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Research Paper

Hypolipidemic Effect of Rice Bran and Rice Bran Oil Incorporated Cookies

Agriculture

KEYWORDS : Stabilized rice bran, High fiber, cardiovascular diseases, lipids.

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ABSTRACT

There has been an evident correlation between an increased intake of dietary fiber and the prevention of cardiovascular diseases, diabetes, diverticlosis and colon cancer. Rice bran contains 25 to 30% fiber and its soluble fiber can affect blood cholesterol level when combined with biliary acid. Moreover, due to the emulsifier property, rice bran has a good effect on the texture of cookies. The stabilized rice bran, unlike wheat bran as well as other fibers, has sweet and palatable taste. The wister rat was fed with cholesterol and Atorvastatin and the standardized rice bran and rice bran oil incorporated cookies for 30 days. The results shows that the RB & RBO incorporated cookies significantly suppress the elevated blood concentration of TGs. Hence the anti hyperlipidemic effect on rice bran and rice bran oil in particular could be considered as a possible therapeutic value.

INTRODUCTION:

Many people with diabetes have conditions called "risk factor" that contribute to atherosclerosis and its complications. These include high blood pressure, excess weight and high blood glucose levels. Dyslipidemia further raises risk of atherosclerosis in people with diabetes. Dyslipidemia affects people with type 2 diabetes more often than those with type 1 diabetes. The most common Dyslipidemia in diabetes is the combination of high triglycerides and low HDL levels. People with diabetes may also have elevated LDL cholesterol.

Rice bran, a good source of protein and fat, is at present underutilized as a food material. Rice bran has been used in food as full-fat rice bran, defatted rice bran, and in the form of rice bran oil and protein concentrates. Although rice bran has been recognized as an excellent source of vitamins and minerals yet it has been under-utilized in human diet and in India 90 per cent is being used primarily in animal feeds (Moldenhauer *et al.,* 2003).

Both the bran and oil from rice bran have a range of bioactive phytochemicals with potential for reducing the risk of chronic degenerative diseases (Hui, 1996 and Bor *et al.,* 1991). At present, only about half of the potential source of rice bran is exploited for oil. There is a need to utilize the full potential of the available rice bran in the country, both as a source of healthy edible oil and as a food supplement for promoting our population's nutrition and health. In the present study an attempt has been made to screen the rice bran and its oil for the Hypolipidemic activity.

Materials and methods

Rice bran and rice bran oil were used to prepare cookies at different level of incorporation. The cookies were prepared by the standard recipe. Stabilized rice bran was substituted in the place of flour at the ratio of 5,10,15,20 and 25 per cent and rice bran oil viz., 10, 20, 30, 40 and 50 per cent respectively. The prepared cookies were sensory evaluated by semi trained panel members. Based on the acceptability, the incorporation level of rice bran and rice bran oil was standardized.

Animals

Wister albino rats were obtained from central animal house, K.M.College of pharmacy, Madurai. The animals were given standard rodent diet and water ad libitum throughout the study. The rats used in the present study were maintained in accordance with guidelines of the national institute of nutrition, Indian council for medical research, Hyderabad, India and study approved by Institutional animal ethical committee.

Materials:

Rice bran and rice bran oil incorporated cookies (rice bran 20% and rice bran oil 50%)

Cholesterol extra pure for feeding purpose was obtained from S D fine-chem. limited, Mumbai, India. Coconut oil was used as a vehicle for cholesterol feeding.

Atorvastatin was obtained from Micro labs, Bangalore, India.

Experimental procedure:

All the animals were weighed and divided into five groups each of six animals.

Control (Group I) : Normal control.

T_1 (Group II) : Fed *cholesterol* at a dose of 400mg/kg body weight for 30 days.

T_2 (Group III) : fed cholesterol as in group II and *Atorvastatin* 1mg/kg body weight from days 15 to day 30.[11]

T_3 (Group IV) : fed cholesterol as in group II and Rice bran incorporated cookies 20 per cent at a dose of 100mg/kg body weight from days 15 to day 30.

