INFLUENCE OF TURMERIC POWDER (*CURCUMA LONGA*) ON EGG YOLK CHOLESTEROL AND TOTAL SERUM CHOLESTEROL IN RHODO WHITE LAYERS

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ABSTRACT

Turmeric powder (Curcuma longa) has been used in several countries as a traditional remedy for the treatment of many diseases. It is an established fact that the active principle present in the turmeric powder viz. curcumin has broad spectrum biological activities including antioxidant, anticancer, anti-inflammatory and lowering effects of lipid and cholesterol. Hence an experiment was conducted to study the influence of turmeric powder on egg yolk cholesterol and total serum cholesterol level of Rhodo White layers. Seventy two Rhodo White layers were randomly divided into four treatment groups where in turmeric powder was included in their ration @ 0, 0.05 %, 0.10 % and 0.15 %. Each treatment had three replicate of six birds each and reared with iso-nitrogenous and iso- calorie diet for a total period of 14 weeks from 26th week to 39th week of age. The birds were housed in cage system of rearing and they were fed with weighed quantities of feed with ad libitum water following uniform standard managemental practices. The egg yolk cholesterol and total serum cholesterol were estimated during 32 and 39th week of age. At 32 weeks of age, the egg yolk cholesterol level was significantly (P<0.01) reduced in all turmeric supplemented groups than control group. The maximum reduction of egg yolk cholesterol level by 32.9 % was observed in 0.15 % turmeric powder supplemented group when compared to control. The egg yolk cholesterol level was also found to be significantly (P<0.01) decreased at 39th week in all turmeric supplemented groups. The reduction of egg yolk cholesterol was by 19.42, 23.26 and 31.53 % in 0.05, 0.10 and 0.15 % respectively in turmeric supplemented groups compared to control. The total serum cholesterol level was also significantly (P<0.01) decreased at 32nd week and 39th week in turmeric powder supplemented group than control. The maximum decrease in total serum cholesterol was observed by 15.32% at 32 week and 17.20 % at 39 week in 0.15 % turmeric powder supplemented group than control. It was concluded that the inclusion of turmeric powder (Curcuma longa) at 0.15 % reduce the egg yolk cholesterol and total serum cholesterol in Rhodo White layers to the maximum extent.

Key words: Turmeric Powder, Laying hens, Egg yolk cholesterol, total serum cholesterol

INTRODUCTION

Natural dietary agents like fruits and vegetables including spices have drawn a great deal of attention from both the scientific community and the general public due to their various health promoting effects (Shukla and Singh, 2007). The rhizome of *Curcuma longa* (Family: Zingiberaceae) named turmeric is a perennial herb widely cultivated in tropical regions of Asia and it has been used as a coloring, flavouring agent and spice in many foods. Spices

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like turmeric powder are the natural food additives contribute immensely to the taste and flavour of foods. The most important components in turmeric, responsible for their various pharmacological properties are the curcuminoids (Badreldin *et al*, 2008; Chattopadhyay *et al,* 2004). In several countries, it has been used as a traditional remedy for the treatment of many diseases. Turmeric has been subjected to chemical analysis and has yielded essential oils (2.4-4%) and fatty acids (1.7-3.3%). In spite of the fact that spices have been extensively consumed for centuries, occasional doubts have been expressed regarding the safety of some of them. Fortunately the safety of turmeric and its yellow coloring agent, curcumin, are approved by researchers (Hallagan *et al*., 1995) and many organizations such as the joint FAO/WHO Expert Committee on Food Additives, JECFA, (WHO, 1987); Department of Biochemistry and Nutrition of Central Food Technological Research Institute of India, CFTRI (Hallagan *et al*, 1995 and Srinvasan, 2005). In poultry it was observed that the curcumin has been recognized for its broad spectrum biological activities including antioxidant, anticancer properties, anti-inflammatory property and lowering effects of lipid and cholesterol (Sharma *et al*.,2005; Lantz *et al*., 2005; Radwan *et al*., 2008;Chauhan *et al*, 2014). There are limited studies on the effect of turmeric powder supplementation in birds, specially in laying hens (Radwan *et al*., 2008; Chauhan *et al*, 2014). Hence the present study was carried out with an objective to investigate the effect of different levels of turmeric powder on egg cholesterol and total serum cholesterol of Rhodo White laying hens.

