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Biochemical response in rats to the addition of curry leaf (*Murraya koenigii*) and mustard seeds (*Brassica juncea*) to the diet

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Abstract. Three groups with 12 weanling male albino rats were group fed for 90 days on a standard laboratory rat diet plus 20% coconut oil either without a supplement or with the addition of 10% curry leaf or 10% mustard seeds. Feed was offered at a level of 10% body weight. At the end of the trial, measurements were made on the total serum cholesterol, high density lipoproteins, low density lipoproteins, and very low density lipoproteins fractions, release of lipoproteins into the circulation, lecithin cholesterol acyl transferase activity and lipoprotein lipase activity. Feed intake and mean body weight of the rats on each treatment was not significantly different. Both spices resulted in a reduction in total serum cholesterol and LDL + VLDL, an increase in the HDL, lower release of lipoproteins into the circulation and an increase in the LCAT activity.

Key words: Curry leaf, Mustard, Spices, Lecithin cholesterol acyl transferase, Lipoproteins, Cholesterol

Introduction

Spices are well known appetizers and add flavor to otherwise insipid foods. Some of the biochemical effects of spices, especially their influence on lipid metabolism, have been documented. Iyer & Mani [1] have shown the effect of curry leaf supplementation on lipid, protein and amino acid profiles in non-insulin dependent diabetic patients. Clinical studies [2, 3] using this spice have also shown a significant reduction in the serum total cholesterol, LDL & VLDL cholesterol and triglyceride levels. Because curry leaf and mustard are condiments used in Indian homes, this study was undertaken to investigate the effects of addition of these spices to high fat diets on the metabolism of lipids in rats.

Materials and methods

Young male Sprague-Dawley rats (50–60 g) were used for the experiments. The rats were divided into the following groups, each containing 12 rats.

Table 1. Concentration of cholesterol (mg/100 ml) in animals fed curry or mustard seeds in a high fat diet

Group	Serum cholesterol	Serum Lipoproteins		LDL/HDL
		HDL	LDL + VLDL	
Normal	64.80 ± 1.7	40.3 ± 0.7	14.83 ± 0.24	0.30
Control	73.8 ± 1.2	40.9 ± 0.65	30.7 ± 0.49	0.75
Curry	61.2 ± 0.97*	48.5 ± 0.77*	12.2 ± 0.19*	0.25*
Mustard	62.8 ± 1.00*	47.7 ± 0.76*	14.6 ± 0.23*	0.31*

Control group has been compared with the Curry and Mustard fed groups. Results are expressed as average of values from 6 rats ± SE.
*$p < 0.01$.

Group I – Normal laboratory diet mixed with 20% coconut oil (High fat diet [Control]).
Group II – High fat + 10% curry leaf [Curry].
Group III – High fat + 10% mustard [Mustard].

Fresh curry leaves were ground well and mixed with the diet. Dried mustard seeds were powdered and mixed with the diet. The average diet consumption was found to be the same in all the three groups (10%/rat/day). After 3 months on the respective diets, the animals were sacrified by decapitation. The different tissues were chilled at 0 °C and transferred to the cold containers for various estimations. The following parameters were studied: serum cholesterol, lipoprotein lipase (LPL, Ec 3.1.1.3), lecithin cholesterol acyl transferase (LCAT, Ec. 2.3.1.43), release of lipoproteins into the circulation and separation of serum HDL and LDL + VLDL fractions. Statistical evaluation of the analytical data was done by Student's t test [4].

Average weight per group

	Initial (g)	*Final (g)*
Control	52.4	135.0
Curry	51.0	128.0
Mustard	53.0	121.6

The standard laboratory diet was the rat feed, supplied by Lipton India Ltd, Banglore.

