The Effects of Passive Heat Exposure on Five-Kilometer Running Performance in Hot Environments for Recreational Runners

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Introduction

Numerous studies demonstrate both the health benefits and improved markers for exercise capacity with passive heat exposure such as sauna and/or hot water immersion. Yet, there is limited research on whether these benefits translate over to increased running performance.

Purpose

1.) Investigate whether multiple passive heat exposure sessions in a steam room improves performance in a 5k time trial in a hot environment, and 2.) Investigate $VO_{2\ max}$ and submaximal heart rate in the hot environment after multiple passive heat exposures sessions.

Methods

Ten recreational runners (12.8 mi/wk ± 3.9) participated in the study. Each participant completed a pre- and post- incremental $VO_{2\ max}$ test and heat tolerance test (HTT) conducted separately over 2 days. After the pre-assessments, participants were randomly selected into 2 groups: the steam room group (SR, n=5) and control group (CON, n=5). All participants were asked to continue their running routines without change while the SR participants added once-daily steam room sessions (30 min sessions for total of 10 sessions at 40.6-43.3°C). The intervention was carried out over the course of 13 ± 1 days excluding the testing days with a total time of ~18 days.

A two-way repeated measures ANOVA (group x time) was used to determine the effects on the assigned treatment group (SR or CON) on 5k time, VO_{2max}, and average heart rate at 3 selected intervals (INT 1, INT 2, INT 3) recorded during the first half of the 5k run during the HTT. Data portrayed represents those that were able to fully complete both pre- and post- assessments.

