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METABOLIC MONITORING FOR FEEDBACK DIETARY AND EXERCISE PRESCRIPTIONS IN ISS. A PROPOSAL FOR THE ISS4MARS PROJECT

Abstract

Nutrition and physical activity are two of the most important factors affecting health, quality of life and survival in extreme conditions as long-term spaceflight and/or dwelling outside earth. Microgravity has detrimental effects on skeletal muscle and bone. These alterations can be minimized by maintaining a neutral energy balance and adequate levels of protein intake (i.e., 1g/kg of body weight/day) and physical exercise [1-3]. To date, bioimpedance (BIA) is the most convenient tool for quick, user-friendly, non-invasive and reasonably accurate assessment of body composition, i.e., fat-free mass (FFM) and fat mass (FM). FM changes are directly correlated to energy balance changes, while FFM is maintained by both resistance and endurance exercise training. In the perspective of the ISS4MARS project, it appears to be of utmost importance to monitor nutritional and body composition status, muscle strength and physical activity levels of ISS crew and to provide them feedback dietary and exercise prescriptions on their status to counteract changes in body composition and muscle performance. Before and after spaceflight a thorough evaluation of body composition, physical performance and metabolic data will be carried out. During flight (e.g. every 15 days), body weight, muscle strength and physical activity level will be monitored using instruments already available on ISS (i.e., SLAMMD, Space Linear Acceleration Mass Measurement Device and HGD, Handgrip Dynamometer). Body composition changes will be assessed by a portable, stowable bioimpedance-meter (BIA). All collected data will be transmitted to earth and analyzed by a team of specialized nutritionists and kinesiologists who will update individual dietary and exercise prescriptions every 15 days, based on recent changes in energy balance, FFM and muscle strength. Algorithms for dietary and exercise adjustments, based on data collected from the proposed body monitoring, will be developed in earth-based studies. The propose intervention will prevent long-term, microgravity-induced changes in FM, FFM and muscle strength, thereby maintaining astronaut health

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