



Studies on Antioxidant Activity in Medicinal Land Races of Rice

KEYWORDS

In vitro antioxidant activity, DPPH, Kathanellu, Njavara, Chennallu, Kavuni, Veeradangan.

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ABSTRACT Free radical-induced oxidative stress is the root cause for many human diseases, naturally occurring antioxidant supplements from plants are vital to counter the oxidative damage in cells. The main objective of the present study was to characterize the antioxidant potential of rice grains obtained from different medicinal landraces of rice: Njavara, chennallu (from Kerala, Kavuni, Veeradhangan, Kathanellu (from different districts of Tamil Nadu). Methanolic extract of dehusked rice grain-powder from five medicinal landraces of rice; Njavara Chennallu, Kavuni, Veeradangan, Kathanellu were used to study their in vitro antioxidant activities by scavenging of 1,1-Diphenyl-2-picrylhydrazyl (DPPH) radical. Rice grain methanolic extract from Njavara, Chennallu, Kavuni, Veeradhangan, Kathanellu showed the significant antioxidant potential by scavenging of 1,1-Diphenyl-2-picrylhydrazyl (DPPH) radical and IC₅₀ values for scavenging DPPH were in the range of 3.37-7.77 mg/ml. The antioxidant activity was increasing with increasing amounts of extract. Compared to the released varieties, medicinal landraces are having higher antioxidant potential. The result of the present study showed that highest antioxidant potential is in Veeradangan followed by Kathanellu, Njavara and Chennallu with equal of free radicals of DPPH. In conclusion, it is conceivable that the medicinal landraces of rice could be exploited as one of the potential sources for plant - based pharmaceutical products.

Introduction

Antioxidants are vital substances, which possess the ability to protect the body from damages caused by free radical-induced oxidative stress. Free radicals are formed due to a process called oxidation which happens in the context of normal metabolic processes and our everyday exposure to our environment. These radicals are in a very unstable state, and so they have the tendency to release electrons or absorb a new electron from living cells. Every time an electron is released from or absorbed into any free radical, a new free radical is formed. The newly formed free radicals continue to do the same. In this way, a chain of radicals are formed. If this continues for a long time, it will end up in decaying the living cells. Cells have developed antioxidant mechanisms to quench the free radicals but when the generation of free radicals exceeds the scavenging capacity of the cell, the excess free radicals seek stability through electron pairing with biological macromolecules such as proteins, lipids and DNA in healthy human cells resulting the induction of lipid peroxidation and mutation in DNA which leads to many human sufferings like cardiovascular and pulmonary diseases, some types of cancer, cataracts, immune/autoimmune diseases, inflammation, arthritis, atherosclerosis and brain dysfunction (Parkinson's, Alzheimer's, Huntington's diseases). Due to the adverse side effects of synthetic antioxidants leading to carcinogenicity, search for effective and natural antioxidants has become crucial. Coloured fruits and vegetables have higher antioxidant activity than the cereal grains [1]. Optimum quantity of coloured fruits and vegetables can't be in the diet of common man. So, an alternate staple food should quench the needs

Rice is a staple food for more than three billion people in the world. India has been endowed with more than two lakhs rice varieties a rich biodiversity that no other country on earth. The ayurvedic treatise records show the existence of several medicinal rice varieties in India. Njavara is one of such important Indian medicinal rice variety, grown in Kerala and is used mainly for ayurvedic treatments [2]. It is regarded as a special rice variety with beneficial properties for the circulatory, respiratory, digestive and nervous systems according to the Indian indigenous system of medicine or ayurveda [3]

and many other landraces are being used by local people were not properly documented. They are many landraces cultivated by the people of Tamil Nadu traditionally which is used for some special purposes. The main objective of the present study was to characterize the antioxidant potential of rice grains collected from five different medicinal landraces of rice. Two from Kerala viz., Njavara, Chennallu and three from Tamil Nadu viz., Kavuni, Veeradangan, Kathanellu were used to study the antioxidant activities by scavenging of 1,1-Diphenyl-2-picrylhydrazyl (DPPH) radical.

Materials and methods

Seeds of five medicinal landraces, Kavuni (from Chettinadu, Tamil Nadu), Veeradangan and Kathanellu (from Kanya kumari districts of Tamil Nadu), Njavara and Chennallu (from Kerala) were collected during 2010 and raised during Kharif 2011 at the Research farm, Agricultural college and Research Institute, Madurai in randomized block design and replicated thrice along with other released varieties of Tamil Nadu. Growth and biometrical characters were recorded to find out their yield potential at Madurai conditions. Seeds were collected, dried and processed and stored at optimum conditions.