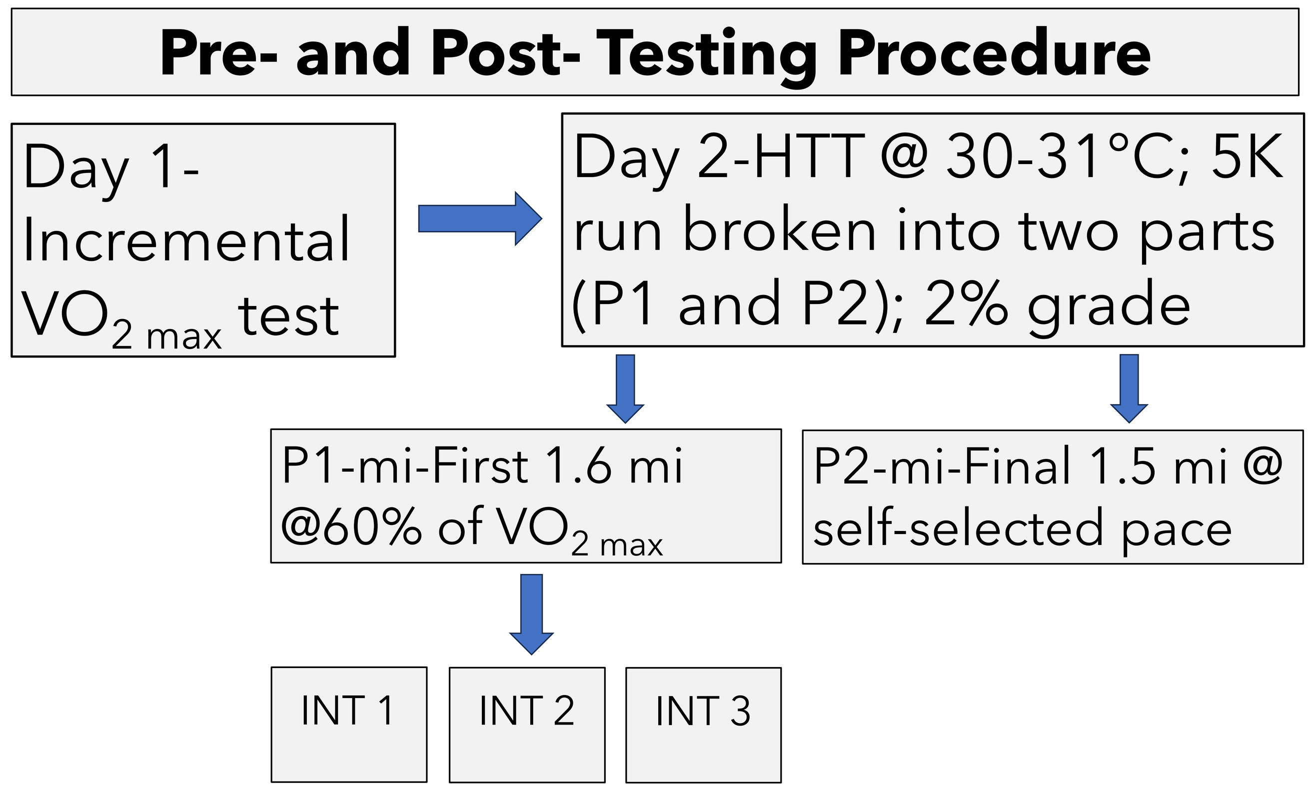

Figure 1-Diagram of the testing procedures conducted separately over two days. Day 2 heat tolerance test (HTT) was divided into two parts: part 1 and part 2 (P1, P2). P1 was divided into three intervals: Intervals 1, 2, and 3 (INT 1, INT 2, INT3) for HR recording.

Results

No significant difference was observed in P2 of the 5k time between the SR and CON group (p=0.568; η^2_p=.038). There was a significant improvement in pre-/post-VO_{2max} in the SR group (SR Pre: 48.54 mL*kg*min^{-1} ± 8.53, SR post: 53.59 mL*kg*min^{-1} ± 10.91; p=0.045; Cohen's d=0.606) with no change in the CON group (CON Pre: 53.28 mL*kg*min^{-1} ± 6.97, CON Post: 53.92 mL*kg*min^{-1} ± 6.13, Cohen's d=0.077). No effects were observed in average heart rate between SR and CON groups during INT1 (p=0.625, η^2_p=0.038), INT2 (p=0.486, η^2_p=0.065), or INT3 (p=0.659, η^2_p=0.029)

