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Research Article

RICE BRAN OIL THE NON-TRADITIONAL OIL: A REVIEW

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ABSTRACT
Rice bran oil is not only a nutritious vegetable oil, but also special oil with unique properties and many health benefits. Good stability, appealing flavor and long fry-life enable rice bran oil be used for frying and also to make margarine and shortening and advanced nutritional oils. More importantly, rice bran oil has been reported to have a high potential for making pharmaceuticals and cosmeceuticals. Rice bran oil has surprisingly high levels of bio active and nutraceutical components, such as oryzanol, fat-soluble vitamins, sitosterol, other plant sterols and other nutrients. Thus, rice bran oil has been a study focus in relation to its function and application in many countries in the world, as well as a family's daily health edible oil. Rice bran oil's with high oxidative stability makes it preferred oil for frying and baking applications.

INTRODUCTION
Rice Bran Oil is a unique vegetable oil produced from the outer brown layer of rice which is removed in the form of rice bran during the polishing process of the rice milling industry. Besides having an almost ideally balanced fatty acid profile, it is rich in natural anti-oxidants, and better cholesterol lowering properties. All these studies have attributed these properties of the oil to the presence of unique nutraceuticals in this oil known as oryzanol & tocotrienols. Rice bran oil is the world's healthiest edible oil, containing vitamins, antioxidants and nutrients. Rice Bran Oil is extensively used in Japan, Korea, China, Taiwan and Thailand as premium edible oil and is popularly known as "Heart Oil" in Japan. It has acquired the status of a "Functional Food" or a "Health Food" in Western Countries. India is the second largest producer of rice in the world next to China, having potential to produce about 13.04 lakh MT of Rice Bran Oil per annum. India produces 140 Million MT of paddy and 93 Million MT of rice. Currently, the industry is processing about 44 lakh MT of Rice Bran producing about 8.30 lakh MT of Rice Bran Oil per annum, out of which 8.0 lakh MT are of edible grade and the balance 0.30 lakh MT is of nonedible grade (SEA, India, 2010-11). Edible rice bran oil in India is still not very popular among the consumers. Typically rice bran accounts for 7 –8 % of the rice produced and the recovery of rice bran oil from rice bran is usually 15 - 16.5% in the country. Rice bran oil content ranges from 12-25% depending upon the quality of the bran. RBO has the ideal ratio of saturated, monounsaturated and poly-unsaturated fatty acids and is the closest to World Health Organization recommendation. The tocotrienol present in RBO has anti-thrombotic and anti-Cancer properties and good for skin. It contains squalene which improves skin tone and delays wrinkle formation. It has 4 hydroxy 3 methoxy cinnamic acid which stimulates hormonal secretion and rejuvenates health. The high smoke point prevents fatty acid breakdown at high temperatures. Its light viscosity, allows less oil to be absorbed in cooking, reducing overall calories. Rice bran oil (RBO) has a good balance between oleic and linoleic acid, with a low linolenic acid content. Another interesting feature of RBO is its high unsaponifiable matter content compared to other oils. It contains the unique antioxidant gamma-oryzanol, which is mostly absent in other oils (Mezouari & Eichner, 2007). The typical composition of crude rice bran oil is 81.3-84.3% triglycerides, 2-3% diglycerides, 5-6% monoglycerides, 2-3% free fatty acids, 0.3% waxes, 0.8% glyco-lipids, 1.6% phospholipids, 4% unsaponifiables. The wax content of rice bran oil can be somewhat variable, depending upon cultivar and processing parameters. The phospholispids in rice bran oil predominantly include phosphatidylcholine, phosphatidylethanaolamine and phosphatidylinositol. High content of natural antioxidants present in rice bran oil, impart higher oxidative stability and a longer shelf life as compared to other edible oils. The oxidative stability of refined rice bran oil has been found to be five times more than the groundnut oil. Although, the polyunsaturated fatty acid content of rice bran oil is

