

Antioxidant properties of some Sri Lankan traditional red rice (*Oryza sativa* L.)

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Abstract

Rice bran is one of the most abundant co-products produced in the rice milling industry and research conducted in last two decades has shown that it contains a unique complex of naturally occurring antioxidant compounds. Rice is the staple food in Sri Lanka and there are over 300 different traditional Sri Lankan rice varieties (RV). However, no antioxidant activity evaluation study has been conducted on these indigenous varieties. Present study evaluates the antioxidant properties of some Sri Lankan traditional red RV.

Freeze-dried 70% ethanolic extracts of brans of 4 traditional red RV (*Oryza sativa*) namely Masuran (M), Dik Wee (DW), Goda Heeneti (GH) and Sudu Heeneti (SH) were used in this study. Antioxidant properties of bran extracts of selected RV were evaluated using total polyphenolic content (TPC) (n=6), 1,1-diphenyl-2-picryl-hydrazyl (DPPH) radical scavenging (n=4), 2-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid [ABTS] radical scavenging (n=4) and ferric reducing antioxidant power (FRAP) (n=6) *in vitro* antioxidant assays.

Significant differences were observed among bran extracts of selected RV for investigated antioxidant properties ($P < 0.05$). Mean TPC, DPPH, ABTS and FRAP antioxidant properties were in the range of 11.74 - 29.75 mg gallic acid equivalents/g, $5.14 \pm 0.17 - 6.77 \pm 0.06$ mmol Trolox equivalents (TE)/100g, $8.67 \pm 0.14 - 14.25 \pm 0.46$ mmol TE/100g, $8.30 \pm 0.15 - 11.02 \pm 0.25$ mmol FeSO₄/100 g rice bran respectively. The order of mean TPC was SH > M > GH > DW. Bran extracts of all the RV exhibited dose dependent radical scavenging activity against both DPPH[•] and ABTS⁺ radicals. Bran extracts of GH demonstrated maximum radical scavenging activity for both radicals. However, the order of scavenging was observed to be different among bran extracts of different RV for DPPH[•] and ABTS⁺ radicals. The order of scavenging for DPPH[•] was GH > SH > DW > M and for ABTS⁺ it was observed as GH > SH > M > DW. Highest mean

FRAP was observed for bran extract of GH variety while lowest for bran extract for SH variety. The antioxidant power of the bran extracts for FRAP was in the order of GH > M > DW > SH.

1. Introduction

Increased concern over the safety of synthetic antioxidants like butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT) has led to an increased interest in exploration of effective and economical natural antioxidants. Rice bran is one of the most abundant co-products produced in the rice milling industry and research conducted in last two decades has shown that it contains a unique complex of naturally occurring antioxidant compounds [1]. Rice is the staple food in Sri Lanka and there are over 300 different traditional rice varieties. However, no antioxidant activity evaluation study has been conducted on these indigenous varieties. Present study evaluates the antioxidant properties of some Sri Lankan traditional red rice varieties.

2. Materials and Methods

Four Sri Lankan traditional red rice varieties (Sudu Heeneti, Goda Heeneti, Masuran and Dik Wee) were obtained from Rice Research and Development Institute (RRDI), Batalagoda. Rice seeds were dehulled (Satake THU 35B), polished in a laboratory mill (Satake TM 05C) and passed through a 60-mesh sieve, resulting in a uniform fraction of rice bran. Rice brans were then extracted by shaking for overnight at room temperature with 10 times the sample weight of 70 % ethanol-water (v/v). Rice extracts were centrifuged and filtered through 0.45 µm nylon filters. Crude rice extracts obtained by filtration were evaporated to dryness with a rotary evaporator, under reduced pressure at 40 °C and freeze dried. The freeze dried extracts were redissolved in dimethyl sulfoxide (DMSO) and subjected to *in vitro* antioxidant assays.

The total polyphenolic content (TPC) of rice bran extracts was determined by the Folin-Ciocalteu method [2] using 96-well micro-plates. The 2-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid (ABTS⁺) radical scavenging assay was performed according to the method described by Re *et al.* [3] and 1,1-diphenyl-2-picryl-hydrazyl (DPPH) radical scavenging assay by Biolis [4] using 96-well micro-plates. Ferric reducing antioxidant power (FRAP) of rice bran was performed according to modified method of Benzie and Strain's protocol [5] using 96-well micro-plates.

3. Results and Discussion

Antioxidant properties of brans of selected Sri Lankan traditional red rice varieties are given in Table 1.

Table 1: Antioxidative properties of bran extracts of selected Sri Lankan traditional red rice varieties

Variety	Antioxidative properties of rice bran			
	TPC	ABTS	DPPH	FRAP
Sudu Heeneti	29.75 ± 0.97 ^a	12.32 ± 0.33 ^b	6.32 ± 0.15 ^b	8.30 ± 0.15 ^c
Masuran	23.79 ± 0.41 ^b	11.94 ± 0.25 ^b	5.14 ± 0.17 ^d	9.38 ± 0.36 ^b
Goda Heeneti	18.82 ± 0.26 ^c	14.25 ± 0.46 ^a	6.77 ± 0.06 ^a	11.02 ± 0.25 ^a
Dik Wee	11.74 ± 0.18 ^d	8.67 ± 0.14 ^c	5.84 ± 0.12 ^c	8.73 ± 0.42 ^{bc}

