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Sesamol attenuates genotoxicity in bone marrow cells of whole-body γ-irradiated mice

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Abstract

Ionising radiation causes free radical–mediated damage in cellular DNA. This damage is manifested as chromosomal aberrations and micronuclei (MN) in proliferating cells. Sesamol, present in sesame seeds, has the potential to scavenge free radicals; therefore, it can reduce radiation-induced cytogenetic damage in cells. The aim of this study was to investigate the radioprotective potential of sesamol in bone marrow cells of mice and related haematopoietic system against radiation-induced genotoxicity. A comparative study with melatonin was designed for assessing the radioprotective potential of sesamol. C57BL/6 mice were administered intraperitoneally with either sesamol or melatonin (10 and 20 mg/kg body weight) 30 min prior to 2-Gy whole-body irradiation (WBI) and sacrificed after 24 h. Total chromosomal aberrations (TCA), MN and cell cycle analyses were performed using bone marrow cells. The comet assay was performed on bone marrow cells, splenocytes and lymphocytes. Blood was drawn to study haematological parameters. Prophylactic doses of sesamol (10 and 20 mg/kg) in irradiated mice reduced TCA and micronucleated polychromatic erythrocyte frequency in bone marrow cells by 57% and 50%, respectively, in comparison with radiation-only groups. Sesamol-reduced radiation-induced apoptosis and facilitated cell proliferation. In the comet assay, sesamol (20 mg/kg) treatment reduced radiation-induced comets (% DNA in tail) compared with radiation only ($P < 0.05$). Sesamol also increased granulocyte populations in peripheral blood similar to melatonin. Overall, the radioprotective efficacy of sesamol was found to be similar to that of melatonin. Sesamol treatment also showed recovery of relative spleen weight at 24 h of WBI. The results strongly suggest the radioprotective efficacy of sesamol in the haematopoietic system of mice.

Introduction

Ionising radiation exposure is harmful and consequences on health depend on the extent of damage to DNA. The haematopoietic system is the most radiosensitive and in the case of whole-body exposure can lead to haematopoietic syndrome with increasing radiation dose. Damage to DNA, genotoxicity and related short- and long-term effects on health are well documented (1–3). Antioxidants that have the ability to scavenge free radicals, can protect DNA and facilitate cell functioning are considered for investigating radioprotection and underlying mechanisms in animal models. A single prophylactic dose of a radioprotector is envisaged to provide protection against whole-body exposure. Because of the complex nature of the response to radiation in cells and tissues, the much desired radioprotector is still not available. The only compound approved by Food and Drug Administration, USA, as cytoprotectant for head and neck cancer radiotherapy patients is amifostine, developed at Walter Reed Institute, USA (4). Different approaches are currently being pursued in various institutes (5–9). Antioxidants have gained importance because of their strong free radical scavenging properties, low toxicity and multiple roles at cellular level. In general, most of the studies in animal models

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