

Common Carotid Artery Hemodynamic and Stiffness Responses to Acute and Repeated Bouts of High Intensity Cardiorespiratory and Resistance Exercise

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ABSTRACT

High intensity exercise is a popular mode of physical activity amongst professional and recreational athletes. The physiological stress induced by intense cardiorespiratory and muscular strengthening exercise has clinically relevant cardiovascular benefits. However, the immediate cerebrovascular response to acute and repeated bouts of intense exercise has yet to be determined. **PURPOSE:** To observe the hemodynamic and stiffness indexes of the common carotid artery (CCA) in response to acute and repeated bouts of cardiorespiratory and resistance exercise. **METHODS:** Participants (n=28) performed a maximal oxygen consumption test (VO_{2max}), leg strength test (1RM), a sprint interval session (SIS, all out 20m sprints, 3 sets, 6 repetitions), and a repeated leg press session (RLP, 80% of 1RM, 3 sets, 6 repetitions). CCA peak systolic velocity (PS), end-diastolic velocity (ED), time-averaged maximal velocity (TAMAX), time-averaged mean velocity (TAMEAN), pulsatility index (PI), and average diameter (DIAM) were captured in the supine position by Doppler ultrasound before and within 10 minutes of the cessation of exercise. Carotid stiffness index (β), Peterson's Elastic Modulus (E_p), distensibility (DISTEN), and compliance (AC) were also calculated. **RESULTS:** Significant changes were observed in heart rate (HR) across all condition ($p < 0.05$ for all). VO_{2max} significantly changed PS ($p < 0.001$), ED ($p = 0.029$), TAMAX ($p = 0.002$), TAMEAN ($p = 0.018$), PI ($p = 0.009$), and DIAM ($p = 0.028$). SIS significantly changed PS ($p < 0.001$), ED ($p < 0.001$), TAMAX ($p < 0.001$), TAMEAN ($p < 0.001$), β ($p = 0.009$), E_p ($p = 0.008$), AC ($p < 0.001$), DISTEN ($p = 0.002$). When comparing response of each measure (Δ) between conditions, main effects were evident for HR ($p < 0.001$), PS ($p = 0.002$), ED ($p = 0.009$), PI ($p = 0.003$), β ($p = 0.027$), E_p ($p = 0.047$), DIAM ($p = 0.027$), DISTEN ($p = 0.017$). **CONCLUSION:** Acute and repeated bouts of high intensity cardiorespiratory and resistance exercise induce hemodynamic and stiffness changes in the CCA, with differences in response observed between conditions.