Does nitric oxide modulate postexercise skin blood flow and sweating?

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Introduction

It is well established that core body temperature remains elevated during postexercise recovery due to a rapid suppression in heat loss responses (i.e., skin blood flow and sweating) (1). However, the mechanism(s) by which skin blood flow (SkBF) and sweating are suppressed remains to be fully elucidated. Nitric oxide has been previously shown to have a notable role in the control of skin blood flow (SkBF) (2) and sweating (3) during exercise-induced heat stress. Thus, we examined whether nitric oxide modulates the suppression of heat loss responses following intermittent exercise.

Methods

Three young males (26 ± 5 years) cycled at 70% of their maximal aerobic capacity (VO_{2max}) for two 30 minute bouts, each followed by 30 minutes of seated recovery. Two intradermal microdialysis fibres were inserted into the forearm and were perfused with: *1*) Lactated Ringer's (Control); or *2*) 10 mM L-NAME (non-selective nitric oxide synthase inhibitor). SkBF (laser Doppler), sweat rate (ventilated capsule), and esophageal temperature were measured continuously. SkBF responses are presented as maximum cutaneous vascular conductance (CVC) calculated as SkBF (perfusion units) divided by the mean arterial pressure.

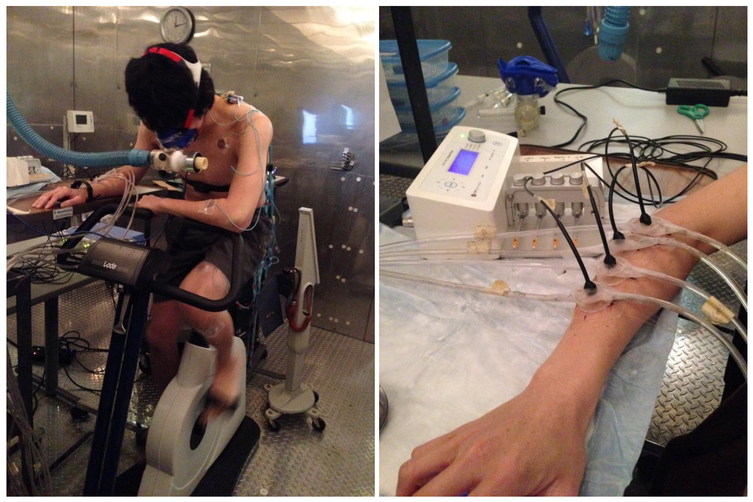

Figure 1. Lactated Ringer's solution and L-NAME were infused continuously via microdialysis (right). Subjects cycled for two 30 min bouts at 70% of VO_{2max} (left).

Results

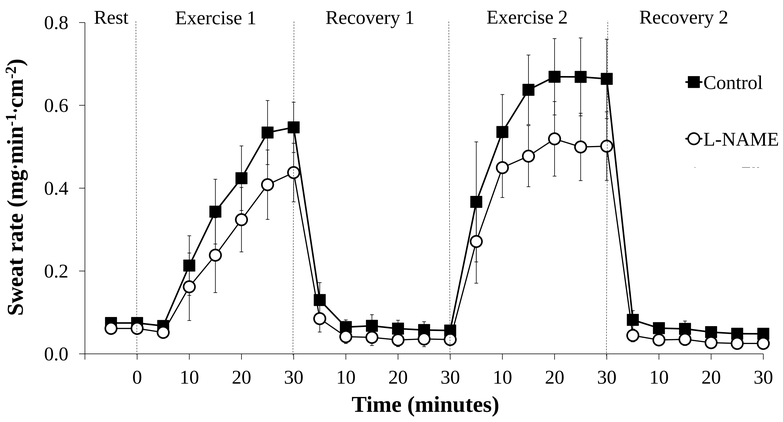

Figure 2. Sweat rate measured at 5 minute intervals starting at baseline (Rest) and continuing through two bouts of exercise (Exercise 1 and 2) and two recovery periods (Recovery 1 and 2). Filled squares, Control; open circles, L-NAME. Values represented by the mean ± standard error.

