HYPERGRAVITY EXERCISE TRAINING: EFFECTS ON EXERCISE CAPACITY AND ORTHOSTATIC TOLERANCE

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ABSTRACT

Exposure to microgravity during spaceflight results in changes in cardiovascular function that impair normal function on return to a 1G environment. Among these changes are loss of exercise capacity and development of orthostatic intolerance (i.e. inability to stand upright for prolonged periods). Current countermeasures to these deleterious effects of spaceflight have had limited success. The present study tests exercise-coupled hypergravity training on a human-powered short arm centrifuge [1] as a potential countermeasure for loss of exercise capacity and orthostatic intolerance. Specifically, the study will test the following hypotheses:

Hypothesis 1: Both exercise-coupled hypergravity training and passive hypergravity training will enhance orthostatic tolerance.

Hypothesis 2: Exercise-coupled hypergravity training at 2.5 +Gz will produce a greater improvement in VO2max than equivalent exercise training at 1G.

Healthy, sedentary subjects will be screened and randomized to three treatment groups for a four-week training program. The exercise-coupled hypergravity training (HGTx) group will train on the Space Cycle at 80% of VO2max for 45 minutes/day, 4 days/week at 2.5 +Gz. The passive hypergravity (HGTp) group will ride the Space Cycle for an equivalent time period without pedaling. A third group will ride a standard upright bicycle ergometer at 80% of VO2max for 45 minutes/day, 4 days/week at 2.5 +Gz.

Subjects will be tested for VO2max and orthostatic tolerance prior to and following the 4 week training period. VO2max will be measured with an incremental exercise test to volitional fatigue on an upright cycle ergometer. Orthostatic tolerance tests will measure the time to presyncope under a simultaneous combination of head-up tilt and lower body negative pressure. Comparisons between exercise and control groups will be made using repeated measures ANOVA.

REFERENCES