Title:

The physiological and perceptual responses of restrictive heat loss attire in hot and temperate conditions.

Authors:

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Efficacy of sauna suit

Introduction:

Athletes and military personnel undertake heat acclimation (HA) to confer physiological/perceptual adaptation to heat stress. HA typically occurs within environmental chambers, which may be impractical precluding use of the intervention. An alternate HA method aside from post-exercise bathing and sauna use, includes restricting evaporative heat loss during exercise. We investigated the efficacy of an inexpensive and practical sauna suit across hot/temperate conditions to induce equivalent physiological strain to HA.

Methods:

Ten moderately trained individuals (mass; 69.4±7.5kg, statue; 1.8±0.1m, body fat; 19.2±7.2%) completed four randomised exercise sessions. Participants cycled for 30min (15min at 2W.kg^{-1} then 15min at 1W.kg^{-1}) under four experimental conditions; temperate (TEMP, 22°C/45%), temperate whilst wearing a vinyl sauna suit (TEMPSAUNA, 22°C/45%), hot (HOT, 45°C/20%) and hot whilst wearing a vinyl sauna suit (HOTSAUNA, 45°C/20%).

Results

Core temperature changes were greater in TEMPSAUNA (+1.7°C.hr^{-1}), HOT (+1.9°C.hr^{-1}) and HOTSAUNA (+2.3°C.hr^{-1}) than TEMP (+1.3°C.hr^{-1}). Peak HR was higher ($p<0.05$) in HOTSAUNA (171 beats.min^{-1}) than TEMP (151 beats.min^{-1}). Sweat loss was greater ($p<0.05$) in TEMPSAUNA (1.0L.hr^{-1}), HOT (1.2L.hr^{-1}) and HOTSAUNA (1.5L.hr^{-1}) than TEMP (0.6L.hr^{-1}). Thermal sensation was greater ($p<0.05$) in TEMPSAUNA (6), HOT (6) and HOTSAUNA (7) than TEMP (5). No differences ($p>0.05$) were observed between TEMPSAUNA and HOT for core temperature, sweat loss, or perceived exertion. HOT SAUNA was greater ($p<0.05$) than all other conditions.

Conclusion:

Wearing sauna suits to restrict heat loss during exercise in temperate conditions increases physiological and perceptual responses to a comparable magnitude of equivalent exercise in a typical HA environment. Such methods in hot conditions further increases physiological and perceptual strain and may make HA more efficient. Wearing sauna suits during training in temperature conditions could be a viable alternative to environmental chambers. However, the efficacy of these garments during repeated exposures to determine magnitude of heat adaptation vs. established HA needs to be determined.

Introduction

OVER-DRESSING DURING EXERCISE IN TEMPERATE ENVIRONMENTAL CONDITIONS MIMICS PHYSIOLOGICAL STRAIN OF EXERCISE IN THE HEAT

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Abstract

The impact of environmental heat stress can be evaluated using a physiological strain index (PSI) that incorporates rectal temperature (T_{re}) and heart rate (HR) of a subject during exercise. Athletes interested in the performance benefits of heat acclimation often over-dress during exercise in temperate environments in an attempt to simulate heat stress, but it is unknown whether this creates a similar level of physiological strain as exercise in the heat. PURPOSE: To compare the PSI of athletes exercising in a HOT (40C; 30% RH) environment and with excess clothing in a COOL (15C; 50% RH) environment. METHODS: Eight endurance trained athletes were studied (5M, 3F; Aged 23 ± 7 years; VO_{2max} 59.8 ± 10.2 ml/kg/min) during one hour of running at 50% of their VO_{2max} in HOT and COOL environments. In the HOT trial, the clothing was minimal (singlet and shorts). In the COOL trial, multiple insulative and vapor-impermeable layers were worn to impose similar themoregulatory strain as the HOT trial. T_{re} and HR were recorded at 5 minute intervals and used to calculate PSI = $5(T_{re}\ t - T_{re0}) \cdot (39.5 - T_{re0})^{-1} + 5(HR t - HR_0) \cdot (180 - HR_0)^{-1}$. Mean PSI was compared using paired sample t-tests, and PSI values were additionally compared between trials using an a priori zone of indifference of ±1. RESULTS: PSI rose over time in both environments (HOT: 2.95 to 8.71; COOL: 2.80 to 7.25) Mean PSI was higher in HOT compared with COOL (6.00 ± 0.95 vs 5.16 ± 1.10; p=.042). When comparing mean PSI between HOT and COOL, 5 of 8 subjects tested were within the zone of indifference. The 3 subjects that were outside of the zone had the highest initial HR of all the subjects tested. CONCLUSIONS: These preliminary data suggest that overdressing during a bout of exercise in a temperate environment results in significant increases in PSI, but that the ensemble used did not fully match the HOT condition. By adequately overdressing, athletes may be able to mimic heat stress and potentially obtain the benefits of heat acclimation in a cooler environment.

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