Thigh venous occlusion does not increase sudomotor drive during sinusoidal exercise

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During dynamic exercise, a complex interaction of thermal and non-thermal inputs drives sudomotor activity. We have previously reported evidence consistent with the existence of intramuscular thermoreceptors1, with muscle temperature changes accounting for 31% of the variability in sudomotor drive during exercise. To further test the hypothesis that sweating during dynamic exercise may be driven by intramuscular thermoafferents, we repeated this experiment with venous occlusion (thighs), thereby delaying the elevation in core, but not muscle, temperature.

Ten males performed semi-recumbent cycle ergometry in 25°C (50% R.H.). After 35 mins of steady-state exercise at 35% of peak power (119.9 watts), subjects completed a sinusoidal-forcing function (period 8 min), varying between 30 watts and 60% of peak power (205.6 watts): control). After returning to steady-state cycling for 10 min, a second sinusoidal-forcing function was instituted with venous occlusion applied to both thighs (8 min). Oesophageal temperature (T_{es}), skin temperatures, cardiac frequency (f_c), mean arterial pressure (MAP) and sweat rate (forehead, chest, forearm) were measured.

From a steady-state T_{es} of 37.3°C (±0.3), T_{es} tracked the control sinusoidal function with a mean phase delay of 140.6 s (±24.3). However, the T_{es} response was delayed during venous occlusion (198.1±21.0 s) relative to the control waveform ($P<0.05$), and remained elevated while work rate decreased. Sweating also tracked the first 90^o of each waveform, with neither its phase delay nor its amplitude being modified by occlusion ($P>0.05$). Sweat rate also failed to decline when work rate decreased. Significant increases were observed for f_c, MAP and psychophysical indices after 4 min of occlusion, relative to control ($P<0.05$).

These observations indicate that central (core) thermoafferents did not dominate sudomotor drive when work rate was increasing. Since muscle temperature responds very rapidly with work rate changes, it is possible that intramuscular thermoafferents contributed to sudomotor drive, but we are unable to evaluate the contribution of non-thermal afferents. However, when work rate was decreasing, it appeared that central thermoafferents again dominated sudomotor control.

(1) Russell, G., Hennekens, D., Groeller H., and Taylor, N.A.S. (1999). Sudomotor responses to sinusoidally-driven core, cutaneous and intramuscular temperatures. Proceedings of the Australian Physiological and Pharmacological Society. 30(2): 23P