much lower than the other conventional oils, but it has higher cholesterol reduction power than even the polyunsaturated fatty acid rich oils. Oryzanol is a powerful antioxidant only found in rice bran oil. It is more active than Vitamin E in fighting free radicals. Crude rice bran oil contains about 1.5% or more gamma-oryzanol, a group of ferulate esters of triterpene alcohols and phytosterols. These include its ability to reduce plasma cholesterol, reduce cholesterol absorption and decrease early atherosclerosis (Rong *et al.,* 1997), inhibit platelet aggregation (Seetharamaiah *et al.,* 1990), and increase fecal bile acid excretion (Seetharamaiah & Chandrasekhara, 1989). Oryzanol has also been used to treat nerve imbalance and disorders of menopause (Nakayama *et al.,* 1987). The processing of rice bran to yield crude bran oil involves: preparation of rice bran for extraction, solvent extraction, distillation of miscella, slipping of the oil and separation of oil from water in the post-dissolventiser tank. The various steps involved in the refining are: Degumming: Dewaxing: Neutralisation: Bleaching: Deodorization: In India, Rice Bran Oil is the most important oil among the non-conventional oils in terms of its potential to augment the availability of oils.

Nutritional Qualities and Health Effects of Rice Bran Oil

The nutritional qualities and health effects of rice bran oil are also established and is considered rich in unsaponifiable fraction which contains the micronutrients like vitamin E complexes, gamma oryzanol, phytosterols, polyphenols and squalene. RBO is an excellent cooking and salad oil due to its high smoke point and delicate flavour. Kato *et al.,* (1981) studied the esterified tocopherols and tocotrienols in rice bran oil contained 40 mu g/g alpha -tocopherol, 3 mu g/g beta tocopherol, 3 mu g/g gamma-tocopherol and 5 mu g/g gamma -tocotrienol. Oryzanol, a bioactive molecule reported as the key element responsible for that function is naturally present in crude rice bran oil and ranges from 1.1 to 2.6 % (Seetharamaiah *et al.,* 1986). RBO is rich in unsaponifiable fraction (unsap 4.2%) which includes antioxidants and micronutrients, like vitamin E complexes, gamma oryzanol, phytosterols, polyphenols and squalene. Presence of antioxidants imparts a very good shelf life to RBO as compared to other cooking oils. Its low viscosity allows less oil to be absorbed during cooking, reducing overall calories (Chakrabarty, 1989). Fat simulating butter was prepared from a fat base containing 70% partially hydrogenated rice bran oil and 30% refined rice bran oil; the margarine thus, obtained had a smooth texture. Fat base comprising rice bran oil yielded good quality margarines/spreads, due to formation of stable 'beta' type crystals by partially hydrogenated rice bran oil (Joshi *et al.,* 1993). RBO contains unique component oryzanol which is linked with increase in good cholesterol and lowering down of bad cholesterol and triglycerides and also possesses high levels of phytosterols, gamma-oryzanol, tocotrienols as well as tocopherols (Taylor *et al.,* 1996). Takahashi & Wasa, (1998) reported the excellence of rice bran oil as a glazing agent for food coating. A simple, cost-effective enrichment process for enhancing antioxidant content of rice bran oil (RBO) from crude RBO was reported by Cherukuri *et al.,* (1999). RBO does not produce any allergenic reactions when ingested, unlike several vegetable oils (Crevel *et al.,* 2000). Prakash *et al.,* (2001) studied the effects of blending on sensory odour profile and physico-chemical properties of selected vegetable oils. Rice bran blends were greener in colour. Apparent viscosity of the oil blends indicated a pseudo plastic shear thinning behaviour. Apparent viscosity of the base oil increased slightly with addition of sesame or rice bran oil. Use of 5% rice bran, 5% rice bran oil and 10% honey produced good biscuits with even yellow colour, a fragrant flavour and fluffy texture studied by Chen *et al.,* (2003). Tahira *et al.,* (2007) studied the characterization of stabilized rice bran oil. The refractive index, peroxide value, iodine value, and free fatty acid value were recorded as 1.4792, 0.92 meq/kg, 105, and 0.07% (as oleic acid), respectively. The fatty acid profile showed palmitic acid (16.74%), stearic acid (1.9%), oleic acid (42.79%), linoleic acid (34.65%) and linolenic acid (0.19%) as major fatty acids.

