HYPOLIPIDEMIC ACTION OF RICE BRAN, BARLEY AND LEGUMES

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Abstract

Cardiovascular disorders have been the major cause of death. In India, due to industrialisation and a change in living pattern during the past 2 to 3 decades, the incidence of cardiovascular disorders has increased. Hyperlipoproteinemia is a common disorder, which results from an inability of breaking down of lipids or fats in body, specifically cholesterol and triglycerides. Rice bran, barley and legumes are tend to have some Hyperlipidemic actions such as Barley and oats have a similar concentration of soluble fibers β-glucan. Rice bran in addition to the presence of soluble dietary fibre, has other components such as Polyphenols which are considered to contribute to its Hypolipidemic action. Pulse grains are low in fat, high in protein and complex carbohydrates, and a low glycemic index with high dietary fibre and high Poly unsaturated fatty acid and magnesium. Which may help to decrease risk of other diseases as well. Rice bran, Barley and legumes should be consumed in a diet

Key words: Rice bran, Barley, Legumes, Hyperlipidemia, Hypolipidemic actions.

Introduction

Cardiovascular disorders have been the major cause of death. In India, due to industrialisation and a change in living pattern during the past 2 to 3 decades, the incidence of cardiovascular disorders has increased. It is thus, becoming a major cause of death especially in the adult male population, which includes the diseases of heart and blood vessels such as hyperlipidaemia, atherosclerosis etc that develops the coronary heart disease (CHD) and hypertension. **(Shanthi et al 2011)**

Hyperlipoproteinemia is a common disorder, which results from an inability of breaking down of lipids or fats in body, specifically cholesterol and triglycerides**. (Dorland, 2007)**

There are several types of Hyperlipoproteinemia. The type depends on the concentration of lipids. High levels of cholesterol or triglycerides are serious because they are associated with heart problems **(Chait A and Brunzell JD, 1990)**

On the contrary serum lipids can also be lowered through dietary interventions and therapy which has been shown to decrease the atherosclerotic events. Although statins are effective in reducing low-density lipoprotein (LDL) cholesterol levels, major health organizations have

maintained that the initial and essential approach to the prevention and management of cardiovascular disease is to modify dietary and lifestyle patterns. When low density lipoprotein- (LDL-) cholesterol is lowered by 12% and total cholesterol by 8%, the risk of cardio cerebrovascular disease decreases by 19%. Further there will be discussion on Hypolipidemic actions of Rice Bran, Barley, and Legumes **(Fung M *et al.*, 2011).**

Rice Bran

Rice bran is properly known as „Heart Oil „therefore rice bran oil has acquired the status of „Health Food" because of its cholesterol lowering properties. Rice bran have been proved to improve the plasma lipid profiles in animals and humans by reducing total plasma cholesterol and triglycerides by 20-40% **(Orthoefer F. T. 2005).**

Attention begins to be focused on the components of rice bran oil. Crude rice bran oil is rich in bioactive compounds such as γ-oryzanol, phytosterols, tocopherols and tocotrienols as well as possible hypocholesterolaemic agents (**Friedman, 2013**). Anthocyanins can be found in different varieties of rice bran, particularly the highest in purple rice bran which is the most abundant and economical natural source of anthocyanin that can be applied as a natural colourant and being used for health-promoting ingredient as nutraceutical and functional food **(Min et al., 2011).** Anthocyanin is one of the subclasses of flavonoid and it is a natural colourant. As an example, red and purple pigments in most fruit, vegetables and cereal grains including pigmented rice in particular purple rice bran are the natural colourants. Anthocyanins also have been reported to possess strong antioxidant capacity and many health benefits **(Mazza, 2007).**

Rice bran in addition to the presence of soluble dietary fibre, has other components such as Polyphenols which are considered to contribute to its Hypolipidemic action. The specific content of polyphenols, phytosterols, tocopherols and tocotrienols contributes to the anti-hyperlipidemic action, while the particular fatty acid mono- and polyunsaturated (composition seems not to be fundamental in its activity **(Gaddi A. 2001).**

