

Umbelliferone modulates gamma-radiation induced reactive oxygen species generation and subsequent oxidative damage in human blood lymphocytes

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Umbelliferone, also known as 7-hydroxycoumarin, is a widespread natural product of the coumarin family. Umbelliferone occurs in many dietary plants from the Umbelliferae family such as carrot, coriander and garden angelica. The purpose of this study was to investigate the protective effect of umbelliferone, against radiation-induced oxidative damage and chromosomal aberrations in cultured human blood lymphocytes. To explore the radioprotective effect of umbelliferone, freshly isolated human blood lymphocytes were treated with 124 μM umbelliferone (optimumdose-fixed by MTT assay) 30 min before 3 Gy irradiation. It has been found that umbelliferone pretreatment inhibited radiation-induced reactive oxygen species generation in 3 Gy exposed lymphocytes. Microscopic observations showed that there was a significant apoptotic cells (ethidium bromide/acridine orange staining) and decreased mitochondrial membrane potential (Rhodamine 123 staining) in irradiated lymphocytes. On the other hand, 124 μM umbelliferone treatment significantly decreased % of apoptotic cells and prevented radiation induced mitochondrial depolarization in lymphocytes. Further, there was an increased DNA damage (comet assay), cytokinesis-blocked micronuclei frequency, chromosomal aberration attributes, lipid peroxidation with decreased antioxidant enzymatic i.e., superoxide dismutase, catalase and, glutathione peroxidase activities in 3 Gy irradiated lymphocytes. Conversely, umbelliferone (124 μM) treatment before irradiation decreased %DNA damage, micronuclei frequencies, chromosomal aberration attributes and lipid peroxidative markers with improved antioxidant enzyme activities in irradiated lymphocytes. Further, umbelliferone pretreatment modulates radiation-induced apoptotic signaling in human blood lymphocytes. Taken together, the results of this study clearly suggest the radioprotective effect of umbelliferone in human lymphocytes by inhibiting reactive oxygen species generation and its subsequent toxicity.

Biography

N. Rajendra Prasad has completed his Ph.D. from the Department of Biochemistry and Biotechnology, Annamalai University. He has acquired research training at Armed Forces Radiobiology Research Institute and National Cancer Institute, USA under Indian Government Overseas Research Associateships. He has produced 4 Ph.D students and published more than 40 research articles in reputed peer-reviewed journals. He is the active member of several academic societies and Board of Examiner of Biochemistry in several Indian Universities.