

High-Density Lipoprotein Antioxidant Responses to High-Intensity Interval and Steady-State Moderate-Intensity Exercise

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ABSTRACT

High-intensity interval exercise (HIIE) may impart health benefits beyond what is acquired through moderate-intensity steady state exercise (SSE). Paraoxonase 1 (PON1), an antioxidant associated with high-density lipoprotein (HDL), may be altered with exercise; however, it is unclear whether HIIE provides a greater stimulus for increasing PON1 antioxidant activity than a comparable or greater amount of SSE. PURPOSE: Determine the influence of HIIE on PON1 concentration and activity relative to a comparable amount of moderate-intensity SSE and a dose that is half that of SSE. METHODS: Seventeen male participants (age 27.8 ± 6.4 yr; weight 80.6 ± 9.0 kg; BMI 25.1 ± 2.4 kg/m²; %fat = 19 ± 5 ; VO₂max 52.1 ± 7.5 ml/kg/min) underwent HIIE by treadmill running (90% and 40% of VO₂reserve in 3:2 min ratio) to expend 500 kcals (H500); HIIE to expend 250 kcals (H250), and; SSE at 70% VO₂reserve to expend 500 kcals (M500) in a randomized crossover design. Intensities of all exercise conditions averaged 70% VO₂reserve. Blood measures of total antioxidant capacity (TAC) in copper reducing equivalents, HDL (□g/mL), apolipoprotein A-1 (ApoA1: g/L), PON1 concentration (PON1c: □g/mL) and arylesterase activity (PON1a: kU/L) were obtained just before, immediately after, 2 hr and 24 hr after exercise. Significant differences were determined using 3 by 4 repeated measures ANOVAs. Effect sizes were calculated to determine the magnitude of dependent variable responses to exercise. RESULTS: Pre-exercise HDL concentration was lower in H250 and increased most in H250 versus other exercise conditions ($p < 0.001$, ES = 0.83). Other antioxidant responses were similar across exercise conditions. ApoA1 (+ 8.0%) and PON1a (+ 9.3%) increased immediately after exercise and remained elevated 24 hr after exercise ($p < 0.0001$ for each; ApoA1 ES = 0.85, PON1a ES = 0.57). PON1c was increased 2.4% above baseline at 2 hr post-exercise ($p = 0.0296$, ES = 0.18) and TAC was elevated 8.6% above baseline at 24 hr post-exercise ($p = 0.0227$, ES = 0.48). SUMMARY: HDL and HDL antioxidant properties are transiently potentiated by HIIE with as little as 250 kcals of energy expenditure. HDL antioxidant activity and total antioxidant capacity are elevated with HIIE and SSE of moderate intensity in a similar manner and are observed for up to 24 hr after exercise.