In different animal models it was found that rice bran oil and its unsaponifiable matter significantly increase the faecal excretion of acid and neutral sterols **(Seetharamaiah et al. 1989).** Phytosterols are also present in crude rice which is the active principles in the anti hyperlipidemic action of Soyaderived products. Tocotrienols, has anti hypercholesterolemic effect. Tocotrienols are naturally occurring farnesylated unsaturated analogues of α, β, γ and δ tocopherols (Vitamin E). Their hypocholesterolaemic activity has been clearly demonstrated in different animal species (**Pearce et al.1992, Hood et al.1992)** and in humans (**Lichtenstein et al.1994, Qureshi et al. 1991)**. Although there are different possible mechanism of action seen at present, further researches are needed to pinpoint the mechanism of action responsible for the proven anti hyperlipidemic property of rice bran.

A study by Jariwalla (1998) demonstrated that phytic acid in rice bran lowered lipid cholesterol and triacylglycerol in serum indicating a role in inhibiting cardiovascular diseases. Hyperlipidaemia is defined as a high level of total cholesterol and triacylglycerol in blood, and it is associated with cardiovascular diseases. Phytic acid-supplemented diet is shown to reduce

serum cholesterol and triacylglycerol levels in the rats fed with high-cholesterol diet and to down-regulate hypercholesterolaemia marker including zinc/copper ratio. This lipid-lowering agent is observed with no toxic effect in rats **(Jariwalla et al., 1990).**

Apart from widely used in food industry, rice bran also being used in pharmaceutical industry due to its unique properties, high medicinal value and therapeutics applications **(Cicero & Gaddi, 2001)**. It looks promising for application of rice bran-derived products as functional foods with beneficial health effects and as preventive or clinical medicine. With disease-preventing, therapeutic properties and with no or little toxic effect, rice bran can be formulated for prevention of diseases as well as containing dietary factors with improved nutritive value for the future.

Barley

Barley and oats have a similar concentration of soluble fibers β-glucan (3.5%-5.9% of the dry matter), whereas wheat and rice do not possess this constituent type of fiber. The effect of dietary fiber on cholesterol metabolism has been studied extensively **(Gaddi A. 2001).**

Unlike wheat and rice, a diet high in β-glucan has shown the slow gastric emptying, digestion, and absorption. The effects of these are associated with increased excretion of bile acids and neutral sterols, increased catabolism of cholesterol, and reduced absorption of cholesterol and fat. Although the anti hyperlipidemic effect of oats have been studied exclusively, the reduction in total cholesterol and LDL cholesterol is in line with that found for oat-derived β-glucan as Barley and oats have similar concentrations of β-glucans (3.5%-5.9% of the dry matter), the proposed active ingredient in both soluble fibers, so a similar magnitude of total cholesterol or LDL cholesterol reductions is plausible. The intake of 3 grams of β-glucan per day can lower the risk of heart disease. Barley contains active substances and the barley leaf contains lutonarin (isoorientin-7-Oglucoside) and saponarin (flavone-C-glycosides, which are known to have powerful antioxidant effects, as well as a high concentration of hexacosanol (Mucchettib et al., 2007). Research into the various physiological functions of barley and barley leaf extract reveals improved cholesterol and blood glucose levels along with antioxidant effects although further researches are required.