MATERIALS AND METHODS

Four experimental layer diets were formulated (BIS 2007) containing turmeric powder at 0, 0.05, 0.10 and 0.15 % of the diet. Seventy two Rhodo white layers were weighed individually and distributed randomly to the four experimental diets. Each treatment had three replicates of six layers each. The layers were housed in cage system of rearing. The turmeric powder treated feed was given for a period of 14 weeks from 26 to 39 weeks of age of the birds. The layers were fed with weighed quantities of feed with *ad libitum* water following uniform standard managemental practices. The ingredient and chemical composition (AOAC, 1990) of the formulated layer diets are presented in **Table 1**. Six eggs were collected from each treatment group during 32 and 39th week of age and the total cholesterol content analyzed. Similarly six layers were selected from each treatment and the blood was collected and serum separated for total cholesterol analysis. Total cholesterol in serum and eggs was measured using laboratory kits (Friedewald *et al*., 1972; Gordon and Amer, 1977). The data on cholesterol level were statistically analyzed in a completely randomized design by the GLM procedure of SAS software (SAS Institute, 2006) as per the method of Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

The influence of turmeric powder on egg yolk cholesterol (mg/g of yolk), total serum cholesterol (mg/dl of blood) and percent decrease in egg yolk cholesterol, total serum cholesterol are presented in **Table 2**. The egg yolk cholesterol level was significantly ($P<0.01$) decreased in all turmeric powder supplemented groups than control at 32 weeks of age. The decrease in egg yolk cholesterol level was observed by 21.03 %, 26.27 % and 32.9 % respectively in 0.05 %, 0.1 % and 0.15 % turmeric powder supplemented groups than control. The maximum decrease in egg yolk cholesterol level was observed in 0.15 % turmeric powder supplemented group than control. The egg yolk cholesterol level at 39th week also decreased significantly ($P<0.01$) in all turmeric powder supplemented groups when compared to control. The reduction of egg yolk cholesterol level was 19.42 %, 23.26 % and 31.53 % respectively in 0.05%, 0.1% and 0.15% turmeric supplemented groups than control. Similarly, Kermanshahi and Riasi (2006) reported that turmeric powder (0.05, 0.10, and 0.15%) in laying hens decreased total cholesterol. They concluded that the dietary

supplementation of turmeric powder improves some serum blood components and can be applied for manipulating egg composition. Further, the egg cholesterol was also reduced by 35.15% by supplementation of turmeric powder at 4.5g per kg feed (Chauhan *et al*, 2014) in Jabalpur coloured layer birds.

Turmeric extract along with saturated fat and cholesterol in rabbits (Ramirez-Tortosca *et al*,1999) significantly ($p<0.01$) decreased the plasma cholesterol. Dias *et al.* (2006) reported that the total serum cholesterol levels were significantly decreased by dietary supplementation of 1% ginger extract meal in rats ($P<0.05$). They stated that ginger treatment can reduce total serum cholesterol by enhancing the activity of liver cholesterol-7-a-hydrolase or inhibition of hydroxyl-methyl-glutarylcoenzyme- A (HMG-CoA) reductase, either by bile-acid conversion or fecal excretion of cholesterol. Further, Malekizadeh *et al.* (2012) also reported that the supplementation with turmeric powder at 1% and 3% reduced total cholesterol to a greater extent by 34.95% and 31.68 % respectively than control in laying hens.

The total serum cholesterol level was significantly ($P<0.01$) decreased at 32 week by 10.74 %, 12.68 % and 15.32 % respectively in 0.05 %, 0.1 % and 0.15 % of turmeric powder supplemented group than control. The maximum decrease in total serum cholesterol was observed at 0.15% turmeric powder supplemented group than control. At 39th week also significantly ($P<0.01$) decreased the total serum cholesterol in all turmeric treated groups than control. The maximum decrease was also observed at 0.15% turmeric powder supplemented group by 17.20% than control group. Similar report was also observed by Malekizadeh *et al.* (2012) who reported that the supplementation with turmeric powder at 3% decreased the total serum cholesterol. Further Kermanshahi and Riasi (2006) also reported that turmeric powder (0.05, 0.10, and 0.15%) in laying hens decreased total serum cholesterol.

Fuhrman *et al* (2000) suggested that polyphenolic flavonoids like Curcumin may prevent coronary artery disease by reducing platelet aggregation, by reducing damage from ischemia and reperfusion by reducing plasma cholesterol levels or by inhibiting LDL oxidation, a process which is thought to play a key role in the pathogenesis of atherosclerosis. The antioxidant activity of the flavonoids is related to their chemical structure. Miquel *et al.* (2002) suggested that curcumin and related antioxidants may complement the well established anti-atherogenic action of tocopherol. They concluded that curcumin antioxidants might be especially useful as anti-atherogenic agents in those processes linked to a marked increase in blood lipid peroxidation such as myocardial infarction. Similarly the present experiment results were also in agreement with early studies that adding turmeric powder could be useful on reduction of cholesterol in eggs and serum which might be beneficial indicator for the management of cardiovascular disease for human being.

