AEROBIC CAPACITY FOLLOWING LONG DURATION INTERNATIONAL SPACE STATION (ISS) MISSIONS: PRELIMINARY RESULTS
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Introduction: Maximum oxygen uptake (VO2max) is reduced immediately following space flights lasting <15 d, but has not been measured following long-duration missions. The purpose of this study is to measure VO2max and maximum work rate (WRmax) data from astronauts following ISS flights (91 to 188 d). Methods: Five astronauts [3 M, 2 F: 47 ± 6 yr, 174 ± 6 cm, 71.9 ± 10.9 kg (mean ± SD)] have participated in the study. Subjects performed upright cycle exercise tests to symptom-limited maximum. An initial test was done ~270 d before flight to establish work rates for subsequent tests. Subsequent tests, conducted ~45 d before flight and repeated on the first or second day (R+1/2) and at ~10 d (R+10) following landing, consisted of 3 × 5 min stages designed to elicit 25%, 50%, and 75% of preflight VO2max, followed by 25 W•min⁻¹ increases. VO2, WR, and heart rate (HR) were measured using the ISS Portable Pulmonary Function System [Damec, Odense, DK]. Descriptive statistics are reported. Results: On R+1/2 mean VO2max decreased compared to preflight (Pre: 2.98 ± 0.99, R+1/2: 2.63 ± 0.56 L•min⁻¹); 4 of 5 subjects demonstrated a loss of > 6%. WRmax also decreased on R+1/2 compared to preflight (Pre: 245 ± 69, R+1/2: 210 ± 45 W). On R+10, VO2max was 2.86 ± 0.62 L•min⁻¹, with 2 subjects still demonstrating a loss of > 6% from preflight. WRmax on R+10 was 240 ± 49 W. HRmax did not change from pre to post-flight. Conclusions: These preliminary results, from the first 5 of 12 planned subjects of an ongoing ISS study, suggest that the majority of astronauts will experience a decrease in VO2max after long-duration space-flight. Interestingly, the two astronauts with the highest preflight VO2max had the greatest loss on R+1/2, and the astronaut with the lowest preflight VO2max increased by 13%. Thus, maintenance of VO2max may be more difficult in astronauts who have a high aerobic capacity, perhaps requiring more intense in-flight exercise countermeasure prescriptions.