Commentary

iMedPub Journals
www.imedpub.com

Journal of Nutraceuticals and Food Science

2017
Vol. 2 No.3:14

Rice Bran: A Promising Natural Antioxidant Component in Breadmaking

Maria N Irakli[1]*, Dimitris N Katsantonis[1] and Prof. Shane Ward[2]

1 Hellenic Agricultural Organization-Demeter, Plant Breeding and Genetic Resources Institute, Thessaloniki, Greece
2 University College Dublin, National University of Ireland, Belfield, Dublin, Ireland

Corresponding author: Maria N Irakli

irakli@cerealinstitute.gr

Plant Breeding and Genetic Resources Institute, 57001, Thessaloniki, Greece.

Tel: +302310471544

Citation: Irakli MN, Katsantonis DN (2017) Rice Bran: A Promising Natural Antioxidant Component in Breadmaking. J Nutraceuticals Food Sci. Vol. 2 No.3:14

Received: March 26, 2017; **Accepted:** October 12, 2017; **Published:** October 19, 2017

Commentary

Rice (*Oryza sativa* L.), after maize, is the second largest cereal grain and the most consumed major staple food that feeds more people over a longer period of time than any other crop. Rice bran, which is a co-product/by-product of rice milling industry, is gaining commercial importance in the world due to its beneficial nutritive and biological properties. Although it is recognized as a good source of many nutraceuticals such as dietary fibre, proteins, minerals and phytochemicals [1,2] it is mainly used in Europe as animal feed at considerably very low prices in comparison with the actual value.

In fact, rice bran could comprise as a substitute for wheat flour supply to enhance the nutritive value. However, in order the replacement procedure to be effective needs appropriate stabilization of the rice bran to prevent the oxidative rancidity and to extent its life. Furthermore, it has a shorter shelf-life compared to the refined white rice due to the increasing of free fatty lipids during storage. Under the normal milling process, rice bran degrades in approximately six hours into an unpalatable material making it unsuitable for human consumption. Under proper packaging and storage recommended conditions, white rice is capable of being stored for decades, compared to the approximately one year of the rice bran fraction [3]. Milling technology advances allow rice bran stabilization via cold storage, sun-drying, steaming, extrusion, infrared radiation, microwave or ohmic heating [4-6]. Although stabilization is a promising feature for rice bran products, most of the rice-producing countries do not utilize that types of technology or infrastructures. Thus, the direct challenge is to develop an effective and inexpensive stabilization method easily adoptable to food industry. Simple heating or steaming could be a valuable tool to accomplish this goal.

Bakery products can be suitable consumer products that can effectively promote the incorporation of functional components with increased nutritional value. Nowadays, there is an increase in new rice bran based products in the human diet, including breads [2,7-9] and cookies [10], mainly due to the content of health-related bioactive components of rice bran. It has been proven that it contains several unique properties that render its suitability for niche markets like nutraceutical and pharmaceutical industry [11].

It was reported that rice bran can substitute successfully at least 20% of the wheat flour in yeast bread formulations without affecting loaf volume and consumer overall acceptability [2]. However, substituting higher than 10% negatively affected the sensory properties of bread in terms of colour crumb and texture. Moreover, substituted breads with rice bran, observed increased firmness with storage due to presence of bran that contributed to the retrogradation of bread [12].

Although rice bran is an excellent source of total dietary fibre (20-27%), it also contains other important compounds, such as γ-oryzanol, tocopherols, tocotrienols, phytosterols and phenolic compounds that are believed to exert important roles in protecting against degenerative diseases [13]. γ-oryzanol, which is a unique component of rice bran, consists of a group of ferulate esters of triterpene alcohols and phytosterols. Also, the phytosterols campesterol and β-sitosterol can be found at relatively high amounts in rice bran oil. Epidemiological studies have been proven that both have the ability to reduce serum cholesterol and possess potent antioxidant properties [14,15]. Vitamin E complex contents (sum of tocopherols and tocotrienols) in rice bran range from 181–314 mg/kg [16], while their inclusion in wheat bread at the rate of 20% increased the vitamin E content of substituted bread approximately 40% more than the control (without rice bran) [2]. Both tocopherols and tocotrienols are regarded as the most important natural antioxidants; however, tocotrienols was shown to have a greater biopotency and bioactivities than tocopherols [17].

Several phenolic compounds have already been identified in rice bran. The main phenolics in rice bran are the phenolic acids, mainly ferulic and p-coumaric acids [2,18], which can be classified into 2 types: bound and free phenolic acids. Content of bound form is approximately two times less than the soluble one [2,19] reported that phenolic acids of rice bran contributed 70-90% of the total phenolic acids in the whole grain.

