

The Synergistic Effects of Environmental Heat Stress and High Intensity Interval Training (HIIT): Impact On Measures of Cardiovascular Function and Performance

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Abstract

The adverse effects of heat stress on markers of exercise performance (e.g. running endurance, power production) and markers of cardiovascular health (CV; e.g. blood pressure, heart rate variability [HRV]) have been well documented. However, effective interventions targeted at mitigating the impact of heat stress remain elusive. **PURPOSE:** To investigate the synergistic effects of HIIT and exercise heat acclimation (EHA) on physiological function, running, and vertical jump performance. **METHODS:** Using a between subjects, parallel design, 10 male (n=5) and female (n=5) participants were allocated to completed six sessions of HIIT in the heat (30°C, 50% RH) or in thermoneutral conditions (~20°C, 15% RH). Heart rate (HR), rating of perceived exertion (RPE), and thermal sensations (TS) were recorded during all HIIT sessions. To understand potential impacts on CV function, HR, HR variability (HRV; root mean square of successive differences; RMSSD, and standard deviation of N-N intervals; SDNN), central (cBP), and systolic blood pressure (sBP) were taken. A 5 km time-trial and graded treadmill exercise were also conducted to assess for running performance and economy, respectively. A vertical jump (VJ) test was employed to analyze for changes in anaerobic performance (power and velocity). The battery of assessments were conducted prior to, and post, training intervention. **RESULTS:** HIIT in the heat had no effect ($p < 0.05$) on resting values of HR and HRV. However, central and peripheral systolic BP decreased by 7% and 9%, respectively ($p < 0.05$). Trends towards improved central ($p = 0.09$) and peripheral ($p = 0.08$) diastolic BP were observed. Although no differences in 5 km time-trial and running economy were revealed ($p < 0.05$), an increase of 4 ml/kg/min in estimated $\text{VO}_{2\text{max}}$ was documented in the heat group, and significance found when analyzed as percent change (+8% increase; $p < 0.05$). Trends ($p = 0.10$) towards improved average VJ velocity and power were also observed. **CONCLUSION:** EHA in conjunction with HIIT may help improve resting blood pressure, oxygen utilization, and markers of anaerobic performance (as assessed by VJ velocity and power), though its effect on aerobic exercise performance may require a longer training intervention and/or varying HIIT protocol. Importantly, the conferred benefits of EHA seem to transfer to thermoneutral conditions.

Keywords: HIIT, Heat, Endurance, Training, Intervals, Acclimation, Fitness, Anaerobic, Blood Pressure, Running