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Radiation Fields, Effects and Risks in Human Space Missions (5)

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ASSESSMENT OF DOSE-DEPENDENT ENDOCRINE AND IMMUNE RESPONSES TO SIMULATED IONIZING RADIATION

Abstract

Cosmic ionizing radiation is an innate risk within the space environment and is known to cause direct DNA damage and indirectly impact cellular function, communication, and signal transduction processes. Assessment of different physiological systems and their interactions are important to consider for mitigation strategies in spaceflight based on the degree of ionizing radiation and relative biological effectiveness. Diurnal patterns and sex dimorphism can influence immune and endocrine responses, and their crosstalk in response to cosmic radiation remains an open question. Therefore, this study assessed dose-dependent immune and endocrine-adrenal responses to cosmic ionizing radiation in male and female mice. 24-week-old, C57BL/6J mice were exposed to simulated, simplified five-ion galactic cosmic ray (GCRsim) radiation at 15 and 50 cGy. Blood and adrenal tissues were collected two-weeks post exposure and inflammatory biomarkers and hormone biochemical pathways were characterized by ribo-depleted, bulk RNA sequencing. Results displayed differential RNA profiles for each condition, sex, and sample type (whole blood verses adrenals), indicating complex responses and networks are generated from different doses of ionizing radiation. Adrenal gland weights and cellular architecture displayed altered biochemical pathways specific to sex and radiation. Characterization of these unique immune and endocrine profiles highlights the current need for personalized medicine, which is a critical requirement for astronauts that will be exposed to similar doses during exploration missions. Supported by the NASA Human Research Program (HRP) Human Factors Behavioral Performance Element Grant 18 18FLAG 2 0028 (AER and AMP) and Embry-Riddle Aeronautical University startup funding (AMP).