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EXAMINING NITRIC OXIDE DEPENDENT MEDIATED VASODILATION DURING UPRIGHT POSTURE

Abstract

Orthostatic Intolerance (OI) is often developed by astronauts post-flight (Buckey et al.,1996). Researchers have investigated mechanisms and have often focused on changes in hemodynamic (Hargens et al.,1996) and sympathetic control (Levine et al.,2002). However, 56 days of head down bed rest (which is analogous to spaceflight) increased supine endothelial vasodilatory capacity (Dyson et al.,2007) suggesting that microgravity alters nitic oxide mediated vasodilation. The purpose of this study was to assess vasodilatory capacity in the supine and upright postures using brachial flow-mediated dilation (FMD). We hypothesized that healthy participants in the upright posture would experience significantly lower FMD due to known increases of sympathetic activity while upright (Rowell,1993). We also hypothesized that women would exhibit greater vasodilatory function in the upright posture compared to men since female astronauts are 5 times more likely to experience OI upon their return to Earth (Summers et al.,2010). We recruited 10 women and 8 men (20.6±1.8years, 27.0±6.04 kg/m2) with no history of cardiorespiratory disease. Women were tested in the low hormone phase of the menstrual cycle (days 2-5) and were not taking hormonal contraceptives. All participants completed 2 randomized FMD protocols (2min baseline, 5min forearm occlusion, and 3min recovery; 30-minute interval) in the supine posture or 70-degree head up tilt. FMD tests were conducted using duplex ultrasonography with the artery at heart level to control for gravitational fluid shifts. Shear rate (maximum and area under the curve) and FMD were calculated using automated software (Cardiovascular Suite, Quipu). Baseline diameter compared between postures was not significantly different (3.5±0.79 mm vs 3.4±0.59 mm, P>0.05) confirming the absence of gravitational fluid shifts. In the upright posture, FMD was greater compared to supine posture (14.8±3.82% vs 9.4±5.10%, P=0.005). However, maximum shear rate and shear rate area were not different between postures (940±272s-1 vs 984±322s-1 and 30429±20257s-1 vs 38197±41151s-1, respectively, P>0.05) despite lower mean arterial pressure (MAP) at the time of maximum dilation during upright posture (77.1±9.66 mmHg vs 85.8±8.24 mmHg, P=0.008) No main or interaction effects of sex were found for any variable (P>0.05). Greater FMD responses while upright, suggest greater vasodilatory capacity. We suggest that metabolite production from postural muscles are contributing to greater vasodilation in upright posture. We seek to 1) increase our sample number to further investigate sex differences, 2) investigate upright FMD after exposure to simulated microgravity, and 3) investigate contributions of endothelium-independent vasodilation.