



Hypolipidemic Actions of Oat, Legumes, Barley and Rice Bran

Singh Kritika, Paul Virginia

Department of Food Nutrition and Public Health, Ethelind College of Home Science, Sam Higginbottom University
of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Email: kritikasingh231094@gmail.com

Abstract: Hyperlipidaemia is the disorders of lipoprotein metabolism in which the elevation of plasma cholesterol, triglyceride takes place. That includes a low level high density lipoprotein level. Hyperlipidaemia associates the development of atherosclerosis, due to the formation of plaques in the arteries which can lead to atherosclerosis, such as coronary heart disease, Peripheral artery disease etc. sedentary lifestyle, eating habits such as -consumption of fried and processed food, red meat etc has shown the rapid effect on lipid profile. A 'heart healthy diet' recommends the less consumption of trans fatty acids, and dietary cholesterol, saturated fats, consumption of omega 3 fatty acid, encourage low to moderate intake of fats high dietary fibre intake and antioxidant rich foods, such as Fruits, Vegetables, Cereals, Oats, Whole grains and legumes are considered good sources of soluble fibres, antioxidants and some other components which gives rise to Hypolipidemic properties.

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, Oat, Barley, and Legumes(Fung M *et al.*, 2011).

Oats

Oat grain consist of three parts the bran, the endosperm and the germ. The outermost layer of the oat is bran which consist of several layers: the pericarp, seed coat, necellus, aleurone layer and sub aleurone layer, from outer to inner. The products of oats are such as Oatmeal, oat flakes, oat bran, oat milk etc which shows the cholesterol lowering property in different ways.(Whitehead *et al.*, 2014) The β -glucan belong to a group of linear polysaccharide are found in the cell wall of oat. Thus oat bran oil and presence of soluble fibre β -glucan is the primary factor responsible for its cholesterol lowering effect in humans.(Whitehead *et al.*, 2014) The European Food Safety Authority has approved the claim that “Regular consumption of β -glucan contributes to maintenance of normal cholesterol level”. Therefore the intake of 3 Gms per day of β -glucan is considered as the minimum quantity required for decreasing the cholesterol level.

The mechanism of actions by which the cholesterol lowering effects of β -glucan are proposed are as follows. Firstly the water-soluble fibre increases the viscosity of the intestinal contents, which in turn creates a thick unstirred layer next to the intestinal wall, which act as a physical barrier for the absorption. Secondly the binding of bile acids by water-soluble fibre leads to reduced re-absorption of bile acids from the small intestine by the liver. Which results the liver to force the production of more bile acids from cholesterol in the blood to compensate for the faecal excretion of bile acids. Thirdly there is a reduction in the absorption of glucose, through the first mechanism which leads to lowering of insulin levels. Reduced insulin levels in turn will lead to a reduction in hepatic cholesterol biosynthesis and lastly Inhibition of the biosynthesis of cholesterol in the liver takes place. Apart from β -glucan, there are other diets of dietary fibres such as lignin, Arabinoxylans, cellulose and Vitamin E (tocotrienols and tocophenols) which are beneficial to health although they have limited cholesterol lowering property.(Ryan *et al.*, 2007)



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 peroxy and alkoxy 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 pretreatment plasma cholesterol.



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). 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 Soya-derived 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.

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 lutoarin (isoorientin-7-O-glucoside) 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.

Conclusion

Oats and 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 and oat bran. Therefore rice bran as well as oat bran, should be included in the prudent diet of individuals with hyperlipidemia.

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