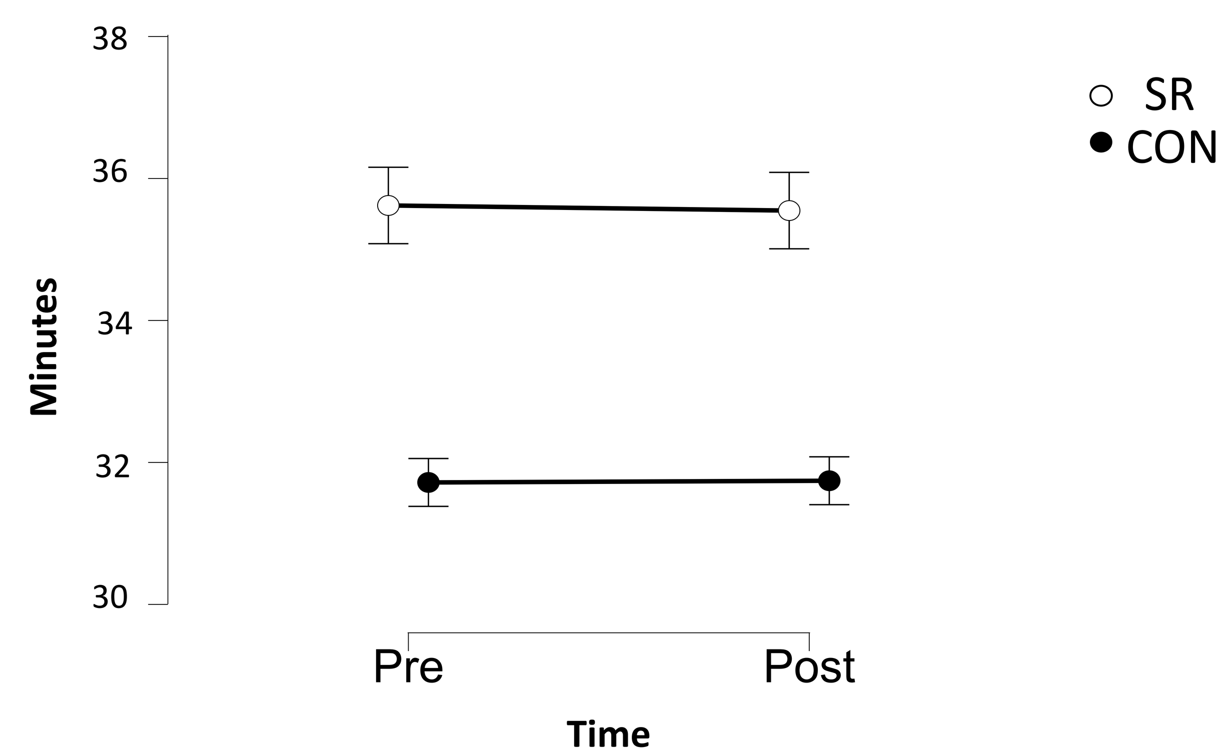

Figure 2-The average time to complete a treadmill 5k for the steam room group (SR, n=5) and the Control group (CON, n=5).

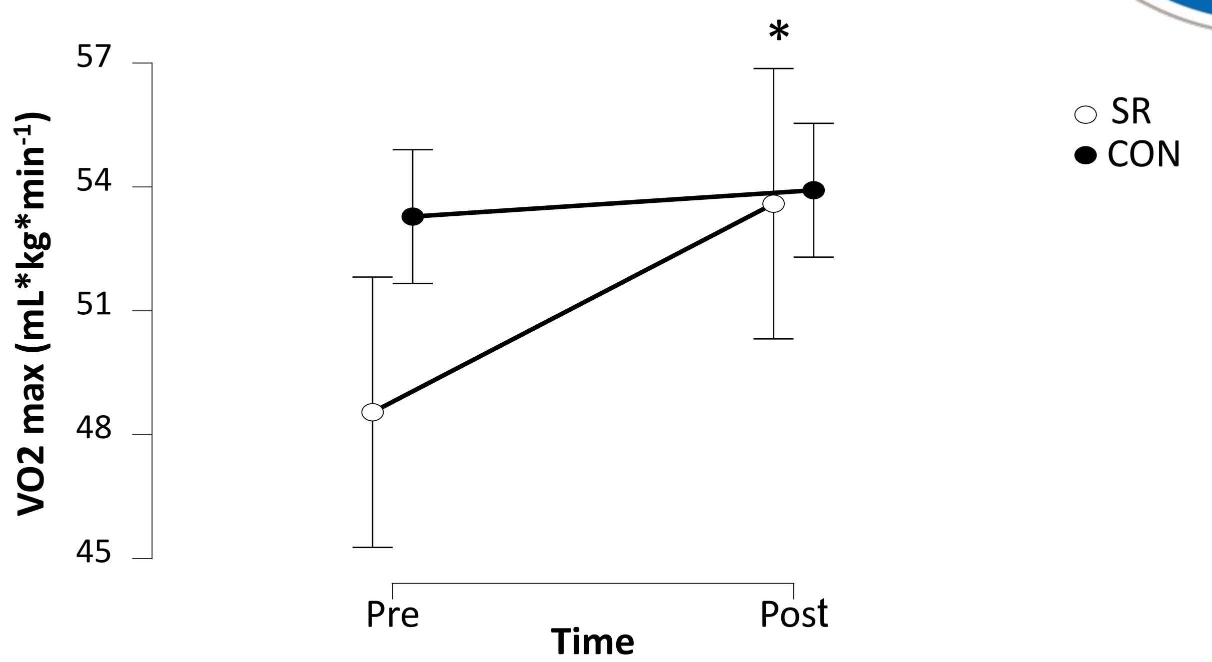

Figure 3-Measured changes in VO_{2max} before and after the steam room treatments (SR, n=5) and control group (CON, n=5). Significant improvement in SR (95% CI, Pre: 48.54 mL*kg*min^{-1} ± 8.53, SR post: 53.59 mL*kg*min^{-1} ± 10.91; p=0.045; Cohen's d=0.606)