In non-pigmented rice bran, flavones are the most commonly encountered flavonoids. Although phenolic acids have been extensively studied in rice, only a few papers have been focused on the flavonoids polyphenols. Tricin appears to be the major flavonoid of the rice bran accounting for 77%; whereas other minor flavonoids that have been identified are luteolin, apigenin, quercetin, isorhamnetin, kaempferol and myricetin [20]. Anthocyanins, which is another class of flavonoids, are responsible for the cyanic colour of the pigmented rice and are regarded as important nutraceuticals mainly due to their antioxidant effect [21]. Pigmented rice varieties showed an up to fourfold differences in total flavonoid content values compared to the nonpigmented ones [22]. Similarly, significant differences were also found among pigmented rice varieties, with black rice > purple rice > red rice [23]. Pigmented rice bran is a type of product that may provide additional benefits to human health due to its elevated bioactive properties. Until recently, pigmented rice varieties were cultivated only in limited areas of the globe for ornamentation and for producing grains for special cooking recipes and alcoholic beverages. However, nowadays their popularity is quickly increasing.

The concentration of total phenolics in the rice bran has been positively correlated with their antioxidant activity [24,25]. The addition of 5% black rice bran to wheat flour for bread baking produced a notable increase in the free radical scavenging and antioxidant activity compared to the rice bran free bread [25]. Furthermore, a 10% to 30% increase of the rice bran level in bread, induced a two to five folds increase in the total antioxidant activity compared to the control with the simultaneously preference by the panellists [2].

Variation has been detected in the amounts and types of phytochemicals in rice bran with respect to cultivars, growing conditions, degree of milling, and kernel thickness. Significant differences between cultivated rice varieties regarding nutrients and health-promoting values have been established in various countries [26-31], but the worldwide evaluation of rice varieties for nutritional profile is rather limited and practically unwieldy. In addition, there are three challenges that need to be further considered: Global climate, food safety and new technology for producing rice with high nutraceutical properties. Close collaboration on those aspects between rice breeders, technologists, millers, bakers, engineers, nutritionists and biomedical scientists would endorse a better valorisation of rice bran in the near future, even though great progress has been made in the understanding of the nutraceutical profile of rice bran.

Funding

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 690142.

References

1 Aguilar-Garci C, Gavino G, Baragano-Mosqueda M, Hevia P, Gavino VC (2007) Correlation of tocopherol, tocotrienol, g-oryzanol and total polyphenol content in rice bran with different antioxidant capacity assays. Food chem 102: 1228-1232.

2 Irakli M, Katsantonis D, Kleisiaris F (2015) Evaluation of quality attributes, nutraceutical components and antioxidant potential of wheat bread substituted with rice bran. J Cereal Sci 65: 74-80.

3 Dhaliwal YS, Sekhon KS, Nagi HPS (1991) Enzymatic-activities and rheological properties of stored rice. Cereal chem 68: 18-21.

4 Kim SM, Chung HJ, Lim ST (2014) Effect of various heat treatments on rancidity and some bioactive compounds of rice bran. J Cereal Sci 60: 243-248.

5 Yilmaz N, Tuncel NB, Kocabiyik H (2014) Infrared stabilization of rice bran and its effects on γ-oryzanol content, tocopherols and fatty acid composition. J Sci Food Agric 94: 1568-1576.

6 Mujahid A, Haq I, Asif M, Gilani AH (2005) Effect of various processing techniques and different levels of antioxidant on stability of rice bran during storage. J Sci Food Agric 85: 847-852.

7 Hu G, Huang S, Cao S, Ma Z (2009) Effect of enrichment with hemicellulose from rice bran on chemical and functional properties of bread. Food Chem 115: 839-842.

8 Tuncel NB, Yılmaz N, Kocabıyık H, Uygur A (2014a) The effect of infrared stabilized rice bran substitution on physicochemical and sensory properties of pan breads: Part I. J Cereal Sci 59: 155-161.

9 Tuncel NB, Yılmaz N, Kocabıyık H, Uygur A (2014b) The effect of infrared stabilized rice bran substitution on B vitamins, minerals and phytic acid content of pan breads: Part II. J Cereal Sci 59: 162-166.

10 Bhanger MI, Iqbal S, Anwar F, Imran M, Akhtar M, et al. (2008) Antioxidant potential of rice bran extracts and its effects on stabilization of cookies under ambient storage. Int J Food Sci Tech 43: 779-786.