The seeds were dehusked using dehusker and 1g of each sample was powdered and extracted with ethanol. The supernatant was concentrated and the residue was dissolved in 100ml distilled water. From this 0.2 ml, 0.4 ml, 0.6 ml, 0.8 ml and 1.0 ml of the extract was pipette out and made upto 1 ml with methanol, 2.5 ml of 0.5 mM methanolic solution of DPPH. The mixture was shaken vigorously and incubated for 37 min in the dark at room temperature. The colour developed was read at 517 nm using UV-vis spectrophotometer Methanol and Methanolic solution of DPPH was used as controls. DPPH free radical scavenging ability was calculated by using the formula and expressed in percentage and results are expressed as IC₅₀ (50 % Inhibition concentration) values

$$\% \text{ inhibition} = \frac{[(Ab - As)]}{Ab} \times 100$$

Results and discussion

The antioxidant potential is inversely proportional to IC₅₀

value, which was calculated from (Fig.1). It showed a showing linear regression of the % antioxidant activity versus extracts concentrations.

Free radical scavenging activities of the rice grain extracts were assessed by the DPPH (1,1-Diphenyl-2- picrylhydrazyl) assay [4]. Figure 1 illustrates a significant decrease in the concentration of DPPH radical due to scavenging ability of the rice grain from different landraces (Kathanellu, Njavara, Chennallu, Kavuni, Veeradangan).

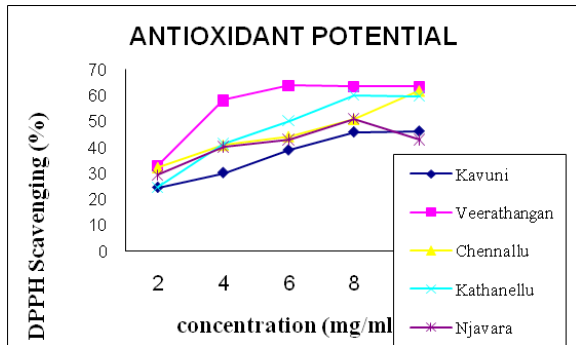


Fig. 1: DPPH radical scavenging activity (%). DPPH scavenging activity of different concentrations of methanolic rice grain extracts from five rice varieties

From the graph the IC_{50} values were calculated and tabulated for Veeradangan, Kathanellu, Njavara, Chennallu.

Table 1: IC_{50} values (mg/ml) of different landraces

Landraces	IC_{50} values (mg/ml)
Veeradangan	3.37
Kathanellu	6.00
Njavara	7.77
Chennallu	7.77

The results show that Veeradangan had the highest DPPH scavenging activity with an IC_{50} value of 3.37 mg/ml followed by Kathanellu (6 mg/ml), Njavara and Chennallu with equal value (7.77) respectively and Kavuni scavenging activity was least among the five medicinal landraces illustrated in Fig.2

Total antioxidant activity of the rice grain extracts increased with increasing concentration of the extracts indicating the potential of rice grain extracts as antioxidants. DPPH radical scavenging is considered a good in vitro model widely used to assess antioxidant efficacy within short time. In its radical form DPPH disappears on reduction by an antioxidant compound or a radical species to become a stable diamagnetic molecule resulting the colour change from purple to yellow. IC_{50} values are inversely proportional to antioxidant activity. So, lower the IC_{50} value higher is the antioxidant activity [5, 6], IC_{50} value of Veeradangan indicated that it has a highest scavenging activity among the five tested rice varieties Fig.2. The results indicate that the extracts, could serve as free radical inhibitors or scavengers, acting possibly as primary antioxidants.

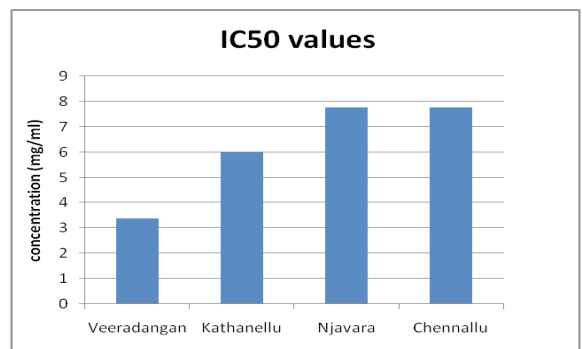


Fig. 2: IC_{50} values of different medicinal land races of rice

Conclusion

The present study indicated that the landrace Veeradangan from Tamil Nadu is having higher antioxidant property followed by Kathanellu, Njavara, Chennallu and Kavuni. As these landraces are grown in very small pockets and the area under cultivation of these landraces should be increased. Naturally occurring antioxidant supplements from plants are an alternate for synthetic antioxidants. They will form a base material for plant breeders for selection of these species for further investigation and to develop new rice cultivars with high bioactive compounds with high nutritive value.

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