



# AIS SPORTS SUPPLEMENT FRAMEWORK

## L-MENTHOL ('MENTHOL')

### What is it?

- > The use of menthol, when co-ingested with or incorporated into a gel or cold/iced-slurry beverage, may be useful during exercise to facilitate a perception of feeling 'cool'.
- > Menthol mimics the cold stimulation of thermosensitive neurons (Transient receptor potential melastatin 8; TRPM-8) when applied to mucous membranes.<sup>1</sup>
  - The sensory impact of L-menthol is directly related to the thickness of the skin, density of afferents, concentration of menthol, repetition and length of time of exposure.<sup>2</sup>
- > The internal application of menthol (via mouth rinse or ingestion) is potentially ergogenic when performing endurance activities (>2.5 min) in hot environments by ameliorating athlete's perception of heat stress by reliably improving thermal sensation, and to a lesser extent, thermal comfort and ratings of perceived exertion in the absence of any change in body (i.e., core and skin) temperature.<sup>3</sup>
  - Further downstream improvements of internal menthol application may include improvements in nasal patency<sup>4</sup>, alterations in blood flow<sup>5</sup> and attenuation of thirst.<sup>4</sup>

### What does it look like?

- > In its raw form (pharmaceutical grade; 100% pure), menthol is a stable solid white crystal.
  - Menthol is a natural compound; the (-) isomer is derived from Mentha species (i.e., peppermint, corn mint) and is associated with a characteristic 'minty' aroma, taste and cooling sensation<sup>6</sup>.
  - Menthol is widely used as a food ingredient to flavour confectionary, oral hygiene and medicinal products, and is unlikely to be detrimental to health and/or performance unless recommended protocols regarding frequency and concentration are exceeded.
  - Menthol is commercially available through food ingredient (e.g., Melbourne Food Depot) and chemical/laboratory materials supply companies (e.g., Sigma Aldrich).
- > Currently there is only one commercially available Menthol-containing product range marketed specifically as a sports product (Turbo+, Science in Sport), which is targeted for use during indoor training. However, it has limited availability for purchase in Australia, and contains other ingredients (22 g Carbohydrate, 0.01% active Menthol, 150 mg Caffeine, 1.5 g Beta-alanine, 1.5 g L-Carnitine) which may limit its use to specific sports situations.
- > Based on the current understanding of the potential benefits of L-Menthol, individuals may wish to experiment with:
  - Ingesting or mouth rinsing a menthol-containing food-grade product (i.e., confectionary such as Fisherman's Friend - Original).

### How and when do I use it?

- > There is no clear consensus on safe and effective menthol use for athletes, practitioners or researchers<sup>3</sup>. Best practice protocols are yet to be established.
  - Current guidelines should be followed, which proposes a mouth rinse or beverage containing L-Menthol (0.1 – 0.5 g of crushed L-menthol crystals in 1 L water, equivalent concentration of 0.01 – 0.05% Menthol).<sup>7</sup>
- > L-Menthol supplementation should only be considered and trialled in collaboration with an accredited sport scientist and/or sports dietitian. Individuals should extensively trial intended uses of menthol and pacing strategies under similar environmental conditions prior to implementing in competition, which may include the following strategies:
  - Repeated internal application every 5-10 min during exercise.
  - optimising the potential sensory benefits, consider use at strategic time points (e.g., towards the end of a prolonged endurance event).
  - The cooling sensation may be heightened if menthol is co-ingested with or incorporated into cold or ice slurry beverages.<sup>8</sup>



## Are there any concerns or considerations?

The potential risks of oral menthol application in the heat are not yet fully understood. The following risks have, so far, been identified:

**Table 1: Potential Risks of Internal Menthol Use**

Concern	
Toxicity	> Estimated lethal dose for menthol in humans as low as 50-150 mg/kg BM (equivalent to 3 g for a 60 kg individual). <sup>9</sup> This volume is equivalent to 15 x 25 g bags (contains approximately 20 lozenges providing 10 mg total menthol per lozenge) of Original Fisherman's Friend® (Extra strong, white packet).
Unsuitable Dose	> Risk of confusion around suitable doses/concentrations of L-Menthol use > It is recommended that athletes use existing commercial products rather than sourcing raw ingredients
Inadvertent Doping	> All orally ingested supplements pose a risk of cross-contamination > It is recommended that the athletes use commercially available L-Menthol-containing products from well-known food/confectionary companies, and in the case of sports nutrition supplements, that these be batch tested
Performance	> Risk of mis-pacing since menthol is capable of mis-representing real-time thermal information to the brain
Thirst Sensation	> Menthol may attenuate thirst, potentially leading to deception-driven dehydration. Hydration should be monitored closely amongst athletes where hydration is key to maintaining performance or for very heavy sweaters
Manual Handling	> Pure menthol causes skin irritation and hence, is labelled as 'Hazardous' when handling raw materials. > It is recommended that athletes source existing commercial products rather than sourcing raw ingredients

### Limitations to the current evidence supporting menthol use

#### High-Performance Environment

- > Studies among elite athletes, particularly in events that are representative of real-world performances and conditions (e.g., the degree of thermal discomfort tolerated, motivation for success/resist fatigue) is of high priority.

#### Sex

- > L-menthol research has largely been conducted on male cohorts who are recreationally active or trained. It is not known whether the subtle alterations in sub-elite populations will translate to measurable outcomes for elite athlete in the field.<sup>3</sup>
- > Research on female participants is to be encouraged because of identified sex-differences in olfaction and trigeminal sensitivity.<sup>10</sup>

#### Sports/Activities

- > More research is warranted on the effects of L-Menthol, on performance of intermittent, dynamic and explosive activities, fine motor movements, or team-based competitive sports due to insufficient research in the field.<sup>3</sup>

#### Safety

- > To our knowledge, there are no recorded instances of heat-related illness in experiments involving the internal application of L-menthol. Such experiments are ethically bound by strict withdrawal criteria and therefore, careful thermal monitoring during athletic events in less-controlled environments is necessary.

#### Individual Responses

- > Interindividual difference in response to L-menthol mouth rinsing may be distinguished by the calculation of an individual's menthol sensitivity index.<sup>11</sup>
- > A clear dose-response has yet to be identified. Individual approaches are warranted above pursuing a 'more is better' approach.

#### Diminishing Returns

- > Further understanding of single or repeated mouth rinsing and the reasons for habituation (i.e., diminished response to the repeated application of menthol dose) need to be clarified.

## Where can I find more information?

Sports Dietitians Australia

### **Position Statement: Nutrition for Exercise in Hot Environments**

Supplement safety information

[www.sportintegrity.gov.au/what-we-do/anti-doping/supplements-sport](http://www.sportintegrity.gov.au/what-we-do/anti-doping/supplements-sport)

Material Safety Data Sheet (MSDS) information

[www.merckmillipore.com/AU/en/product/msds/MDA\\_CHEM-105995](http://www.merckmillipore.com/AU/en/product/msds/MDA_CHEM-105995)

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## Further Reading

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The Australian Institute of Sport (AIS) Supplement Framework is an initiative of the Australian High Performance Sport System. The AIS acknowledges the support of members of the National Institute Network (NIN) and National Sporting Organisations (NSO) and their staff in delivering content expertise. This information is intended to help athletes, coaches and scientists make evidence-based decisions about the use of supplements and sports foods. Before engaging in supplement use, we recommend that each individual refer to the specific supplement policies of their sporting organisation, sports institute or parent body, and seek appropriate professional advice from an accredited sports dietitian ([www.sportsdietitians.com.au](http://www.sportsdietitians.com.au)).

Athletes should be aware that the use of supplements may have doping implications. Athletes are reminded that they are responsible for all substances that enter their body under the 'strict liability' rules of the World Anti-Doping Code. Some supplements are riskier than others. The Sport Integrity Australia (SIA) app is a useful resource to help mitigate the risk of inadvertent doping by helping to identify supplements that have been batch-tested. The SIA App provides a list of more than 11,000 batch-tested products. We recommend that all athletes consult the educational resources of SIA regarding the risks associated with supplements and sports foods. While batch-tested products have the lowest risk of a product containing prohibited substances, they cannot offer you a guarantee that they are not contaminated ([www.sportintegrity.gov.au/what-we-do/supplements-sport](http://www.sportintegrity.gov.au/what-we-do/supplements-sport)).

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