REST HUB
Environment Ready

Cooling Strategies

The application of cooling strategies can assist in the prevention and management of thermal strain during exercise by reducing physiological and perceptual strain, providing the potential to enhance performance in hot environments.

For athletes who generate significant metabolic heat (e.g., athletes competing in prolonged, moderate-high intensity events, or those with higher muscle/body mass), cooling strategies may increase the body's capacity to store heat and prevent a rise in temperatures that can lead to detrimental levels of thermal and cardiovascular strain and impair performance. Conversely, for athletes who experience thermal discomfort without the associated physiological strain, strategies targeting perceptual cooling may be most valuable.

Strategies may be implemented pre-, during (per-), and post-exercise, depending on the needs of the athlete, potential constraints of the sport, and environmental conditions.

Pre-cooling	Involves lowering skin and core temperature prior to exercise to increase heat storage capacity. May be most beneficial for endurance and intermittent/repeated sprint activities. Strategies may be adjusted or avoided before events short in duration, involving maximal muscle contraction, or requiring a maximal effort early in the event. Para-athletes may benefit from pre-cooling if their thermoregulatory capacity is impaired.
Per-cooling	Involves the application of cooling strategies during exercise to lower thermal strain. May be particularly valuable for sports longer in duration as the effects of pre-cooling may be reduced over the course of an event. A reduction in core temperature during exercise is not always necessary to elicit a performance benefit, however, a reduction in skin temperature or improved thermal comfort may elicit performance benefits in some circumstances.
Post-exercise cooling	Involves the implementation of cooling strategies following exercise to reduce core and skin temperature and assist recovery.

Considerations

- It is important to prepare for physiological and perceptual challenges associated with heat stress as both can impact performance.
- Strategies should be thoroughly trialled and refined in 'real world' situations that replicate the demands of competition, prior to being implemented during pinnacle events.
- Much of the existing research has been conducted in a laboratory, does not consider individual responses, and does not replicate typical airflow or radiant heat experienced during outdoor sports or the impact of a warm-up prior to competition.

Cooling Strategy	Pre-cooling	Per-cooling	Post-exercise cooling	ⓘ
Mixed method (combination of strategies)	✓✓✓	✓✓✓	✓✓✓	A combination of strategies, specifically internal and external cooling strategies, is the optimal approach for managing physiological and perceived thermal strain. Tailor strategies to suit the needs of the athlete, sport-specific situation, logistics, and environmental conditions.
Cold water immersion	✓✓✓	✕	✓✓✓	The most effective strategy for rapid cooling in the event of heat illness. Preferred strategy to manage physiological strain, either pre- or post-exercise When implemented pre- or post-exercise, the purpose is to reduce core temperature prior to or following exercise. Immersion temperature, duration, and depth can be manipulated to optimise outcomes, and suit individual requirements and sport logistics. Core temperature monitoring prior to use in competition is encouraged to assess the time course of individual responses and provide individualised recommendations.
Slushie ingestion	✓✓	*Dependent on sport-specific, individual, and environmental considerations*	✓✓	A dose of ≥7g/kg of body mass is typically required to elicit a reduction in core temperature. May be particularly effective during conditions that cause sweat to drip from the skin (e.g., during high humidity, limited air flow, or when a uniform limits the evaporation of sweat). May be less effective under conditions where evaporation of sweat is not impaired, such as low humidity or high air flow as it may negatively reduce sweat rate. Gastrointestinal discomfort may arise, particularly amongst larger individuals prescribed a greater absolute volume of slushie. This may be negated through gut training. 'Brain freeze' can be another common side effect of slushie ingestion.
Water misting	✓	✓✓	✓✓	Can provide both a physiological and perceptual reduction in thermal strain. When applied to a greater proportion of skin surface area, there is a greater potential to reduce physiological strain. The use of all-in-one misting fans or fanning in combination with water spraying can further enhance evaporative cooling.
Cold towels/ cooling packs	✓	✓✓	✓	When used in isolation, decreases skin temperature without reducing core temperature. Soak towels in ice cold water prior to applying to the skin and resoak when they no longer provide a cooling sensation. Ice can also be wrapped in a damp towel and applied to the skin. Use during exercise will be limited to sports that have sufficient breaks in play and when logistically possible. Chamois fabrics are preferrable as they hold more water without dripping and remain cooler for longer.

Cooling Strategy	Pre-cooling	Per-cooling	Post-exercise cooling	ⓘ
Cooling vests	✓	✗	✗	Target a reduction in skin temperature without a reduction in core temperature. Can provide a cool sensation for a short period. Cooling is optimised when in direct contact with the skin surface and removed as soon as it offers no cooling benefit. Can be used in transit, ideally in conjunction with other strategies. Limit use between breaks in play as metabolic heat production during exercise may be significantly increased and the vest may 'trap' heat, limiting evaporation of sweat from the torso. Many vests require freezer storage prior to use, and appropriate storage for transferring locations.
Menthol	✗	✓	✗	May provide perceptual cooling when applied to the skin or mucosal surfaces of the body, whereby a cooling sensation occurs without a change in skin or core temperature. May be more effective at providing a cooling sensation when used internally vs. externally. Cooling sensation improved when beverages are served chilled or when drinking/swilling cold fluids after menthol application. No clear guidelines or specific recommendations regarding the best application method. Physical performance can be impaired (e.g., via impacts on pacing) with use if perceptual thermal strain is improved, without associated physiological changes.

Recommended Reading

Adams W, Hosokawa Y, Casa D. Body-cooling paradigm in sport: Maximizing safety and performance during competition. J Sport Rehabil. 2016 Dec;25(4):382-394. doi: 10.1123/jsr.2015-0008.

Racinais S, Alonso J, Coutts A, et al. Consensus recommendations on training and competing in the heat. Br J Sports Med. 2015 Sep;49(18): 1164-73. doi: 10.1136/bjsports-2015-094915.

van de Kerkhof T, Bongers C, Périard J, Eijsvogels T. Performance benefits of pre- and per-cooling on self-paced versus constant workload exercise: a systematic review and meta-analysis. Sports Med. 2024 Feb;54(2):447-471. doi: 10.1007/s40279-023-01940-y.