STUDIES ON HYPOLIPIDEMIC EFFECTS OF DIETARY RICE BRAN OIL IN HUMAN SUBJECTS

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ABSTRACT

The hypolipidemic action of dietary rice bran oil (RBO) was investigated in human subjects. Twelve subjects either with high serum cholesterol or high triglycerides were advised to use RBO in place of other cooking oils which they were using earlier. There was a significant reduction in serum cholesterol and triglyceride levels after 15 and 30 days after the use of RBO in the diet. In nine control subjects there were no changes in the serum cholesterol and triglyceride levels. RBO could be considered as a edible oil of preference for patients with abnormalities of lipid metabolism.

INTRODUCTION

The quantity and quality of dietary fat is known to play a crucial role on plasma lipid concentration (1). Hyperlipidemia, hypertension, cigarette smoking and obesity are the important predisposing factors for coronary heart disease (CHD). Hyperlipidemia and obesity are diet related abnormalities. Hence dietary manipulation is known to play an important role in the management of hyperlipidemia and obesity. The Expert Panel on Detection, Evaluation and Treatment of High Blood cholesterol in Adults (1988) has recommended that fat constitute less than 30% of total calories, saturated fatty acids less than 10% calories and cholesterol less than 300 mg/day (2). The Expert Panel recommended this considering usual nutritional habits which should not be changed abruptly. Polyunsaturated fatty acids (PUFA) are abundantly available in vegetable oils like safflower, sunflower and corn oil which were found to lower blood cholesterol and low density lipoproteins as revealed by epidemiological studies (3).

Rice bran oil, similar in composition to corn oil is being promoted as an edible oil in India. Rice bran oil is being used as an edible oil in Japan since centuries. China, Korea and other countries also use rice bran oil as an edible oil. There are no systematic studies available in literature on rice bran oil. Chemical, nutritional and toxicological studies on rice bran oil have been carried out at National Institute of Nutrition and reported to be safe for human consumption (4). Studies in rats also indicated that the oil has plasma cholesterol lowering effect (5,6). The present study was undertaken to evaluate the hypolipidemic effect of rice bran oil (RBO) in arteriopathic patients.

MATERIALS AND METHODS

Patients with angiographic evidence of peripheral arteriopathies were initially screened for plasma lipids. Twenty one patients (17 men and 4 women) aged between 40-55 years either with high serum cholesterol ($>$225 mg/dl) or high serum triglycerides ($>$190 mg/dl) were selected and were randomly divided into experimental and control groups. None had diabetes mellitus and were not taking any hypolipidemic drugs.

Weight and height of all subjects were recorded and body mass index (BMI) was calculated (body weight (kg)/height (m^2). Dietary history of edible oil i.e. the type and quantity of oil used/day was elucidated. Twelve patients (9 men and 3 women) who constituted experimental group were provided with edible grade RBO and were advised to use it as cooking medium instead of other oils which they were using earlier. The remaining 9 (8 men and 1 woman) who served as controls were allowed to continue the use of their habitual edible oil. In both groups, the quantity of oil was not restricted and all the patients were advised to use as much fat as they were using earlier before their participation in the study.

Blood samples after overnight fasting were collected at the time of entry into the study and after 15 and 30 days after the use of RBO. In control subjects, two blood samples were collected on fasting at an interval of 30 days. Samples were analysed for serum cholesterol and triglycerides (7,8). Statistical analysis was done by paired 't' test or students 't' test.

RESULTS

The body weight, body mass index (BMI) and oil consumption/day of experimental and control subjects are given in Table I.

Table I

Anthropometric Data and Amount of Edible Oil used*

Subjects	Body weight (kg)	BMI (kg/m^2)	Edible oil used (g/day)
Experimental	69.5±2.92	25.8±1.19	35.2±4.72
Control	70.3±2.58	25.9±0.98	38.9±5.71

*Values are Mean ± SEM.

None of the subjects of both in experimental and control group were obese as assessed by BMI ($>$30.0 kg/m^2). There were no differences in the body weight, BMI and the amount of edible oil consumed/day between experimental and control subjects. All the experimental and control subjects were using palm oil or groundnut oil or a combination of these two oils except one experimental subject who was using only coconut oil before they were recruited for the study. As the subjects were selected purely on voluntary basis, who were interested in lowering their serum cholesterol and triglyceride levels, all the experimental subjects were meticulously using RBO. The amount of RBO used in 30 days was in agreement with the information collected on the quantity of edible oil they were habitually using.

The mean serum cholesterol and triglyceride levels of control and experimental subjects after the use of rice bran oil are given in Table II.

Table II

Mean Serum Cholesterol and Triglyceride Levels*

Subjects		Serum cholesterol (mg/dl)	Serum triglycerides (mg/dl)
I	Experimental		
	Initial	247.3±10.55	349.8±42.4[illegible]
	15 days after RBO use	204.0± 6.60***	236.5±31.8[illegible]***
	30 days after RBO use	182.7± 8.44***	212.9±20.0[illegible]***
II	Control		
	Initial	244.0±14.01	295.5±33.0[illegible]
	After 30 days	249.6±16.11	286.3±34.8[illegible]

*Values are Mean ± SEM; *** $P < 0.001$.

The experimental and control subjects who were selected after an initial screening had similar serum cholesterol and triglyceride levels. There was a significant reduction in serum cholesterol and triglyceride levels after 15 and 30 days after the use of RBO ($P < 0.001$). In control subjects, who continued to take their habitual edible oil, there were no significant changes in serum cholesterol and triglyceride levels.

The extent of changes in serum cholesterol and triglyceride levels in control and experimental subjects are shown in Figure 1.

