Countermeasures for Space Radiation Induced Myeloid Leukemia

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INTRODUCTION

Of particular concern for the health of astronauts during space travel is radiation from protons and highly energetic, heavy charged particles known as HZE particles. In this program, the ability of dietary supplement agents to prevent radiation induced biological effects, including myeloid leukemia, are being determined. Several surrogate endpoint biomarkers (SEBs) are being evaluated as measures to predict the ability of dietary antioxidant supplements to prevent space radiation induced myeloid leukemia. Our previous studies have shown that various types of ionizing radiation can induce oxidative stress in both *in vitro* (1-4) and *in vivo* model systems (1, 5). In the present study, the plasma total antioxidant status was used as a biomarker of oxidative stress induced by proton and HZE particle radiation in CBA mice, and the protective effects of certain dietary supplement agents were evaluated.

MATERIALS, METHODS AND RESULTS

CBA mice were fed with either AIN-93G rodent diet (Diet C), or AIN-93G rodent diet supplemented with a combination of L-selenomethionine (SeM), ascorbic acid, N-acetyl cysteine, alpha-lipoic acid, vitamin E succinate and co-enzyme Q10 (Diet A), SeM alone (Diet B), or Bowman-Birk Inhibitor Concentrate (BBIC) (Diet D) for 3 days prior to irradiation with iron ions (50 cGy) or protons (300 cGy) at the NASA Space Radiation Laboratory (NSRL) Facility at the Brookhaven National Laboratory. Four hours after the radiation exposure, the animals were killed by carbon dioxide inhalation and blood was collected following euthanasia by cardio-puncture with 22-gauge needles attached to 1 ml syringes. The blood was centrifuged to separate plasma from red and white blood cells and the plasma samples were frozen at -70^{o}C before being analyzed to determine the total antioxidant status. The plasma total antioxidant status was determined by a colorimetric assay system developed by Randox Laboratories Ltd.

The results demonstrate that exposure to proton and HZE particle radiation significantly decreased the plasma level of total antioxidant status in the irradiated CBA mice. Diet supplementation with BBIC, SeM, or a combination of selected antioxidant agents was shown to partially or completely prevent the decrease in the plasma level of total antioxidant status in animals exposed to proton or HZE particle radiation. These findings suggest that exposure to space radiation may compromise the capacity of the host antioxidant defense system and this adverse biological effect can be prevented at least partially by diet supplementation with BBIC, L-selenomethionine or a combination of antioxidant agents. This project is supported by a grant from the National Space Biomedical Research Institute through NASA NCC 9-58.

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