It was concluded that the inclusion level of turmeric powder (*Curcuma longa*) at 0.15% reduced the egg yolk cholesterol and total serum cholesterol level of Rhodo White layers to the maximum extent in the present study and it might be useful as anti-atherogenic agent.

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Table 1. Ingredient and chemical composition of experimental layer diet

S.No.	Feed ingredients (kg)	Turmeric powder (%)			
		0	**0.05**	**0.10**	**0.15**
1	Maize	58.50	58.50	58.50	58.50
2	Soya bean meal	22.50	22.50	22.50	22.50
3	De-oiled rice bran.	05.00	05.00	05.00	05.00
4	Fish meal	05.00	05.00	05.00	05.00
5	Shell grit	06.50	06.50	06.50	06.50
6	Mineral mixture	02.00	02.00	02.00	02.00
7	Salt	00.50	00.50	00.50	00.50
	Total	**100.00**	**100.00**	**100.00**	**100.00**
	Supplements (g/100 kg)				
1.	Vitamin AB_2D_3K[1]	10.00	10.00	10.00	10.00
2.	B-complex vitamins[2]	25.00	25.00	25.00	25.00
3.	Trace minerals[3]	50.00	50.00	50.00	50.00
	Chemical composition				
1.	Dry matter (%)	91.66	91.66	91.66	91.66
2.	Crude Protein (%)	18.06	18.06	18.06	18.06
3.	Crude fibre (%)	7.91	7.91	7.91	7.91
4.	Ether extract (%)	3.33	3.33	3.33	3.33
5.	Total ash (%)	9.05	9.05	9.05	9.05
7.	Acid insoluble ash (%)	1.96	1.96	1.96	1.96
8.	Calcium (%)	3.29	3.29	3.29	3.29
9.	Phosphorus (%)	0.71	0.71	0.71	0.71
10.	Available Phosphorus (%)*	0.41	0.41	0.41	0.41
11.	Metabolizable Energy (kcal/kg)*	2613.00	2613.00	2613.00	2613.00

*Calculated value

[1] One gram of Vitamin AB_2D_3K supplement contained 82500 IU of Vitamin-A, 50 mg of Vitamin-B_2, 12000 IU of Vitamin-D_3 and 10 mg of Vitamin-K.

[2] One gram of B-Complex supplement contained 8 mg of Vitamin-B_1, 16 mg of Vitamin-B_6, 80 mg of Vitamin B_{12}, 80 mg of Vitamin-E, 120 mg of Niacin, 8 mg of Folic acid, 80 mg of Calcium pantothenate, 120 mg of Calcium and 300 mg of Phosphate.

[3] One gram of Trace Minerals contained 54 mg of manganese, 52 mg of zinc, 20 mg of iron, 2 mg of iodine and 1 mg of cobalt.

Table 2. Influence of turmeric powder (*Curcuma longa*) on egg yolk cholesterol and total serum cholesterol level in Rhodo White layers (Mean ± S.E.)

Turmeric powder	0 % of the diet (0 g/kg feed)	0.05% of the diet (0.5 g/kg feed)	0.1% of the diet (1.0 g/kg feed)	0.15% of the diet (1.5 g/kg feed)
Egg yolk cholesterol level at 32 week age (mg/g of yolk)	13.74 ± 0.42 [c]	10.85 ± 0.19 [b]	10.13 ± 0.05 [b]	9.22 ± 0.18 [a]
Percent decrease in egg yolk cholesterol than control at 32 week	0	21.03	26.27	32.90
Egg Cholesterol level at 39 week age (mg/g of yolk)	13.54 ± 0.19 [c]	10.91 ± 0.24 [b]	10.39 ± 0.17 [b]	9.28 ± 0.09 [a]
Percent decrease in Egg cholesterol than control at 39 week	0	19.42	23.26	31.46
Total serum cholesterol level at 32 week age (mg/dl)	189.33 ± 0.99 [c]	169.00 ± 1.39 [b]	165.33 ± 1.31 [b]	160.33 ± 0.80 [a]
Percent decrease in Total serum cholesterol than control at 32 week	0	10.74	12.68	15.32
Total serum cholesterol level at 39 week age (mg/dl)	191.83 ± 0.60 [c]	166.50 ± 1.98 [b]	164.33 ± 2.14 [ab]	158.83 ± 1.45 [a]
Percent decrease in Total serum cholesterol than control at 39 week	0	12.83	14.34	17.20

Mean of six observations; Means with at least one common superscript in a same row do not differ significantly (P<0.01)