Ameliorative effect of melatonin against gamma-irradiation-induced oxidative stress and tissue injury

El-Missiry, MA (El-Missiry, M. A.); Fayed, T. A. (Fayed, T. A.);
El-Sawy, MR (El-Sawy, M. R.); El-Sayed, AA (El-Sayed, A. A.)
E-mail Address: maelmissiry@yahoo.com

Abstract

While radiation hazards, due to free radical generation, present an enormous challenge for biological and medical safety, melatonin is a potent scavenger of a variety of free radicals. The aim of this study was to investigate the radioprotective effect of melatonin against oxidative stress and tissue injury induced by gamma radiation. Rats were subjected to two doses of 2 and 4Gy from cesium-137 source. Four days prior to irradiation, animals received melatonin daily (10mg/kg body weight i.p.). In the irradiated animals, the oxidative stress markers malondialdehyde (MDA) and protein carbonyl were significantly increased in the liver, while a marked decrease in hepatic contents of DNA, RNA, and glutathione (GSH) as well as activity of glutathione-S-transferase (GST) was demonstrated. In addition, catalase (CAT) activity was increased in the liver 5 days after irradiation. The levels of total lipids, cholesterol, triglyceride (TG), low-density lipoprotein (LDL), urea, and creatinine, as well as activities of aspartate aminotransferase (AST), alkaline phosphatase (ALP), and gamma-glutamyltransferase (GGT), were significantly increased in sera of the irradiated rats. This is coupled with decreased serum levels of high-density lipoprotein (HDL), total protein and albumin, and total globulins by irradiation. The administration of melatonin alone daily for 4 days caused significant decreases in MDA and protein carbonyl content and produced significant elevations of GSH content and GST activity in the liver. Moreover, significant decreases in total lipids, cholesterol, and TG without change in LDL or HDL levels in serum were demonstrated. Treatment with melatonin for 4 days before acute irradiation significantly abolished radiation-induced elevations in MDA and protein carbonyl levels in the liver and significantly maintained hepatic GSH content, GST, and CAT activities close to the control values. Preirradiation treatment with melatonin showed significantly higher hepatic DNA and RNA contents than irradiated rats. The levels of total lipids, cholesterol, TG, HDL, LDL, total proteins, albumin, total globulins, creatinine, and urea, as well as the activities of AST, ALT, and GGT in serum were significantly ameliorated when melatonin was injected before irradiation. In conclusion, the increase in oxidative stress markers and the concomitant change in antioxidant levels indicate the role of oxidative stress in radiation-induced tissue damage. Moreover, melatonin shows a radioprotective impact against ionizing-
radiation-induced oxidative stress and organ injury.

**Keywords:** Melatonin; radiation; radioprotection; antioxidants; oxidative stress; liver

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