Table 2. Lecithin Cholesterol Acyl Transferase (LCAT) and Lipoprotein lipase (LPL) activity of animals fed curry or mustard seeds in a high fat diet

Group	Activity of LCAT*	LPL heart	(micromoles of glycerol/hr/g protein) Adipose
Control	31.6 ± 0.50	44.3 ± 0.7	161.4 ± 2.6
Curry	43.7 ± 0.69*	17.8 ± 0.28*	112.7 ± 1.8*
Mustard	41.4 ± 0.66*	17.2 ± 0.29*	109.8 ± 1.7*

Control group has been compared with the Curry and Mustard fed groups. Results are expressed as average of values from 6 rats ± SE.
*$p < 0.01$.

Table 3. Release of Lipoproteins into the circulation (Conc: of cholesterol...mg/100 ml serum) in animals fed curry or mustard seed in a high fat diet

Group	Saline injected	Triton injected	Percentage increase in cholesterol
Control	78.6 ± 1.2	118.4 ± 1.8	50.6 ± 0.8
Curry	58.7 ± 0.93*	83.6 ± 1.3*	42.4 ± 0.67*
Mustard	62.4 ± 0.99*	87.8 ± 1.4*	40.7 ± 0.65*

Control group has been compared with the Curry and Mustard groups. Results are expressed as average of values from 6 rats ± SE.
*$p < 0.01$.

Results

The level of total serum cholesterol in rats fed spices was decreased as compared to those with the high fat diet alone. The concentration of cholesterol in the HDL fraction increased, while that of LDL + VLDL fraction showed significant decrease. We observed decreased LDL/HDL cholesterol ratio in the experimental groups compared to the control. LCAT activity showed a significant increase in rats fed these spices. The activity of LDL in the heart and adipose tissues showed significant decrease in the spice administered groups. There was significantly lower release of lipoproteins into the circulation in curry leaf and mustard fed groups compared to high fat diet group.

Discussion

The results obtained in the present study indicate that the oral administration of curry leaf and mustard has profound influence on lipid metabolism. This is in agreement with earlier studies on other spices, like eugenol, curcumin, mango ginger [5] and fenugreek. The enhancement in HDL cholesterol and lowered LDL + VLDL cholesterol in serum could be beneficial in many heart diseases. Significant lowering of LDL + VLDL and elevation of HDL values have been observed in rats fed normal diet with 10% curry leaf or 10% mustard seeds. A similar selective effect [11] of LDL + VLDL component has been observed with fenugreek also. Sreenivasan [6] also reported similar lowering of LDL + VLDL in the serum and an increase in HDL cholesterol in sucrose-induced hyper-triglyceridemia in rats fed ginger. LDL cholesterol/HDL cholesterol level was significantly elevated with garlic supplementation [7] also. The decreased release of lipoproteins into the circulation as evidenced from a Triton WR-1339 experiment can result in hypocholesterolemia and hypotriglyceridemia. Further the uptake of triglycerides rich lipoproteins (chylomicrons + VLDL) from the circulation is also decreased as revealed by the decreased activity of LPL of the extra hepatic tissues. The increased activity of LCAT now observed may cause increased cholesterol esters in HDL. LCAT and HDL operate in conjunction to promote removal of cholesterol from the tissues.

In the light of available reports [8–10], HDL cholesterol is negatively correlated and LDL cholesterol is positively correlated with coronary heart disease. Lipoprotein fractions form the fair index of blood cholesterol. The depression in plasma cholesterol caused by the administration of curry leaf and mustard is in agreement with the results of Subba Rao et al. [11]. The reduction in total and the increase in HDL, VLDL cholesterol in plasma by inclusion of capsaicin in atherogenic diet has been reported [12].

In common with other spices or their active principles like gingerols [13], curcumin [11], capsaicinoids [14], curry leaf and mustard also showed beneficial effects such as decreased very low and low density lipoproteins and enhanced high density lipoprotein cholesterol in serum, decreased LDL/HDL ratio which is considered significant in atherosclerosis. Further studies in relation to lipid metabolism, the effect of these spices on an atherogenic diet fed to animals is in progress.

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