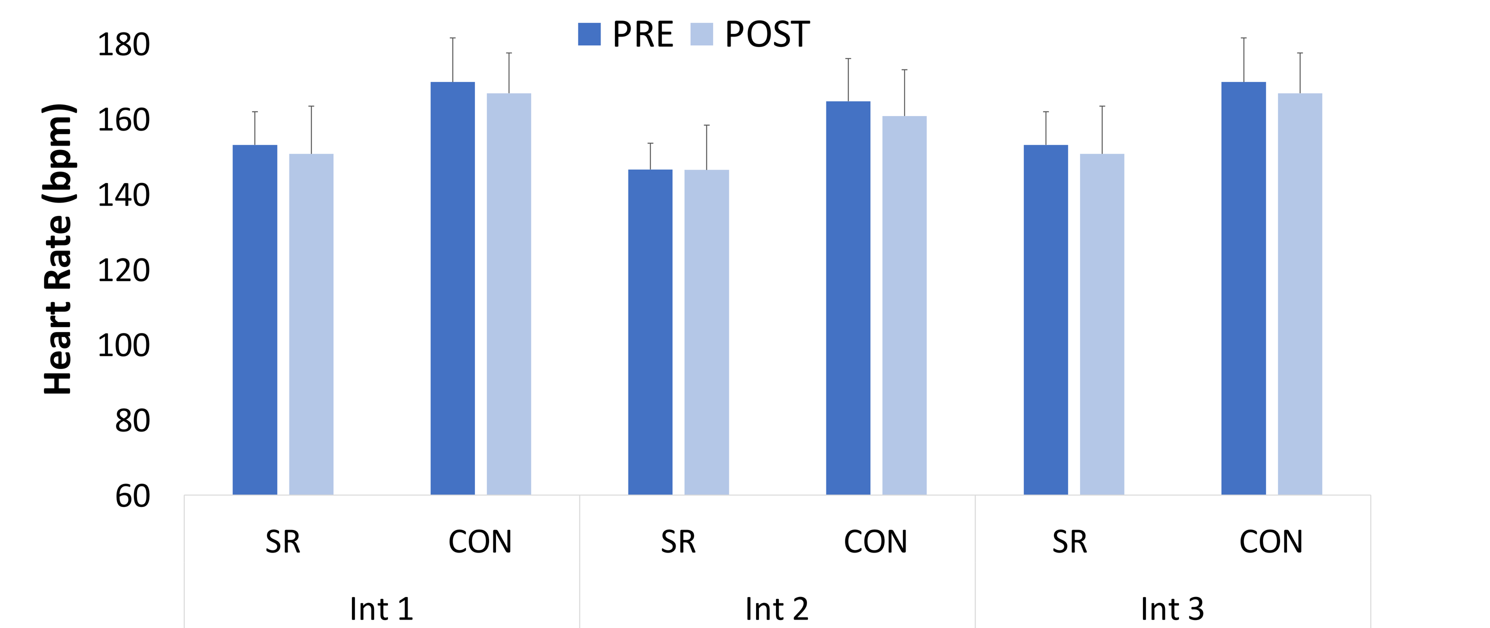

Figure 4-Average heart rate recorded during the final 15 minutes of the initial part of the 5k (first 1.6 miles). Each interval represents a 5-minute period. (SR, n=5; CON, n=5)

Conclusion

Running performance in a 5k time trial in 30°C environment was unaffected by passive heat exposure through steam room sitting. There was a significant increase in $VO2_{max}$ while submaximal heart rate remained unaffected.

Practical Applications

Athletes who live and train in colder environments but may compete in a warmer climate are at a distinct performance disadvantage as a result of not being heat-acclimated. While passive heat exposure may provide an accessible and practical means to mitigate that barrier, our investigation was unable to demonstrate performance would improve in recreational runners.