Legumes

Legumes also known as pulses, legumes include beans, soybeans, lentils, peas, peanuts, snap beans, and any edible pod such as green beans, pole beans, and okra. Pulse grains are low in fat, high in protein and complex carbohydrates, and a low glycemic index with high dietary fibre and high Poly unsaturated fatty acid and magnesium (**Conde and Nast. 2014).** Legume consumption lowers the risk of coronary heart disease by 22% and 11% and cardiovascular disease (CVD), respectively **(Flight & Clifton, 2006).**

The nutritional properties of pulses reported to impart physiologically beneficial effects in humans have been investigated extensively. Legumes contain a considerable amount of resistant starch, which is any starch that resists to digestion by amylase in the small intestine and progresses to the large intestine for fermentation by the gut bacteria. Resistant starch is associated with reduced glycemic response, which can be beneficial to insulin-resistant

individuals and those with diabetes. Dietary non–oil-seed pulses (beans, chickpeas, lentils and peas) are foods that have received particular attention for their ability to reduce the risk of cardiovascular disease. Presenting < 1% of total Fatty Acids. Vitamin E are the well-known antioxidant that acts as a free radical scavenger, The Tocopherol content are higher in seeds and legumes in comparison to the cereals. Soybeans are an important source of Tocopherol, which have health beneficial properties. High consumption of soluble fibers is associated with a decrease in serum total cholesterol (TC), in LDL-C, and is inversely correlated with CHD mortality rates. Consumption of dietary fibers, in particular resistant starch, is related with improved glucose tolerance and insulin sensitivity. Dietary fibers may also be beneficial against obesity. It has the state of satiety which may reach faster and last longer after intake of high fiber foods, because they are bulkier and take longer time to eat than lower fiber foods and delay gastric emptying (Macarulla et al., 2001). The antioxidant mechanisms result in a reduction of susceptibility of low density lipoprotein cholesterol (LDL-C) particles to oxidation via a scavenging action of lipid peroxyl and alkoxyl radicals **(Conde and Nast. 2014).**

Faba beans (V. faba) also have lipid-lowering effects. It is the novel sources of legumes that may provide health benefits when included in the daily diet **(Macarulla et al., 2001**). Legumous phytosterols and saponins have beneficial effect against hyperlipidemia. A study on Rhesus male and female monkeys has shown that isoflavone-intact soy protein supplementation involves a hypocholesterolaemic effect that appears to be significantly related to pre-treatment plasma cholesterol.

A report compared the hypocholesterolemic effects of diets containing four legumes: lentil, pea, common bean, and Lima bean. All experimental diets were effective at lowering cholesterol levels, but the diets containing common bean and Lima bean were more potent than the diets based on lentil and pea. The better cholesterol-lowering capacity of the legume diet was not associated with larger concentrations of faecal bile acids or neutral sterols. **(Dabai et al., 1996).**

A study aimed at investigating the effect of a legume-based hypo caloric diet on pro inflammatory status and the metabolic features of overweight/obese subjects, provided useful data on blood pressure. Thirty obese subjects (17 M/13 F) were randomly assigned to two groups: control and treatment. The control group followed a balance diet without legumes, whereas the treatment group consumed a diet including four different servings (160–235 g) per week of lentils, chick peas, peas or beans. The legume treatment improved the lipo protein profile and also lowered the systolic and diastolic blood pressure by 5 mmHg and 2 mmHg, respectively, vs. the control diet. **(Hermsdorff et al., 2011)**

Conclusion

Rice Bran extensively proved to have the properties of anti hyperlipidemic actions which results in reducing cardiovascular diseases, whereas Barley and legumes they have shown significant Hypolipidemic actions. Rice Bran contains minimal soluble fiber, but rice bran oil has a Hypolipidemic effect. The LDL-C: HDL-C ratio decrease significantly in the rice bran. Therefore rice bran as well as oat bran, should be included in the prudent diet of individuals with hyperlipidaemia. The components in rice bran demonstrated to have protective effect

against several types of disease including hyperlipidaemia, cancer, diabetes, kidney stones and heart disease. To date, rice bran phytonutrients can be potentially used as natural medicines for prevention or treatment of chronic diseases. Considering the rice grain production in the world, it is estimated that high volumes of rice bran by-products will be produced. To adding value to these by-products and producing healthy foods from them, usage of rice bran is essential. Lastly, rice bran is an inexpensive functional food with a range of bioactive compounds. Research described in this review, clearly indicates that legumes may have a major role in the dietary prevention of hyperlipidemia and hypertension

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