T_4 (Group V) : fed cholesterol as in group II and Rice bran and rice bran oil incorporated cookies 20% and 50% combination at a dose of 2ml/kg body weight from days 15 to day 30.

At the end of 30 days all the rats were sacrificed, blood was collected, allowed to clot and serum was obtained by centrifugation. The serum samples were used for various biochemical procedures.

Biochemical analysis:

The serum was analyzed for total cholesterol, triglycerides, high density lipoprotein (HDL), low density lipoprotein (LDL), very low density lipoprotein (VLDL), by using standard protocol methods. (Auto Analyzer) (AOAC, 2000)

Statistical analysis

All the values were expressed as mean ± SEM.

Data was analyzed by one way analysis of variance (ANOVA) followed by Newmankeuls multiple test.

P values <0.05 were considered as statistically significant.

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RESULTS AND DISCUSSION

Table 1: Effect on rice bran and rice bran oil incorporated cookies in Lipid Profile

Group/ treatments	C	T_1	T_2	T_3	T_4
Total cholesterol (mg/dl)	50.65 ± 1.85	112.48 ± 1.74$^{**(a)}$	73.61± 1.60$^{**(b)}$	93.85 ± 1.32$^{**(b)}$	84.83 ± 1.84$^{**(b)}$
Triglycerides (mg/dl)	58.06 ± 0.99	162.6 ± 1.88$^{**(a)}$	83.9 ± 1.87$^{**(b)}$	124.38 ± 2.05$^{**(b)}$	98.4 ± 1.27$^{**(b)}$
HDL (mg/dl)	28.41 ± 1.26	13.91 ± 0.76$^{**(a)}$	22.7 ± 0.62$^{**(b)}$	17.3 ± 0.59$^{**(b)}$	22.6 ± 1.45$^{**(b)}$
LDL (mg/dl)	16.33 ± 0.84	32.98 ± 1.70$^{**(a)}$	24.01 ± 0.84$^{**(b)}$	26.23 ± 0.78$^{**(b)}$	24.08 ± 0.91$^{**(b)}$
VLDL (mg/dl)	32.88 ± 1.22	14.03 ± 0.82$^{**(a)}$	26.88 ± 0.67$^{**(b)}$	19.88 ± 0.60$^{**(b)}$	21.36 ± 0.60$^{**(b)}$
AI	0.78 ± 0.50	7.04 ± 1.33$^{**(a)}$	2.24 ± 2.33$^{**(b)}$	4.42 ± 1.48$^{**(b)}$	2.75 ± 0.24$^{**(b)}$
LDL/HDL	0.57	2.36 $^{**(a)}$	1.05 $^{**(b)}$	1.51$^{**(b)}$	1.06 $^{**(b)}$

Values are expressed as Mean ± SEM.
Values were find out by using ONE WAY ANOVA followed by Newman Keul's multiple range tests.
** (a) values were significantly different from normal control at P< 0.01.
** (b) Values were significantly different from hyperlidemic control at P< 0.01.

Results

Table I shows the levels of Cholesterol, Triglycerides, HDL, LDL and VLDL of control and experiment rats respectively. Serum of hyperlipidemic rats showed significantly increased levels of Cholesterol, Triglycerides, LDL - C and low HDL – C, when compared with normal rats. In rats treated with rice bran and oil and Atorvastatin there was significant decrease in the content cholesterol, TGs, LDL – C, and VLDL and increases HDL – C, when compared with cholesterol control rats.

Atherogenic index (AI) and LDL – C / HDL – C ratio:

Table I shows the changes of Atherogenic Index and LDL – C / HDL – C ratio in control and treated rats. It appears clear form these results that the cholesterol induction significantly affects the cardio vascular risk markers.

Indeed, AI was statistically increased in cholesterol control group 90% compared with the values found in their normal control group.

Besides there were significant further increase of LDL – C / HDL – C ratio in cholesterol control group compared to normal control group.

