

Ethyl acetate extract of germinated brown rice attenuates hydrogen peroxide-induced oxidative stress in human SH-SY5Y neuroblastoma cells: role of anti-apoptotic, pro-survival and antioxidant genes

ABSTRACT

Background There are reports of improved metabolic outcomes due to consumption of germinated brown rice (GBR). Many of the functional effects of GBR can be linked to its high amounts of antioxidants. Interestingly, dietary components with high antioxidants have shown promise in the prevention of neurodegenerative diseases like Alzheimer's disease (AD). This effect of dietary components is mostly based on their ability to prevent apoptosis, which is believed to link oxidative damage to pathological changes in AD. In view of the rich antioxidant content of GBR, we studied its potential to modulate processes leading up to AD. **Methods** The total phenolic content and antioxidant capacity of the ethyl acetate extract of GBR were compared to that of brown rice (BR), and the cytotoxicity of both extracts were determined on human SH-SY5Y neuronal cells using 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) Assay. Based on its higher antioxidant potentials, the effect of the GBR extract on morphological changes due to hydrogen peroxide (H₂O₂)-induced oxidative damage in human SH-SY5Y neuronal cells was examined using inverted light microscope and fluorescence microscope by means of acridine orange-propidium iodide (AO/PI) staining. Also, evaluation of the transcriptional regulation of antioxidant and apoptotic genes was carried out using Multiplex Gene Expression System. **Results** The ethyl acetate extract of GBR had higher total phenolic content and antioxidant capacity compared to BR. The cytotoxicity results showed that GBR extract did not cause any damage to the human SH-SY5Y neuronal cells at concentrations of up to 20 ppm, and the morphological analyses showed that the GBR extract (up to 10 ppm) prevented H₂O₂-induced apoptotic changes in the cells. Furthermore, multiplex gene expression analyses showed that the protection of the cells by the GBR extract was linked to its ability to induce transcriptional changes in antioxidant (SOD 1, SOD 2 and catalase) and apoptotic (AKT, NF- κ B, ERK1/2, JNK, p53 and p38 MAPK) genes that tended towards survival. **Conclusions** Taken together, the results of our study showed that the ethyl acetate extract of GBR, with high antioxidant potentials, could prevent H₂O₂-induced oxidative damage in SH-SY5Y cells. The potential of GBR and its neuroprotective mechanism in ameliorating oxidative stress-related cytotoxicity is therefore worth exploring further.

Keyword: Germinated brown rice; Antioxidant; Oxidative stress; Neuroprotective; SH-SY5Y