Loughborough University
Institutional Repository

Muscle temperature, exercise perception and central fatigue

This item was submitted to Loughborough University’s Institutional Repository by the/an author.

Citation: LLOYD, A. ... et al, 2014. Muscle temperature, exercise perception and central fatigue. 5th International Symposium on the Physiology and Pharmacology of Temperature Regulation (PPTR), Skukuza, Kruger National Park, South Africa, 7th-12th September

Additional Information:

• This is a conference contribution.

Metadata Record: https://dspace.lboro.ac.uk/2134/18159

Rights: This work is made available according to the conditions of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0) licence. Full details of this licence are available at: https://creativecommons.org/licenses/by-nc-nd/4.0/

Please cite the published version.
MUSCLE temperature, exercise perception and central fatigue

Alex Lloyd, Nick Bowler, Simon Hodder, George Havenith

Environmental Ergonomics Research Centre, Loughborough University, Loughborough, UK

Central fatigue during thermal stress has been widely attributed to changes in core temperature as well as the central integration of perceptual feedback from the periphery. In this experiment, we examined the effect of localised changes in muscle temperature (Tm) on sensory feedback and muscle activation during maximal intensity exercise. Sixteen subjects were assessed for neuromuscular responses to a range of Tm (22°C, 28°C, 34.9°C, 37°C & 38.5°C), before, during and after, 120-s maximal isometric (n = 8) or dynamic (n = 8) knee extension exercise. Single leg water immersion was used to set Tm to the required level for each condition. Mean muscle activation (ACT%) and resting potentiated twitch force (RPTF) were used to examine the relationship between Tm, sensory feedback and central fatigue. Mean isometric force output (MIFO) and dynamic power output (DPO) was used to compare differences between the two exercise modalities. MIFO and ACT% were significant for the effect of Tm (p <0.005) showing a negative relationship (r = -0.74 & -0.66; p <0.001, respectively) across the muscle temperature continuum (-7N & -0.7% per-degree-centigrade increase). Both isometric and dynamic RPTF at the start of the exercise was significantly augmented as Tmuscle increased (p <0.001), however RPTF post-exercise was similar across conditions. Peak DPO was markedly reduced (P<0.001) in cold Tmuscle, however after 60-s of maximal dynamic exercise, DPO plateaued at a similar level across all conditions. The rate of decline in PO was therefore higher (p < 0.001) in hot Tm (-85.3 W.min⁻¹) and thermoneutral Tm (-82.1 W.min⁻¹) compared to cold Tm (-51.2 W.min⁻¹).

The negative relationship between ACT% and Tmuscle indicates that Tmuscle can affect central fatigue onset, contributing in part to a reduction in mean force output during sustained isometric contractions. While this may not be significant to override the optimised force-velocity relationship in hot muscle, the contributory effects of the increases in muscle sensory feedback may still contribute significantly to early exercise cessation.

Presenting author: A.Lloyd@Lboro.ac.uk