

MEETING ABSTRACT

Open Access

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

Nicholas Ravanelli¹, Matthew Cramer¹, Pascal Imbeault¹, Ollie Jay^{1,2*}

From 15th International Conference on Environmental Ergonomics (ICEE XV)
Portsmouth, UK. 28 June - 3 July 2015

Introduction

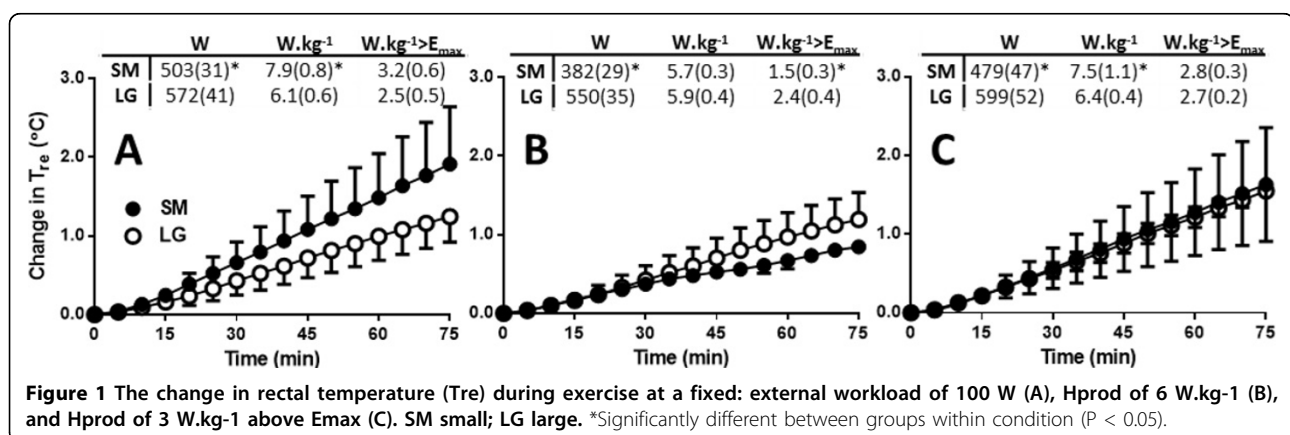
Evidence demonstrates that for unbiased comparisons of changes in core temperature (ΔT_{core}) between groups unmatched for body morphology, exercise should be performed using a fixed heat production (H_{prod}) per unit mass in physiologically compensable environments [1]. In uncompensable conditions, 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) m², 276(21) cm².kg⁻¹) and four large (LG: 94.2(7.2) kg, 2.19(0.09) m², 233(8) cm².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-



* Correspondence: Ollie.jay@sydney.edu.au
¹School of Human Kinetics, University of Ottawa, Canada
Full list of author information is available at the end of the article

nal workload of 100 W ($P = 0.036$; Figure 1A); and in the LG group at an H_{prod} of $6 \text{ W}\cdot\text{kg}^{-1}$ ($P < 0.001$; Figure 1B). This systematic difference in ΔT_{re} between SM and LG groups was abolished at a fixed H_{prod} of $3 \text{ W}\cdot\text{kg}^{-1}$ 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 $\text{W}\cdot\text{kg}^{-1}$. At a fixed absolute workload of 100 W, ΔT_{re} and $H_{\text{prod}}-E_{\text{max}}$ in $\text{W}\cdot\text{kg}^{-1}$ were greater in SM. At a fixed H_{prod} of $6 \text{ W}\cdot\text{kg}^{-1}$, ΔT_{re} and $H_{\text{prod}}-E_{\text{max}}$ in $\text{W}\cdot\text{kg}^{-1}$ as greater in LG due to a smaller surface area-to-mass ratio. When $H_{\text{prod}}-E_{\text{max}}$ in $\text{W}\cdot\text{kg}^{-1}$ was fixed between SM and LG, ΔT_{re} was the same despite a different H_{prod} in $\text{W}\cdot\text{kg}^{-1}$.

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 $H_{\text{prod}}-E_{\text{max}}$ in $\text{W}\cdot\text{kg}^{-1}$.

Authors' details

¹School of Human Kinetics, University of Ottawa, Canada. ²Thermal Ergonomics Laboratory, Faculty of Health Sciences, University of Sydney, Australia.

Published: 14 September 2015

References

1. Cramer MN, Jay O: *J Appl Physiol* 2014, **116**:1123-1132.
2. Mora-Rodriguez : *Exerc Sport Sci Rev* 2012, **40**(2):79-87.
3. Kenney WL, Zeman MJ: *J Appl Physiol* 2002, **92**:2256-2263.

doi:10.1186/2046-7648-4-S1-A143

Cite this article as: Ravanelli et al.: The influence of body morphology on changes in core temperature during exercise in an uncompensable environment. *Extreme Physiology & Medicine* 2015 **4**(Suppl 1):A143.

Submit your next manuscript to BioMed Central
and take full advantage of:

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

Submit your manuscript at
www.biomedcentral.com/submit

