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CARDIOVASCULAR MECHANISMS INVOLVED IN THE RECOVERY OF ORTHOSTATIC
TOLERANCE IN OLDER ADULTS AFTER 14 DAYS OF HEAD-DOWN TILT BEDREST**Abstract**

Background: Previous studies have shown that orthostatic tolerance (OT) is reduced after prolonged periods of head-down tilt bedrest (HDBR), a spaceflight analog, in younger adults. The cardiovascular variables relevant to the recovery from HDBR, which include heart rate (HR) and stroke volume (SV), are well established in these subjects; however, variables pertinent to older adults that undergo a similar HDBR protocol have not been described yet. Their identification will inform space agencies on how to preserve the cardiovascular health of astronauts of advanced age upon their return from space missions.

Objective: This study investigated the cardiovascular mechanisms that allowed the recovery of OT in older adults after the resumption of mobility following 14 days of 6-degree HDBR.

Methods: In this randomized clinical trial, 22 participants (11 women, age: 55-65 yr) were assigned to “exercise” or “control” groups. The exercise group completed 60 minutes/day of combined aerobic, high-intensity interval and resistance training, while the control group received passive manual therapy. OT and cardiovascular responses were assessed with a passive 80-degree head-up tilt test (HUT) to a maximum of 15 minutes, which was conducted at baseline (BDC), on day 1 (R1), 6 (R6) and on week 4 (R4wk) post-HDBR (R1 and R4wk data are not presented here). The HUT data of 1 participant were considered invalid, whereas 2 others did not complete the test protocol. Therefore, the findings of only 19 subjects are discussed herein.

Results: The HUT completion time did not change between R6 and BDC in the control ($p=1.000$) or exercise ($p=0.875$) groups. Only 3 participants (1 control, 2 men) did not complete the 15 minutes of HUT at R6. They were characterized by an increased HR (non-finishers: 105.7 ± 6.8 beats/min, finishers: 83.7 ± 2.9 beats/min; simple effect: $p=0.007$) and reduced SV (non-finishers: 52.9 ± 10.7 mL, finishers: 57.2 ± 4.6 mL; main effect: $p=0.979$) at HUT termination, during R6.

Conclusion: The HUT completion time at R6 recovered from HDBR. This result suggests that OT is regained at least by day 6 post-HDBR in older adults. These observations differ from young adults who underwent bedrest protocols that lasted less than 37 days. They recovered OT later, 17-50 days post-bedrest. As shown by HUT finishers, the capacity of older individuals to maintain an elevated SV without having to increase HR in order to maintain cardiac output, appears to be an important determinant of OT following HDBR.

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