Promising results in lowering of AI by rice bran and oil was found in Table I. The rice bran and rice bran oil showed an improvement of the cardio vascular risk level by decrease of AI in the treated group by more than 73% and 63% ($p < 0.01$), when compared to the cholesterol control group.

The ratio of LDL – C to HDL – C is also a protective indicator of cardio vascular disease incidence. The cholesterol induction produced a significant increase of this marker. In contrast, elevated ratio in treated group and Atorvastatin group returned to basal value when the data were compared in the same period to the data found for cholesterol rats. **(Table I).** Animals fed on rice bran had significantly lower LDL levels and the highest HDL to total cholesterol ratios when compared to all other bran diets (Kahlon *et al.,* 1998).

Discussion

The reduction of plasma total cholesterol was associated with a decrease in its LDL fraction which is a major, potentially modifiable risk factor of cardio vascular disease and the target of drug. Several studies in laboratory animals and humans, stipulated that bioactive components of RBO acted synergistically to induce hypocholesterolemic effects (Rukmini and Raghuram, 1991; Lichtenstein *et al.,* 1994; Sugano and Tsuji, 1997; Vissers *et al.,* 2000). In addition rice bran and rice bran oil showed protective action which is reported to have a preventive function against atherogenesis since an independent inverse relationship between blood HDL – C levels and cardio vascular risk incidence is reported. Similarly, triglycerides were significantly lowered in chicks fed on full fat rice bran diet (Newman *et al.,* 1992).

It is also recently reported that triglycerides plays a key role in the regulation of lipoprotein interaction to maintain normal lipid metabolism. Indeed, the elevated plasma TG levels were associated with an increased incidence of coronary artery disease. Moreover these higher plasma TG levels have been attributed mainly to increase population of small, dense LDL deposits which are very atherogenic and enhanced cholesteryl ester mass transfer from apolipoprotein B containing lipoproteins (VLDL and LDL) (Purushothama *et al.,* 1995). The supplementation of RBO in the diet, significantly, influenced serum TC and LDL, resulting upto 40% reduction in LDL without affecting HDL levels (Nicolosi *et al.,* 1991). TG has also been proposed to be major determinant of cholesteryl esterification, its transfer and HDL remodeling in human plasma.

Rice bran and rice bran oil significantly suppress the elevated blood concentration of TGs. This result suggests that the product is able to restore, at least partially, the catabolism of TG. Rice bran oil and its components significantly improved the plasma profile in rats. Rats were fed on diets containing 10% rice bran oil showed significant decrease in TG (Sharma and Rukmini, 1986).The underlying the mechanism of this activity is not elucidated by the present study. However, as hypothesized by many works with other plants, the restoration of catabolic mechanism of TGs would be due to an increased stimulation of the lipolytic activity of Plasma Lipoprotein Lipase (LPL) (Khosla *et al.,* 1995) .

Administration of rice bran and rice bran oil provides a beneficial action on rat lipid metabolism with regard to the reduction of AI (Brown *et al.* 1999). Infact, the AI was decreased in all treated groups. Similar results were reported by others when studying the hypolipidemic effects of natural products (Lai *et al.,* 2001). This ameliorative action was due to the plasma lipid lowering activity of different constituents of the plant.

It is also desirable to have higher plasma HDL and lower LDL – C to prevent atherogenesis, since there is a positive correlation between an increased LDL – C / HDL – C ratio and the development of atherosclerosis. Again, the administration of rice bran and rice bran oil significantly suppress the higher values of LDL – C / HDL – C ratio showing the beneficial effect of this rice bran and rice bran oil in preventing atherosclerosis incidence.

CONCLUSION

Hyperlipidemia is considered to be major risk factor for the premature atherosclerosis and essentially the cholesterol in atherosclerotic plaque is derived from that of circulatory cholesterol. The anti hyperlipidemic effect on rice bran and rice bran oil in

particular could be considered as a possible therapeutic value.

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