Data represented as mean ± SE. Mean values in a column superscripted by different letters are significantly different at $p < 0.05$. Results are presented on dry weight basis. TPC (n=6): mg Gallic acid equivalents/1g bran; ABTS (n=4): mmol Trolox equivalents/100g bran; DPPH (n=4): mmol Trolox equivalents /100g bran; FRAP (n=6): mmol FeSO₄/100g bran

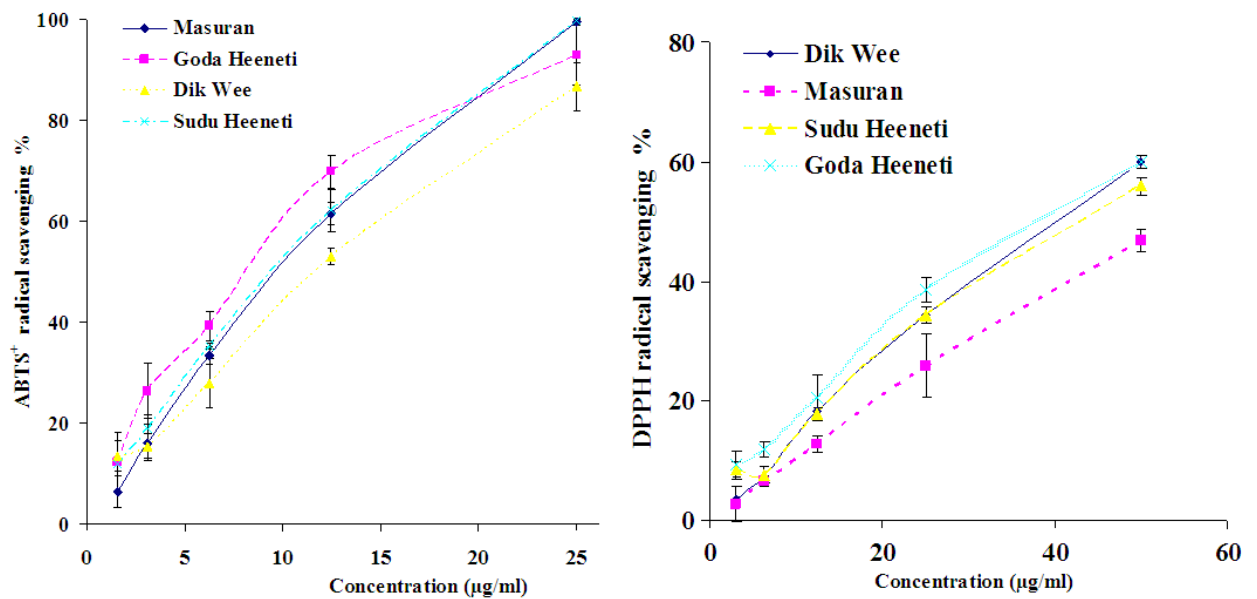


Figure 1: (a) Dose response relationship of different concentrations of rice bran and the

ABTS⁺ radical scavenging activity (b) Dose response relationship of different concentrations of rice bran and the DPPH[·] radical scavenging activity

Significant differences were observed among bran extracts of selected rice varieties for investigated antioxidant properties ($P < 0.05$). Mean TPC, DPPH, ABTS and FRAP antioxidant properties were in the range of 11.74 - 29.75 mg gallic acid equivalents/g, 5.14 ± 0.17 - 6.77 ± 0.06 mmol Trolox equivalents (TE)/100g, 8.67 ± 0.14 - 14.25 ± 0.46 mmol TE/100g, 8.30 ± 0.15 - 11.02 ± 0.25 mmol FeSO₄/100 g rice bran respectively. The order of mean TPC was Sudu Heeneti > Masuran > Goda Heeneti > Dik Wee. Bran extracts of all the varieties exhibited dose dependent radical scavenging activity against both DPPH[·] and ABTS⁺ radicals (Fig 1). Bran extracts of Goda Heeneti demonstrated maximum radical scavenging activity for both radicals. However, the order of scavenging was observed to be different among bran extracts of different varieties for DPPH[·] and ABTS⁺ radicals. The order of scavenging for DPPH[·] was Goda Heeneti > Sudu Heeneti > Dik wee > Masuran and for ABTS⁺ it was observed as Goda Heeneti > Sudu Heeneti > Masuran > Dik Wee. Highest mean FRAP was observed for bran extract of Goda Heeneti variety while lowest for bran extract for Sudu Heeneti variety. The antioxidant power of the bran extracts was in the order of Goda Heeneti > Masuran > Dik Wee > Sudu Heeneti.

4. Conclusion

It is concluded that, brans of selected Sri Lankan traditional red rice possess marked antioxidant properties and consumption may play an important role in prevention of oxidative stress associated chronic diseases.

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In vitro assessment of antioxidant capacity of Sri Lankan black tea (*Camellia sinensis L.*), during storage and its relation to phenolic content

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Abstract

Black tea is reported to contain natural antioxidants mainly with polyphenolic compounds. In this study, the effect of storage on antioxidant capacity and total polyphenols content of black tea (stored at 25±2 °C and 50±5% RH) from major agroclimatic elevations in Sri Lanka were studied for 36 months at 6 months intervals. The antioxidant capacity measured by DPPH assay had shown significant (P < 0.05) and time dependent decrease