

# INFLUENCE OF TOPICALLY APPLIED MENTHOL COOLING GEL ON SOFT TISSUE THERMODYNAMICS AND ARTERIAL AND CUTANEOUS BLOOD FLOW AT REST

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## ABSTRACT

**Background:** Topical application of menthol is a popular form of cold therapy and chemically triggers cold receptors and increases cutaneous blood flow. However, although cutaneous blood flow increases, it remains unknown where this increase arises from. Intramuscular temperature assessment may indirectly indicate a change in muscular blood flow.

**Purpose:** To establish intramuscular temperature, blood flow responses and subjective temperature sensation following application of menthol-based cooling gel to the anterior thigh.

**Study design:** Controlled, randomized cross over interventional study

**Methods:** Twenty (age: 21.4 + 1.7) healthy males were treated on three separate days in random order with ice, a menthol-based gel or placebo gel (participant single blinded) on one anterior thigh. All measurements were taken at baseline and for 80 mins following treatment: 1) Skin, core, and intramuscular temperatures (1 & 3 cm deep); 2) femoral arterial blood flow (duplex ultrasound); 3) cutaneous blood flow (laser Doppler) and 4) subjective cold sensation.

**Results:** Ice and both gels decreased ( $p < 0.0001$ , CI (Ice): -5.2 to -6.2 and CI (gels) -1.4 to -2.5) intramuscular temperature by 5.7 and 1.9°C respectively, but by 80 mins were similar to each other (1.5-2°C less than pre-treatment). Skin temperature mirrored muscle temperature with 8.8 and 4.2°C respective decline for ice and gels. Menthol gel increased ( $p < 0.0001$ ) cutaneous blood flow by 0.3 ml/min compared to unaltered flow associated with the placebo gel and a decline of 0.3 ml/min for the ice. Menthol gel cold sensation was subjectively reported to be cooler ( $p < 0.0001$ ) than the other two treatments. Core temperature and arterial flow were unaffected.

**Conclusion:** This is the first study to demonstrate the intramuscular cooling effect of menthol-based gel. However, the likely cause was from evaporative cooling despite menthol-derived increases in cutaneous blood flow and cooling sensation.

**Level of evidence:** Treatment, level 2.

**Key words:** Cold therapy, intramuscular temperature, temperature sensation

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The authors have no conflicts of interest to declare.