

Role of sensory nerves in the rapid cutaneous vasodilator response to local heating in young and older endurance-trained and untrained men

1. Introduction

- In humans, the skin blood flow (SkBF) response to a non-painful, rapid heat stimulus consists of two phases: an initial peak followed by a secondary rise and plateau (Figure 1C; Kellogg *et al.*, 1999).
- The magnitude of both these phases is diminished with advanced age (Minson *et al.*, 2002), potentially making the elderly more susceptible to local tissue damage in response to directly applied heat.
- The mechanisms underpinning the age-related decline in the initial peak are unclear.
- Sensory nerves are known to contribute to the initial peak (Minson *et al.*, 2001).
- We investigated whether the age-related decline in the initial peak was due to diminished sensory nerve function and whether habitual aerobic exercise prevents this age-related decrement.**

2. Methods

- Using laser Doppler flowmetry, we measured SkBF at baseline and during 35 min of local heating (42°C; Figure 1) at two forearm sites in young and older endurance-trained and untrained men (Table).
- One skin site was pre-treated with topical local anaesthetic cream (EMLA) to block local sensory innervations (Figure 1A).
- SkBF was expressed as cutaneous vascular conductance (CVC: SkBF/mean arterial pressure) and indexed to a percentage of maximum (%CVCmax) obtained via local heating to 44°C.
- Analysis: Two-factor (group × condition), mixed-model ANOVAs with Tukey *post-hoc* tests. Data are means ± SEM and significance was set at $P \leq 0.05$.

3. Results

- At the control site, the initial peak was lower in the older untrained group compared to all other groups, both when expressed as raw CVC (Table) and %CVCmax (Figure 2).
- Sensory nerve blockade decreased the initial peak in all groups such that there were no between-group differences at the EMLA-treated site (Table & Figure 2).

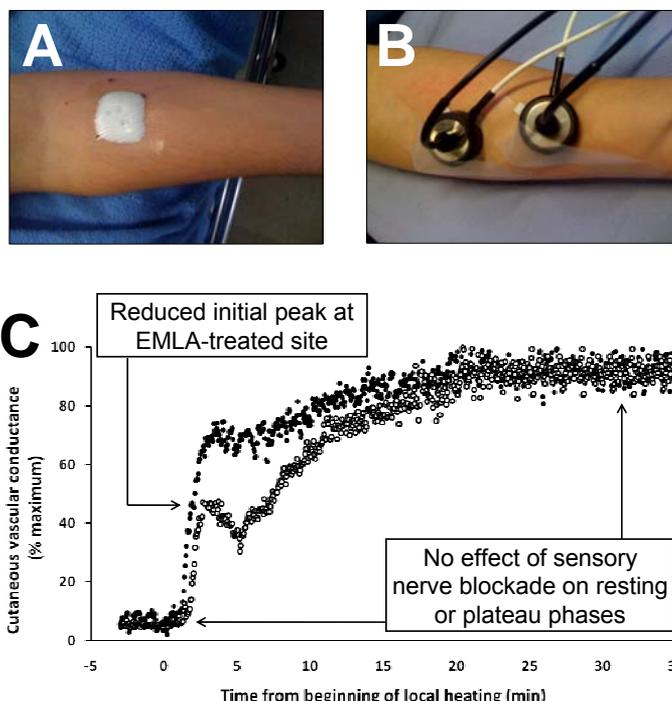


Figure 1. Experimental set-up: A, EMLA cream application for 90 min; B, Integrated laser Doppler flowmetry probes at EMLA and control sites; C, Typical %CVCmax responses during 35 min of local heating at 42°C.

Table. Participant characteristics and SkBF data

Variable	Young trained (n = 7)	Young untrained (n = 7)	Older trained (n = 7)	Older untrained (n = 7)
Age (years)	24 ± 1	25 ± 1	64 ± 1*	64 ± 1*
Body mass (kg)	78 ± 4	75 ± 7	77 ± 3	85 ± 4
Stature (cm)	180 ± 1	179 ± 2	175 ± 2	179 ± 3
VO _{2max} (mL·kg ⁻¹ ·min ⁻¹)	58 ± 3†	40 ± 2	44 ± 2	28 ± 2†
Control initial peak CVC	2.86 ± 0.30	2.09 ± 0.21	2.19 ± 0.25	1.88 ± 0.12†
EMLA initial peak CVC	1.51 ± 0.29	1.50 ± 0.16	1.52 ± 0.19	1.33 ± 0.12
Control maximum CVC	3.76 ± 0.34†	2.82 ± 0.29	2.71 ± 0.34	2.75 ± 0.13

*versus young groups ($P < 0.05$); †versus all other groups ($P < 0.05$)

4. Discussion

- The lower control-site initial peak responses of the older untrained group suggest that sedentary ageing is associated with an increased risk of local tissue damage when heat is directly applied to the skin surface.
- These lower responses appeared to be explained by diminished sensory nerve-mediated vasodilatation, because the initial peak did not differ between groups at sites pre-treated with EMLA cream.
- Our findings also suggest that sensory nerve-mediated cutaneous vasodilator function can be preserved into advanced age by participating in regular aerobic exercise training.

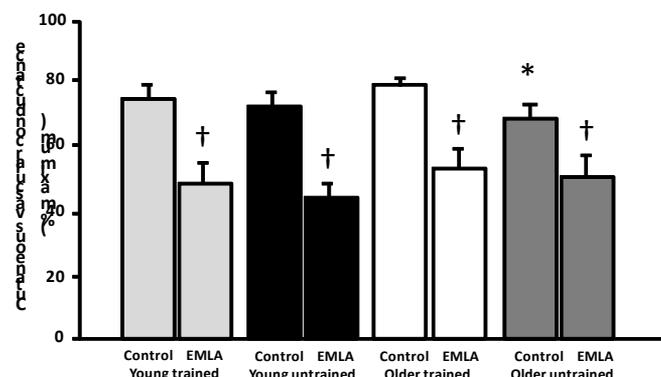


Figure 2. Initial peak CVCmax data for control and EMLA-treated sites. *versus all other groups ($P < 0.05$); †versus control site ($P < 0.05$)