Bioactive Components in RBO

RBO contains multiple bioactive phytochemicals in high levels, such as about 4 % of unsaponifiable constituents (USC). The important USC in Rice bran oil include phytosterols (1.5–2 %), oryzanols (1.2–1.8 %), tocopherols and tocotrienols (0.15–0.2 %) (Rupali *et al.,* 2012). Crude rice bran oil contains a high amount of wax (1.5–4 %), phosphatides (0.5–1.5 %) and free fatty acids (59.19 %) (Afinisha & Arumughan, 2012). Free fatty acids consist of oleic acid, linoleic acid, linolenic acid, palmitic acid,

stearic acid and arachidonic acid. RBO has higher free fatty acid values than other vegetable oils, in which oleic acid and linoleic acid account for about 70 % while palmitic acid for about 22 % (Gopala *et al.,* 2006). Therefore, RBO can be a good raw material for those bioactive components (Ghatak & Panchal, 2006). RBO is the main natural rich source of oryzanols (Patel & Naik, 2002) which can help to decrease plasma cholesterol (Yoshino *et al.,* 1989), Tocotrienols and tocopherols are natural forms of Vitamin E, which together with oryzanol in rice bran oil have antioxidant effects.

Storage Stability of Rice Bran Oil

One of the most important factors in oil processing is packaging which affect the shelf life of oil in such a manner that carefully processed oil can be damaged by improper selection of packaging material. Packaging protects the product from the point of manufacture to its usage by consumers. Environmental factors such as light, gaseous atmosphere, temperature and moisture can affect the stability of oil (Leo, 1985).

Health aspects of rice bran oil are described together with its properties in extending the shelf-life of fried snacks such as potato, corn and tortilla chips. Rice bran oil's with high oxidative stability makes it preferred oil for frying and baking applications as per the study of Anonymous, (1991). Nasirullah *et al.,* (1991) prepared edible oil blends by mixing groundnut oil with rice bran oil (GR) and mustard oil with rice bran oil (MR).

In the GR blend, the iodine value decreased from 95 to 92.9, and saponification value from 189 to 187.9; increases free fatty acid % from 0.6 to 2.1, peroxide value from 0.4 to 54.8 where as in MR blend, iodine value 99.7 to 94.6; saponification value 182.7 to 181.6; butyrorefractometer reading 58.5 to 60.5; free fatty acid % 0.46 to 1.3; peroxide value 1.0 to 9.5. Dong and Jong, (1998) evaluated the oxidative stabilities of rice germ oil, dried rice germ oil, and crude and refined rice bran oils, by measuring acid value and fatty acid composition during 0-31 days of storage at 40 and 60°C. Acid values of all lipids were slightly altered during storage.

Sundararaj *et al.,* (2002) reported an increase in color, refractive index, free fatty acid peroxide value, anisidine value, totox value and decrease in iodine value after 3, 6, 9 months of storage of rice bran oil at 7°C and 38°C in transparent PET bottles.

Rice bran oil (RBO) was applied into baked products such as cookies to check its effectiveness in extending the shelf life of product due to its natural antioxidants by using thiobarbituric acid number (TBA number) test and results showed that by increasing the percentage of rice bran oil (RBO), the TBA number decreases and the onset of rancidity are delayed according to the study of Sharif *et al.,* (2003). Blends of sunflower oil (SFO) and rice bran oil (RBO) were evaluated by Mezouari & Eichner (2007) for their stability. Additionally, known amounts of natural antioxidants extracted from RBO were added to SFO, and their protective effect was compared to that of the blends.

Conclusion

There is an increasing public awareness about edible oil to combact and mitigate health related problems. Among the various edible oils with health related properties the use of rice bran oil is in top of the list because of its health related components. Rice Bran Oil is a unique vegetable oil produced from the outer brown layer of rice which is removed in the form of rice bran during the polishing process of the rice milling industry. Besides having an almost ideally balanced fatty acid profile, it is rich in natural anti-oxidants, and better cholesterol lowering properties. All these studies have attributed these properties of the oil to the presence of unique nutraceuticals in this oil known as oryzanol & tocotrienols. Rice bran oil is the world's healthiest edible oil, containing vitamins, antioxidants and nutrients.

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