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MEETING ABSTRACT Open Access

The influence of body morphology on changes in core temperature during exercise in an uncompensable environment

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Introduction

Evidence demonstrates that for unbiased comparisons of changes in core temperature (ΔT_{core}) between groups unmatched for body morphology, exercise should be performed using a fixed heat production (H_{prod}) per unit mass in physiologically compensable environments [1]. In uncompensable conditions, it has been suggested that a fixed external workload is the primary determinant of ΔT_{core} [2], however in addition to not accounting for differences in H_{prod} relative to mass, such an approach excludes the influence of differences the surface area-to-mass ratio on the absolute maximum rate of evaporative heat loss (E_{max}). We examined the best method for performing unbiased comparisons of ΔT_{core} between groups unmatched for body morphology during exercise in an uncompensable environment.

Methods

Six small (mean(SD) SM: 64.4(7.2) kg, 1.78(0.10) m^2, 276(21) $cm^2.kg^{-1}$) and four large (LG: 94.2(7.2) kg, 2.19(0.09) m^2, 233(8) $cm^2.kg^{-1}$) participants were recruited. E_{max} for each participant was first assessed [3]. Participants then completed three trials, during which they cycled for 75 min at 35 °C, 70 % RH, at a target (i) absolute workload of 100 W, (ii) H_{prod} of 6 $W.kg^{-1}$, or (iii) H_{prod} of 3 $W.kg^{-1}$ above E_{max}.

Results

E_{max} at 35 °C, 70 % RH was similar between SM and LG in $W.m^{-2}$ (167 [27] vs. 146 [9] $W.m^{-2}$), but lower in LG in W/kg (3.4 (0.2) vs. 4.6 (0.1) $W.kg^{-1}$) by virtue of a difference in surface area-to-mass ratio. A systematically greater ΔT_{re} was observed in the SM group at an exter-

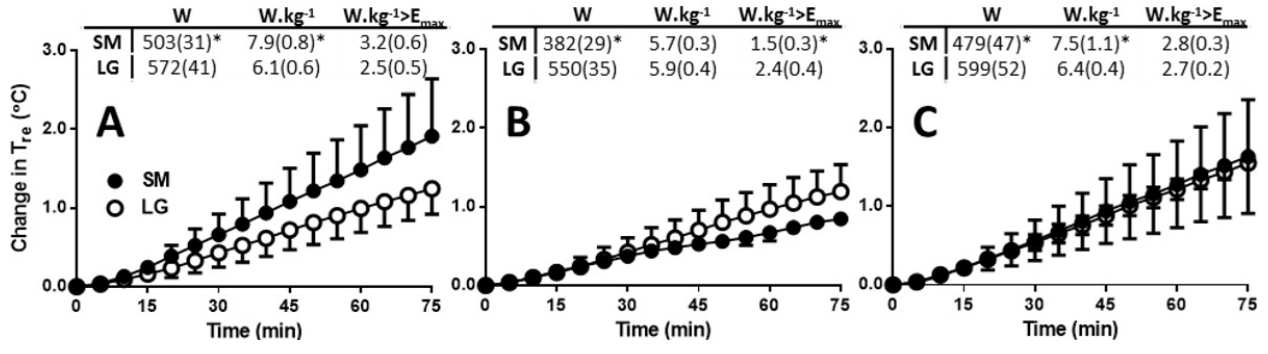

Figure 1 The change in rectal temperature (Tre) during exercise at a fixed: external workload of 100 W (A), Hprod of 6 W.kg-1 (B), and Hprod of 3 W.kg-1 above Emax (C). SM small; LG large. *Significantly different between groups within condition ($P < 0.05$).

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nal workload of 100 W (P = 0.036; Figure 1A); and in the LG group at an H_{prod} of 6 $W.kg^{-1}$ (P < 0.001; Figure 1B). This systematic difference in ΔT_{re} between SM and LG groups was abolished at a fixed H_{prod} of 3 $W.kg^{-1}$ above E_{max} (P = 0.999; Figure 1C).

Discussion

Theoretically, ΔT_{re} in an uncompensable environment should be determined by the rate of heat storage per unit mass, which is presently expressed as the difference between H_{prod} and E_{max} in $W.kg^{-1}$. At a fixed absolute workload of 100 W, ΔT_{re} and H_{prod}-E_{max} in $W.kg^{-1}$ were greater in SM. At a fixed H_{prod} of 6 $W.kg^{-1}$, ΔT_{re} and H_{prod}-E_{max} in $W.kg^{-1}$ as greater in LG due to a smaller surface area-to-mass ratio. When H_{prod}-E_{max} in $W.kg^{-1}$ was fixed between SM and LG, ΔT_{re} was the same despite a different H_{prod} in $W.kg^{-1}$.

Conclusion

Preliminary results suggest that over a fixed exercise duration in an uncompensable environment, unbiased comparisons of ΔT_{re} between groups/individuals of different body size (mass and BSA) may be best attained using an exercise intensity at a fixed H_{prod}-E_{max} in $W.kg^{-1}$.

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