11 Ito M (2003) Characterization of natural waxes and their application to cosmetic foundations. Fragrance J 31: 38-46.

12 Lima I, Guraya H, Champagne E (2002) The functional effectiveness of reprocessed rice bran as an ingredient in bakery product. Food 46: 112-117.

13 Goffman F, Bergman CJ (2004) Rice kernel phenolic content and its relationship with antiradical efficiency. J Sci Food Agric 84: 1235-1240.

14 Wilson AT, Idreis HM, Taylor CM, Nicolosi RJ (2002) Whole fat rice bran reduces the development of early aortic atherosclerosis in hypercholesterolemic hamsters compared with wheat bran. Nutr resource 22: 1319-1332.

15 Xu Z, Hua H, Godber JS (2007) Antioxidant activity of tocopherols, tocotrienols, and gamma-oryzanol components from rice bran against cholesterol oxidation accelerated by 2,20-azobis(2-methylpropionamidine) dihydrochloride. J Agric Food Chem 49: 2077-2081.

16 Huang SH, Ng LT (2011) Quantification of tocopherols, tocotrienols, and γ-oryzanol contents and their distribution in some commercial rice varieties in Taiwan. J Agric Food Chem 59: 11150-11159.

17 Aggarwal BB, Sundaram C, Prasad S, Kannappan R (2010) Tocotrienols, the vitamin E of the 21st century: it's potential against cancer and other chronic diseases. Biochem pharmacol 80: 1613-1631.

18 Zhou Z, Robard K, Helliwell S, Blanchard C (2004) The distribution of phenolic acids in rice. Food Chem 87: 401-106.

19 Pradeep PM, Jayadeep A, Guha M, Singh V (2014) Hydrothermal and biotechnological treatments on nutraceutical content and antioxidant activity of rice bran. J Cereal Sci 60: 187-192.

20 Goufo P, Trindade H (2014) Rice antioxidants: Phenolic acids, flavonoids, anthocyanins, proanthocyanidins, tocopherols, tocotrienols, c-oryzanol, and phytic acid. Food Sci Nutr 2: 75-104.

21 Kong JM, Chia LS, Goh NK, Chia TF, Brouuillard R (2003) Analysis and biological activities of anthocyanins. Phytochemistry 64: 923-933.

22 Irakli M, Samanidou VF, Katsantonis DN, Biliaderis CG, Papadoyannis IN (2016) Phytochemical profiles and antioxidant capacity of pigmented and non-pigmented genotypes of rice (*Oryza sativa* L.) Cereal Res Comm 1: 2.

23 Yao Y, Sang W, Zhou M, Ren G (2010) Antioxidant and r-glucosidase inhibitory activity of colored grains in China. J Agric Food Chem 58: 770-774.

24 Stratil P, Klejdus B, Kuban V (2007) Determination of phenolic compounds and their antioxidant activity in fruits and cereals. Talanta 71: 1741-1751.

25 Laokuldilok T, Shoemake CF, Jomgkaewwattana S (2011) Antioxidants and antioxidant activity of several pigmented rice brans. J Agric Food Chem 59: 193-199.

26 Pengkumsri P, Chaiyasut C, Saenjum C, Sirilun S, Peerajan S, et al. (2015) Physicochemical and antioxidative properties of black, brown and red rice varieties of northern Thailand. Food Sci Tech (Campinas) 35: 331-338.

27 Ti H, Li Q, Zhang R, Zhang M, Deng Y, et al. (2014) Free and bound phenolic profiles and antioxidant activity of milled fractions of different indica rice varieties cultivated in southern China. Food Chem 159: 166-174.

28 Moko EM, Purnomo H, Kusnadi J, Ijong FG (2014) Phytochemical content and antioxidant properties of colored and non-colored varieties of rice bran from Minahasa, North Sulawesi, Indonesia. Int Food Res J 21: 1017-1023.

29 Pereira-Caro G, Cros G, Yokota T, Crozier A (2013) Phytochemical profiles of black, red, brown, and white rice from the camargue region of France. Journal of Agricultural and Food Chemistry 61: 7976-7986.

30 Pitija K, Nakornriab M, Sriseadka T, Vanavichit A, Wongpornchai S (2013) Anthocyanin content and antioxidant capacity in bran extracts of some Thai black rice varieties. Int J Food Sci Technology 48: 300-308.

31 Isaac RS, Rimal N, Aparna S, Varghese E, Chavali M (2012) Phytochemical, antioxidant and nutrient analysis of medicinal rice (*Oryza sativa* L.) varieties found in south India. Adv Sci Letters 11: 86-90.