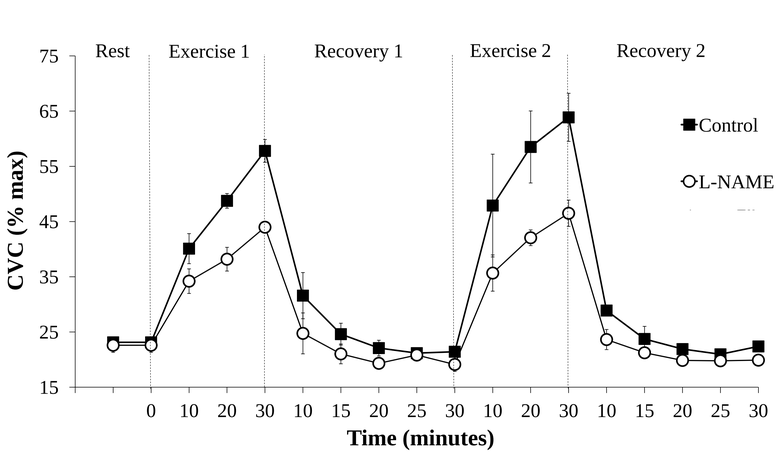

Figure 3. Cutaneous vascular conductance (CVC) measured at 10 minute intervals during two exercise bouts (Exercise 1 and 2), and 5 minute intervals during recovery periods (Recovery 1 and 2)**.** Measurements began at baseline (Rest) in both instances. Filled squares, Control; open circles, L-NAME. Values represented by the mean ± standard error.

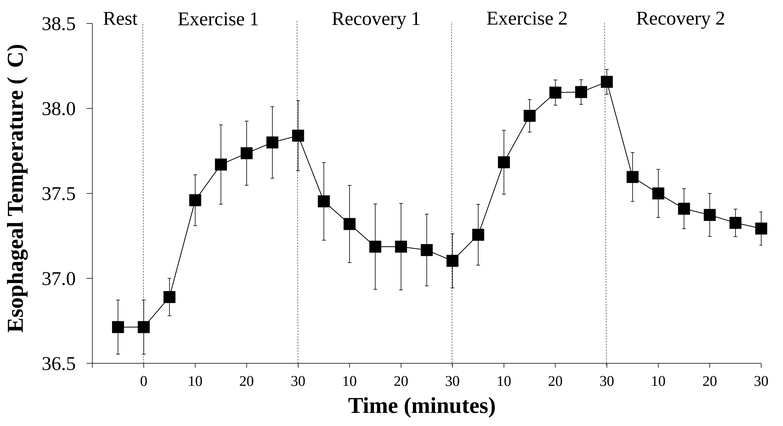

Figure 4. Esophageal temperature measured at 5 minute intervals beginning at baseline (Rest), and continuing through cycling exercise (Exercise 1 and 2), and during the subsequent recovery periods (Recovery 1 and 2). Filled squares, Control. Values represented by the mean ± standard error.

Conclusion

Our results are consistent with previous studies indicating that nitric oxide modulates both SkBF (2) and sweat rate (3) during exercise. In addition, we show that SkBF (measured as CVC) was greater at Control versus L-NAME within the first 10 minutes of Recovery 1 (33 *vs*. 24%) and Recovery 2 (28 *vs*. 19%), respectively. However, SkBF was similar between sites for the remaining 20 minutes of each recovery period. In contrast, no differences in sweat rate were observed throughout either of the recovery periods. Therefore, we show that nitric oxide contributes to the modulation of SkBF in the early stages of recovery; however, nitric oxide does not modulate the postexercise suppression of sweat rate. Further research is warranted to examine the role of nitric oxide during recovery as a function of greatest levels of exercise-induced hyperthermia.

References

1. Kenny & Jay. *Compr Physiol* 3:1689-1719, 2013.

2. McGinn et al. *J Physiol*, In Press.

3.Stapleton et al. *Exp Physiol*, In Press.

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