CALF DERMAL BLOOD CONTENT AND SKIN TEMPERATURE DURING INCREMENTAL UPPER BODY EXERCISE

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During prolonged upper body exercise in cool conditions a gradual decrease in calf skin temperature has been observed, presumably due to redistribution of blood from the relatively inactive lower limb to the active upper body (Price and Campbell, 1997). However, little data exists regarding the relationship between leg blood flow and skin temperature during upper body exercise. Therefore, the aim of this study was to examine this relationship. Eight male subjects (mean±SD age, 23.1±4.1 yrs; height, 179.3±9.4cm and weight, 78.1±9.7 kg) undertook incremental arm crank ergometry on an electronically braked ergometer (Lode, Groningen, the Netherlands). Subjects exercised for four minutes at workloads of 30, 50, 70 and 90W at a cadence of 70 rev.min^{-1} with 6 minutes rest between stages. Following the last rest period subjects exercised continuously at 20W.2min^{-1} from an initial load of 110W until volitional exhaustion. Environmental temperature was similar for all trials (21.3±1.3°C). Expired air was analysed by an online gas analysis system (Vacumed, Turbofit, USA). Calf dermal blood content was measured by a photoplethysmograph (Rheo Dopplex II, Huntleigh Diagnostics, UK) attached 10 cm superior to the medial malleolus. Calf dermal blood content (CDBC) and refill times were assessed via standard photoplethysmographical techniques (post 10 dorsiflexions in the seated position). Skin temperatures were measured via a Grant meter logger (Squirrel 1200 Series, UK) from thermistors attached to the forehead, forearm, upperarm, back, chest, abdomen, thigh and calf (medial and lateral). Aural temperature was measured from a thermistor inserted into the auditory canal and insulated with cotton wool. All temperature measures were recorded at one minute intervals. Blood flow was recorded immediately after the cessation of each exercise stage and at volitional exhaustion. All data were analysed by repeated measures Analysis of Variance. During incremental exercise CDBC decreased to 86.0±16.0, 79.7±7.0, 83.2±12.6, 76.4±10.7 and 57.5±12.6% of initial values at 30, 50, 70, 70W and volitional exhaustion, respectively ($P<0.05$). Lateral calf skin temperature decreased from 29.8±0.7°C at rest to 29.7±0.6, 29.5±0.6, 29.3±0.5, 29.0±0.5 and 28.2±0.4°C at 30, 50, 70, 70W and volitional exhaustion, respectively, whereas upper body skin temperatures increased ($P<0.05$). CDBC and lateral calf skin temperature decreased linearly with exercise intensity ($P<0.05$; $R^2=0.935$; $P<0.05$; $R^2=0.996$, respectively). The relationship between CDBC and lateral calf temperature was also linear ($R^2=0.865$). No differences were observed between medial and lateral calf skin temperatures. The results of this study suggest that calf dermal blood content decreases with increases in exercise intensity and may represent a similar graded response akin to that observed for visceral blood flow during lower body exercise. In addition, either lateral or medial calf skin temperature may be used as an indication of calf dermal blood content and haemodynamics during upper body exercise.

Price, M.J. and Campbell, I.G. (1997) Thermoregulatory response of paraplegic and able-bodied athletes at rest and during prolonged upper body exercise and passive recovery. *Eur. Journ. Appl. Physiol.* 76:552-560.

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