Pal, S., S. Bhaattachara, T. Choudhuri, G.K. Datta., T. Das and G. Sa, 2005. Amelioration of immune cell number depletion and potentiation of depressed detoxification system of tumour, breading mice by curcumin. Cancer.Detection and prevention, 29: 470-478.

Quian, Z.C., J.Y. Liu, S.R. Zhao, L.H, Yu, D.Y. Zhang and W.H. Wei., 1981. Prophylatic effect of active immunization with curcuma aromatic treated tumour cells-exploration of mechanism of action of curcuma aromatica. Yaoxue Xueboa, 16: 892-896.

Salli, K., J.M. Tredger and R. William, 1991. Drugs and the liver. Biopharmaceutical Drug Dispose, 12: 251-259.

SAS, 1993. SAS User's guide: version 6.03 ed., SAS Institute Inc., Cary, North Carolina.

Soudamini, K.K. and R. Kuttan, 1992. Inhibition of lipid peroxidation and cholesterol levels in mice by curcumin. Ind. J. Physiol. Pharmacol., 36: 239-243.

Srimal, R.C., 1997. Turmeric: a brief review of medicinal properties. Fitoterapia LXVIII, 483-493.

Srinvasan, K., 2005. Spices as influencers of body metabolism: an overview of three decades of research. Food Res. Int., 38: 77-86.

Wu, X.U., I.C. Shi and W.B. Zhang, 2000. Inhibitory effects of curcuma aromatic oil on proliferation of hepatoma in mice. Word J. Gastroenterol., 6: 216-219.

Zeng, L.L., G.Y. Wang, D.X. Wang and C.H. Chen, 1982. Studies on the active ingredient of curcumin and its effects. Yaoxue Xueboa, 946-950.