

Title: Individual Variability in Aerobic Fitness Adaptations to 70-d of Bed Rest and Exercise Training

Authors: Meghan Downs¹, Roxanne Buxton¹, Elisabeth Goetchius¹, John DeWitt², Lori Ploutz-Snyder, FACSM³

¹University of Houston, Houston, TX, ²Wyle Science, Technology & Engineering Group, Houston, TX, ³Universities Space Research Association, Houston, TX

Change in maximal aerobic capacity (VO₂pk) in response to exercise training and disuse is highly variable among individuals. Factors that could contribute to the observed variability (lean mass, daily activity, diet, sleep, stress) are not routinely controlled in studies. The NASA bed rest (BR) studies use a highly controlled hospital based model as an analog of spaceflight. In this study, diet, hydration, physical activity and light/dark cycles were precisely controlled and provided the opportunity to investigate individual variability. **PURPOSE.** Evaluate the contribution of exercise intensity and lean mass on change in VO₂pk during 70-d of BR or BR + exercise. **METHODS.** Subjects completed 70-d of BR alone (CON, N=9) or BR + exercise (EX, N=17). The exercise prescription included 6 d/wk of aerobic exercise at 70 – 100% of max and 3 d/wk of lower body resistance exercise. Subjects were monitored 24 hr/d. VO₂pk and lean mass (iDXA) were measured pre and post BR. ANOVA was used to evaluate changes in VO₂pk pre to post BR. Subjects were retrospectively divided into high and low responders based on change in VO₂pk (CON > 20% loss, n=5; EX >10% loss, n=4, or 5% gain, n=4) to further understand individual variability. **RESULTS.** VO₂pk decreased from pre to post BR in CON (P<0.05) and was maintained in EX; however, significant individual variability was observed (CON: -22%, range: -39% to -.5%; EX: -1.8%, range: -16% to 12.6%). The overlap in ranges between groups included 3 CON who experienced smaller reduction in VO₂pk (<16%) than the worst responding EX subjects. Individual variability was maintained when VO₂pk was normalized to lean mass (range, CON: -33.7% to -5.7%; EX: -15.8% to 11%), and the overlap included 5 CON with smaller reductions in VO₂pk than the worst responding EX subjects. High responders to disuse also lost the most lean mass; however, this relationship was not maintained in EX (i.e. the largest gains/losses in lean mass were observed in both high and low responders). Change in VO₂pk was not related to exercise intensity. **CONCLUSION.** Change in VO₂pk in response to disuse and exercise was highly variable among individuals, even in this tightly controlled study. Loss in lean mass accounts for a significant degree of variability in the CON; however, training induced gains in VO₂pk appear unrelated to lean mass or exercise intensity.