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FAT AND BONE DURING THE ISS4MARS MISSION: AN INTEGRATED ENDOCRINE APPROACH

Abstract

During long duration flights, including MARS missions, astronauts undergo a series of adaptation changes, including impaired bone and muscle mass/function, causing problems upon return to Earth. Our previous onground simulations of MARS missions showed slight fasting hyperglycemia and increased fat mass associated to decreased levels of adiponectin, an adipose tissue derived cytokine enhancing insulin sensitivity. This also occurs on Earth as a consequence of poor food habits and physical inactivity carrying the risk for osteoporosis and cardiovascular events. The first in space simulated Mars voyage ISS4Mars offers a prime opportunity to try and confirm these results in healthy subjects kept on a standardized diet and exercise regimen and to correlate them with psychological changes eventually occurring in an integrated analogue exposing astronauts to the impact of the same stressful microgravity, radiation and living conditions as those imposed by a deep space cruise. Our interest would be especially focused on inflammatory and anti-inflammatory cytokines including typical products of visceral fat cells (i.e. adiponectin, leptin, resistin, lipocalin2) and muscles (i.e. irisin and myostatin), as well as, on androgens/estrogens and bone turnover parameters, controlling for stress markers. Before and after the mission anthropometry, bioimpedance and bone mineralometry will provide information on overall metabolic response to the long duration flight. Hormones will be measured on blood before, during and after flight but, within the individually identified limits of available methods, they will be assayed on salivary and urine samples as well, to get sounder information both on tissue exposure to different signals and on integrated rather than punctual hormone secretion. In fact, all above reported signals are strongly linked to one another by allowing an exciting and relentless crosstalk between adipocytes and bone, both of which are known to be strongly influenced by sex hormones whichever the gender. Wild-type and lipocalin2 overexpressing transgenic rodents will serve as a ground based simulated microgravity experimental model to help interpret our results correctly by providing sounder explanations for the interrelationships found among at least some of the parameters under study. Overall we expect to find an altered metabolic phenotype in subjects participating in the ISS4Mars and hope to be able to understand the endocrine mechanisms behind it in order to be ready to let astronauts prevent sustained health-hazardous changes during their space trip and especially to have them to recover as fast as possible after landing on Earth.