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Possible ameliorative effects of kolaviron against reproductive toxicity in sub-lethally whole body gamma-irradiated rats

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ABSTRACT

Ionizing radiation is one of the environmental factors that may contribute to reproductive dysfunction by a mechanism involving oxidative stress. We investigated the possible ameliorative effects of kolaviron (KV) (a biflavonoid from the seeds of *Garcinia kola*) on sperm characteristics, testicular lipid peroxidation (LPO) and antioxidant status after a whole body γ-irradiation in Wistar rats. Vitamin C (VC) served as standard antioxidant in this study. The study consists of four groups of 6 rats each. Group I received corn oil, whereas group II received a single dose of γ-radiation (5 Gy). The animals in groups III and IV were pretreated with KV (250 mg/kg) and VC (250 mg/kg) by oral gavage five times in a week, respectively, for 6 weeks prior to and 8 weeks after exposure to γ-radiation. Gamma-irradiation resulted in a significant ($p < 0.05$) decrease in body weight and relative testes weight. Also, γ-irradiation significantly ($p < 0.05$) decreased the activities of superoxide dismutase, catalase and glutathione S-transferase as well as glutathione level, but markedly elevated malondialdehyde levels in the serum and testes. Irradiated rats showed testicular degeneration with concomitant decrease in sperm motility and viability. Although sperm abnormalities significantly increased, it has no effect on the epididymal sperm count. KV and VC significantly ($p < 0.05$) decreased the body weight loss and increased relative testes weights of the rats. Furthermore, supplementation of KV and VC ameliorated radiation-induced toxicity by increasing the activities of antioxidant enzymes, decreased LPO and abrogated testicular degeneration. Taken together, γ-irradiation caused reproductive dysfunction by depleting the antioxidant defence system in the rats, while administration of KV or VC ameliorated the radiation-induced testicular toxicity.

1. Introduction

All living organisms are exposed to some amount of radiation coming from outer space or emitted from the radioisotopes present in the environment (Kumar, 2004). Radiations are commonly used in a number of medical and industrial situations; however, their pro-oxidative effects limit their applications (El-Missiry et al., 2007). In medicine, radiation treatment is aimed at delivering precise measured doses of ionizing radiation to a defined tumor volume with the minimum accepted deleterous effects of ionizing radiation to neighbouring healthy tissue while eliminating tumor cells. Radiation-induced oxidative stress which results in oxidation of proteins, lipids, and nucleotides is drawing increasing attention (Malekirad et al., 2005). The adverse effects of radiation on the reproductive systems include loss of testis weight and total germ cell population in mice (Saharan and Devi Uma, 1997) and suppression of sperm count in men (Clifton and Bremner, 1983). Irradiation of the testes produces sterility, which may be permanent or temporary depending on the dose levels and rate employed (Kumar, 2004). Doses as low as 0.1–0.15 Gy have been reported to cause temporary sterility, although doses greater than 2 Gy and possibly about 6 Gy are needed to produce permanent aspermia (UNSCEAR, 1982). The germinal epithelium of the testes has been suggested to be primary site of damage by gamma irradiation with recovery of spermatogenesis sometimes delayed for up to 10 years or more (Multigner and Spira, 1997).

The enzymatic and non-enzymatic antioxidants are the natural defense against free radical mediated tissue damage in several organs including testes (Adedara and Farombi, 2010). Oxidative damage occurs when the production of reactive oxygen species (ROS) overwhelms the antioxidant defense mechanisms. A radioprotector is a chemical compound capable of modifying the normal response of a biological system to radiation-induced toxicity or lethality (Mansour et al., 2008). The scavenging of free radicals and inhibition of lipid peroxidation has been suggested to be the key target activities for developing successful radioprotection strategies (Hosseinimehr et al., 2001; Fani et al., 2008). The development of radiation protectors is important not only to enhance the effectiveness of cancer treatment but also for the study of the underlying mechanisms of radiation cytotoxicity (Hahn et al., 1994).

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