

# **The effects of single and repeated applications of menthol to the skin on endurance exercise performance in the heat**

Martin Barwood<sup>1</sup>, Jason Gillis<sup>2</sup>, Russ Best<sup>3,4</sup>, Owen Jeffries<sup>5</sup>

1. Department for Sport, Health and Nutrition, Leeds Trinity University, Horsforth, United Kingdom
2. Human Performance Laboratory, Department of Sport & Movement Science, Salem State University, Salem, MA, USA.
3. School of Health & Social Care, Teesside University, Middlesbrough, United Kingdom
4. Centre for Sport Science & Human Performance, WINTEC, Hamilton, New Zealand
5. School of Biomedical Sciences, Faculty of Medical Sciences, Newcastle University, Cookson Building, Newcastle upon Tyne, NE2 4HH, UK.

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Endurance exercise performance frequently takes place in conditions that pose an increased risk of heat illness. For example, the next Olympic games is set to be staged in Tokyo, Japan, and will take place in high ambient temperatures combined with a high relative humidity thereby minimising viable avenues for heat loss. Accordingly, exercise performance is likely to be impaired through multifaceted mechanisms. One early contributor to the slowing exercise pace is the sensation of becoming hot and uncomfortable caused by hot skin temperatures although elite athletes are accustomed to ignoring these sensations thereby increasing their risk of heat related collapse. The topical application of menthol to the skin may assist in facilitating the uncoupling of thermal state from perceptual state by stimulation of TRPM-8 thermoreceptor thereby stimulating cool sensations and alleviating thermal discomfort in a manner similar to temperature reduction itself. At low concentrations of sprayed Menthol (0.05% concentration) it has been noted that this altered thermal perception is not matched with any (measurable) change in thermoeffector response. At higher concentrations it has been noted that topical menthol application impairs some heat defence mechanisms (i.e. vasoconstriction) and altered sweating thereby increasing the risk of heat illness whilst relieving thermal discomfort. This part of the symposium explores the extant literature on single and repeated topical applications of menthol to the skin with a view to describing the performance and thermoregulatory

consequences of menthol use during sport. We will also consider the research evidence for menthol use in the occupational setting although little is known about the latter. This section of the symposium will conclude with an appraisal of the risk of heat illness that could be caused by menthol application, practical considerations of the application modality and future directions for menthol use in the sporting and occupational setting.

**Key words:** Endurance, menthol, heat, sports performance.