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MEETING ABSTRACT Open Access

Peripheral thermal responses in normal and cold-sensitive individuals to sublingual Glyceryl Trinitrate (GTN)

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Introduction

Non-freezing cold injury (NFCI) is caused by prolonged exposure of the extremities to cold. The long-term sequelae of NFCI, include cold-sensitivity and pain[1]. The cold sensitivity is characterised by a reduction in basal skin blood flow and augmented vasoconstriction during cold exposure. We tested the hypothesis that sublingual GTN would increase blood flow in the peripheral microcirculation during and after a mild cold challenge in individuals who had not been diagnosed with NFCI, but were cold-sensitive.

Methods

In air at 30 °C, seven control and six cold-sensitive participants undertook 12 min of gentle exercise prior to immersing their right foot (protected by a thin plastic bag) into 15 °C water for 2 min, followed by 10 min of spontaneous rewarming. Two minutes prior to immersion, participants were given either 400 μg GTN or placebo sublingually in a single-blinded, counter-balanced order. Toe pad skin temperature (T_{sk}) and blood flow (SkBF) were measured using infrared thermography and laser Doppler flowmetry respectively.

Results

In the placebo condition, T_{sk} was significantly lower in Cold-sensitive participants compared to controls throughout the test ($P < 0.001$) as was SkBF ($P < 0.05$).

GTN increased the rate of rewarming (°C.min^{-1}) and absolute T_{sk} of the coldest toe after the cold challenge in Cold-sensitive (placebo: 0.62(0.14) °C.min^{-1}, 28.03(0.92) °C; GTN: 1.08(0.29) °C.min^{-1}, 32.20(2.43) °C; $p < 0.001$) but not control individuals (Figure 1). GTN also increased the blood flow in the great toe during rewarming in some cold-sensitive individuals.

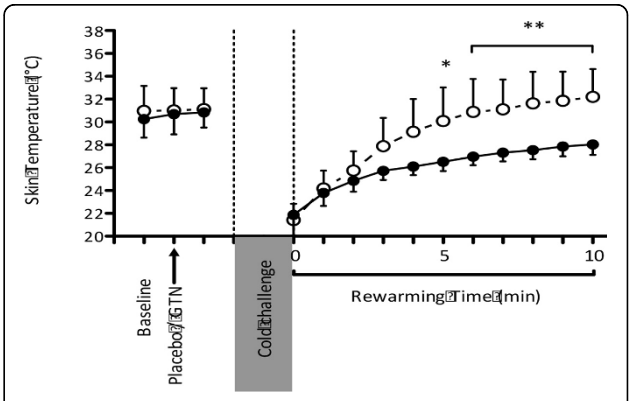

Figure 1 Mean (SD) T_{sk} of coldest toe before and after foot immersion in 15 °C water in Cold-sensitive group following placebo (l) or GTN (¡) * $P < 0.05$, ** $P < 0.001$

Discussion

We accept our hypothesis that impairment in the vasodilatory response seen in individuals with cold-sensitivity can be overcome by the use of GTN, an endothelial-independent nitric oxide donor, and thereby improve the rewarming of cooled peripheral tissues.

Conclusion

Individuals with cold-sensitivity show increased vasoconstrictory tone, both at rest and during warming after a cold stimulus, compared to controls. The use of GTN

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to overcome this implies an abnormal endothelium and nitric oxide pathway in this condition.

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