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Study of Antioxidative Activity in Four Kinds of Cultivated Rice Grains of Mazandaran Province (Iran)

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Abstract: Antioxidants in rice food are important for human health. However, the level of antioxidative activity of different rice grains (*Oriza sativa L.*) which is the staple food in Mazandaran province of Iran and is the main agricultural product exported to other countries has not previously been reported. In this preliminary investigation, the antioxidative activity *in vitro* of the alcoholic extract from four different kinds of rice grains have been determined by ABTS/methemoglobin method compared with Trolox, an vitamin E analog. It was found that the antioxidative activity (TEAC) as $\mu\text{mol per g}$ of dry rice varied from the highest to the lowest as the followings: Tarom rice (20.22), Khazar rice (9.44), Neda rice (8.78) and Sadri rice (1.33), respectively. TEAC is distinguishly the highest in Tarom rice and remarkably high in Khazar rice. This property may be due to the high contents of rice anthocyanins, vitamin E, tocotrienols and oryzanol. The functional chemistry, nutritional value and health benefits of antioxidants contained in rice grains, rice bran and their products should be intensively studied and characterized for their ingredients and stability. Further development for the value addition of rice as diet supplements and maximum health benefits is needed.

Key words: Antioxidative activity, antioxidants, rice grains, anthocyanin, vitamin E

INTRODUCTION

Rice and rice bran (*Oryza sativa L.*) are some of the commonest and healthiest foods. Besides carbohydrates (amylose and amylopectin), lipids, vitamins, minerals and dietary fiber, rice and rice bran contain several bioactive compounds including phytosterols and antioxidants, especially vitamin E, tocotrienols and oryzanol (Suttajit, 1997).

Antioxidants are chemicals which can inhibit the oxidation caused by free radicals. Its mechanism is to neutralize or accept the single electron in free radical molecules. Oxidative stress and damage of cellular biomolecules in our body could occur in the condition with high amount of free radical compounds and deficiency of antioxidants (Levine and Kidd, 1985). Several chronic diseases such as cardiovascular disease, cancer and arthritis are the consequence of oxidative damage (Levine and Kidd, 1985). Plants such as brown rice, vegetables and fruits should be therefore consumed for health protection, since they are the abundant source of antioxidants such as vitamin E, vitamin C, β -carotene and polyphenolic compounds which are flavanoids and proanthocyanidins (Morazzoni and Malandrino, 1998).

Antioxidants in rice and rice bran have been known for human health. Importantly rice is the staple food in Iran and Asian countries and is the main agricultural

product exported to other countries. However, the level of antioxidative activity of different rice grains and bran has never been explored and reported. Therefore, the antioxidative activity *in vitro* of the alcoholic extract from different kinds for rice grains was preliminarily determined and compared in this investigation.

MATERIALS AND METHODS

Materials: Four samples of rice grains were obtained from different sources. These samples and their sources are as follows: Tarom and Neda rice from Mazandaran Rice Research Institute, Sari; Khazar rice and its rice bran from Karaj seed Institute, Karaj; Sadri rice from Sari city markets. The chemicals used for measuring antioxidative activity which were metmyoglobin, H 202 and ABTS [2, 2'-Azino-di-(3-ethyl-benzthiazoline-6-sulphonic acid)] were bought from Sigma Chemical Co, USA.

Methods: The antioxidative activity of the alcoholic extracts from the rice grain samples were colorimetrically determined in duplications by metmyoglobin/H202/ABTS [2, 2'-Azino-di-(3-ethyl-benzthiazoline-6-sulphonic acid)] (Robert and William, 1975). The negative control was buffer blank and the positive one was Trolox solution (1 mM). The absorbance due to the test reaction was

measured at 414 nm and the percent inhibition was calculated as Trolox equivalent antioxidative capacity (TEAC) and compared with that of Trolox. The antioxidative activity was calculated as μmol per g of the extract from the rice samples.

RESULTS AND DISCUSSION

This preliminary study shows that all the rice grains exhibited antioxidative activity (TEAC) in a wide range of 40.88 to 1020.22 μmole per g dry extract and 1.33-20.22 μmole per g dry rice (Table 1). By the calculation of TEAC for dry rice, the TEAC per g extract was divided by 50 which was the dilution factor from the total original rice sample.

Significantly among the rice samples, Tarom rice exhibited the highest level of antioxidative capacity, 20.22 μmole per g dry rice, followed by Khazar rice, Neda rice and Sadri rice. The antioxidant capacity of Tarom rice was about 2-12 folds higher than other those of rice grains tested.

The remarkable high antioxidant capacity of Tarom rice is due to the presence of color pigment which is anthocyanins (Morazzoni and Malandrino, 1998). The Khazar rice and Neda rice samples have shown distinctly difference of antioxidative compounds than Sadri rice samples.

The antioxidative activity of rice is generally suggested to be due to the presence of tocopherols, tocotrienols, which comprise vitamin E and oryzanol as well as a quinolone alkaloid (Chung and Woo, 2001). Oryzanol components are complex compounds that can act as an antioxidant and can improve solubility in cell membranes and potentially lower cholesterol by competitive inhibition of absorption and synthesis (Parrado *et al.*, 2003).

It has been reported by several investigators that rice bran components could reduce the effects of oxidation both in food and in our bodies, the extracts from rice and rice bran could be used as a functional food (Ichikawa *et al.*, 2001). The antioxidant activities of four of the vitamin E and three oryzanol components purified from rice bran were investigated in a chemical model of cholesterol oxidation (Parrado, *et al.*, 2003; Toyokuni, *et al.*, 2002). All components exhibited significant antioxidant activity in the inhibition of cholesterol oxidation. All three oryzanol components were higher than any of the four vitamin E components. (Chatenoud *et al.*, 1998; Hu, *et al.*, 2003).

Iran is the country which export most of rice grains to other countries around the world, however the quality and

Table 1: Analysis of antioxidant activity (TEAC) in four different kinds of rice grains

Samples	Dry wt. of Extract (mg)	Percent of ABTS Reaction Inhibition	Extract ($\mu\text{mole g}^{-1}$) TEAC in	TEAC in the Original rice Samples ($\mu\text{mole g}^{-1}$)
Tarom rice	0.1	29.33	1020.22	20.22
Khazar rice	0.1	44.66	333.54	9.44
Neda rice	0.1	40.22	299.23	8.78
Sadri rice	0.1	12.87	40.88	1.33

price of Iran rice has to still compete with other exporting countries. Since several kinds of Iranian rice contain the high level of antioxidants and other phytochemicals, for better price and value-addition, Iranian rice and its products should be more intensively studied and developed for diet supplements.

In conclusion, the antioxidative capacity of different kinds of Iranian rice grains were determined. Tarom rice as well as Khazar and Sadri rice were found to contain the highest antioxidative activity which should be mainly due to the high content of vitamin E, oryzanol and proanthocyanidins. The potential use of antioxidant compounds extracted from rice for diet supplements should be further studied.

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