The extent of reduction in the serum cholesterol was 16% after 15 days and 25% after 30 days use of RBO. In the serum triglyceride levels also there was a 32% and 35% reduction after 15 and 30 days of use of RBO respectively. Subjects who had high cholesterol >300 mg% and triglyceride > 400 mg% levels responded very fast compared with

891

the subjects who had marginally high levels of cholesterol and triglycerides. The percentage of reduction in serum cholesterol and triglyceride levels were highly significant ($P < 0.001$). On the other hand, in the control subjects who continued to take their habitual edible oil, there were only marginal changes in serum cholesterol and tryglyceride levels.

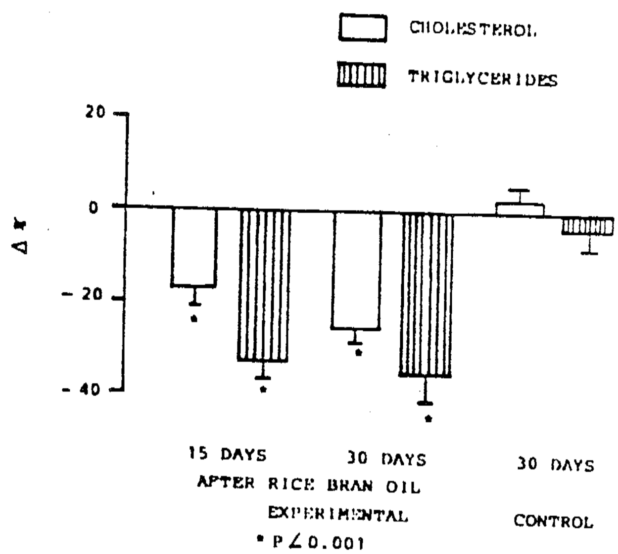

Fig. 1

Changes in serum cholesterol and triglyceride levels in control and experimental subjects

DISCUSSION

The subjects who participated in the study were not obese (BMI < 30 Kg/m^2) and did not indulge in alcohol. The quantity of edible oil used by the experimental and control subjects before they participated in the study were not different.

The significant decrease in serum cholesterol and triglyceride levels with the use of RBO in humans is in agreement with our earlier observation made in experimental rats (5,6).

National Institute of Health Consensus Development Conference on cholesterol defined hypercholesterolemia as a plasma cholesterol level exceeding 240 mg/dl and recommended active treatment to patients with hypercholesterolemia (9). In the present study 11 patients had more than 240 mg/dl. It is generally agreed that ideal total cholesterol values should be below 200 mg/dl as it has been shown that in US population, the risk for CHD is continuously related to the plasma cholesterol concentration at least from 180 mg/dl (2).

892

In the Lipid Research Clinical (LRC) trial, with every 1% decrease in serum cholesterol, there was a 2% reduction in the risk for CHD (10). If the results of the LRC trial can be extrapolated to present intervention studies, the 25% decrease in serum cholesterol levels observed with the use of RBO in 30 days would indicate a 50% reduction in cardiovascular risk.

The mechanism responsible for serum cholesterol lowering effects of PUFA and low fat diets are still obscure. Studies have shown that excretion of endogenous sterols was inversely correlated with the magnitude of change in serum cholesterol concentrations (11). This was also true with our RBO studies in rats (5,6).

Several dietary intervention trials have shown the beneficial effects of PUFA in CHD (12,13). However, there was a concomitant reduction in HDL cholesterol, which is not desirable (14). Unlike the high PUFA containing oils, the results in experimental rats indicate that RBO has no effect on HDL cholesterol (6).

Several dietary factors such as the ratio of PUFA to saturated fatty acids (P:S Ratio) and twice the per cent calories from saturated fatty acids are effective in bringing down the triglyceride levels (16). The results of the present study demonstrate that RBO can also bring down triglyceride levels. The mechanism is still under investigation. The role of triglycerides as a risk factor for CHD is still controversial. With normal cholesterol levels, marginal increase in triglyceride levels may not enhance the risk of CHD. On the other hand, triglyceride levels above 250 mg/dl is associated with increased risk of CHD (17). In the present study, 15 out of 21 subjects had triglyceride levels above 250 mg/dl. The use of RBO in such patients is likely to reduce the risk of CHD.

Experimental studies in rats using various fractions of the unsaponifiable matter of RBO indicated that cycloartenol, a triterpene alcohol present in the unsaponifiable fraction of RBO in appreciable amounts, appears to be responsible for the hypocholesterolemic action (under publication). As cycloartenol has a closely related structure to cholesterol, it may compete with the binding sites of cholesterol, sequestering cholesterol from the system. Olive oil which has a similar chemical composition of the unsaponifiable fraction as that of RBO also has a remarkable hypocholesterolemic action (18). Similarly, hypocholesterolemic effect of triterpene alcohols with soysterol on plasma cholesterol in rats is reported from Japan (19). The authors indicate that the rice bran oil, corn oil and wheat germ oil have greater hypocholesterolemic action than other dietary vegetable oils possibly because they have large amounts of sterols and triterpene alcohols. The principal triterpene alcohols are cycloartenol and its derivatives. These results suggest that in addition to fatty acid composition, triterpene alcohols also may synergistically contribute for the hypocholesterolemic effect of dietary vegetable oils.

Hypocholesterolemic effect of rice bran oil in humans has been reported from Japan (20). It has been shown that a combination of 70% rice bran oil and 30% safflower oil can effectively lower cholesterol levels even within seven days.

893

In summary, although PUFA content of RBO is not as high as that of sunflower and safflower oils, in view of its hypolipidemic effect, RBO could be considered as an alternative source of edible oil particularly for patients with lipid abnormalities.

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894

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895