The BASES Expert Statement on the use of cooling therapies for post exercise recovery

Produced on behalf of the British Association of Sport and Exercise Sciences by Dr Adam Grainger FBASES, Dr James Malone, Dr Joseph T. Costello, Dr Chris M. Bleakley and Dr Robert Allan.

Introduction

In a previous BASES Expert Statement, Howatson **et al.** (2016) described popular athletic recovery interventions, outlining their mechanisms of effect, and summarizing the strength of the supporting evidence base. Cooling therapies remain one of the most popular post exercise recovery strategies used by both professional and recreational athletes. Cooling is purported to reduce blood flow and tissue temperature, which subsequently improves functional recovery and perception of muscle soreness. However, the practical application of cooling therapies varies (Allan **et al.**, 2021), and some practitioners may be unaware of the mechanistic rationale or the margins for safe application. There is also ongoing debate concerning the chronic use of cooling and its potential impact on long-term training adaptation. Using current evidence to outline when cold therapies could be employed, their key (psycho)physiological effects, and guidance on dose considerations, this expert statement provides recommendations for using cooling therapies in post-exercise recovery.

Background and evidence

Commonly used modes of cooling therapy for recovery

Cooling interventions include (but are not limited to): cold water immersion (CWI), whole or partial body cryotherapy (WBC or PBC), and phase change material (PCM) (Figure 1). Of these, CWI, typically involving the submersion up to the waist or mid-torso for ~8–12-minutes in temperatures between ~8-12°C, is arguably the most popular therapy. CWI induces greater reductions in blood flow and tissue temperature compared with WBC (Mawhinney, **et al.**, 2017). By maximising body surface contact, it yields a high cooling rate, and may effectively manage central nervous system mediated fatigue (Ihsan **et al.**, 2016). There is further evidence of effect in experimental studies (Bleakley, **et al.**, 2014) where CWI has favourable outcomes for both subjective (perceived pain and recovery) and objective (functional and humoral assessment) exercise recovery measures. Considering its simplicity and low costs, CWI is likely to continue to be commonly used.

WBC and PBC represent a more expensive and logistically challenging approach to post-exercise recovery. This intervention consists of exposure to extremely cold dry air maintained at -110 to 140°C in a specialised temperature-controlled cryochamber or cabin, for 2-4-minutes, and is typically initiated within 24 hours of exercise (Costello **et al.**, 2015). All cooling modalities offer a strong potential for subjective/perceptual recovery, and a recent survey (Allan **et al.**, 2021) found that athletes and coaches consider post-exercise cooling to be effective. Although the current evidence supporting the use of WBC or PBC is limited, recent research suggests that increasing WBC dose longitudinally may not enhance the recovery response in elite Premier League footballers (Malone **et al.**, 2021) and that PBC has no clear benefits in elite rugby union players (Grainger **et al.**, 2020). Cryotherapy chambers and cabins are also expensive making them inaccessible to most athletes.

Another common method of cooling is the use of phase change material (PCM) or ice packs. A major advantage is that these methods are portable and can be used when travelling (e.g., away fixtures). PCM also provides a high conductive capacity, whereby athletes can cool for longer periods of time and benefit from the thermal contact that occurs. Their use has been predominantly for treatment of injury (i.e., reduction of swelling), but recent research highlights the potential recovery benefits of PCM in professional youth soccer players (measured via maximal

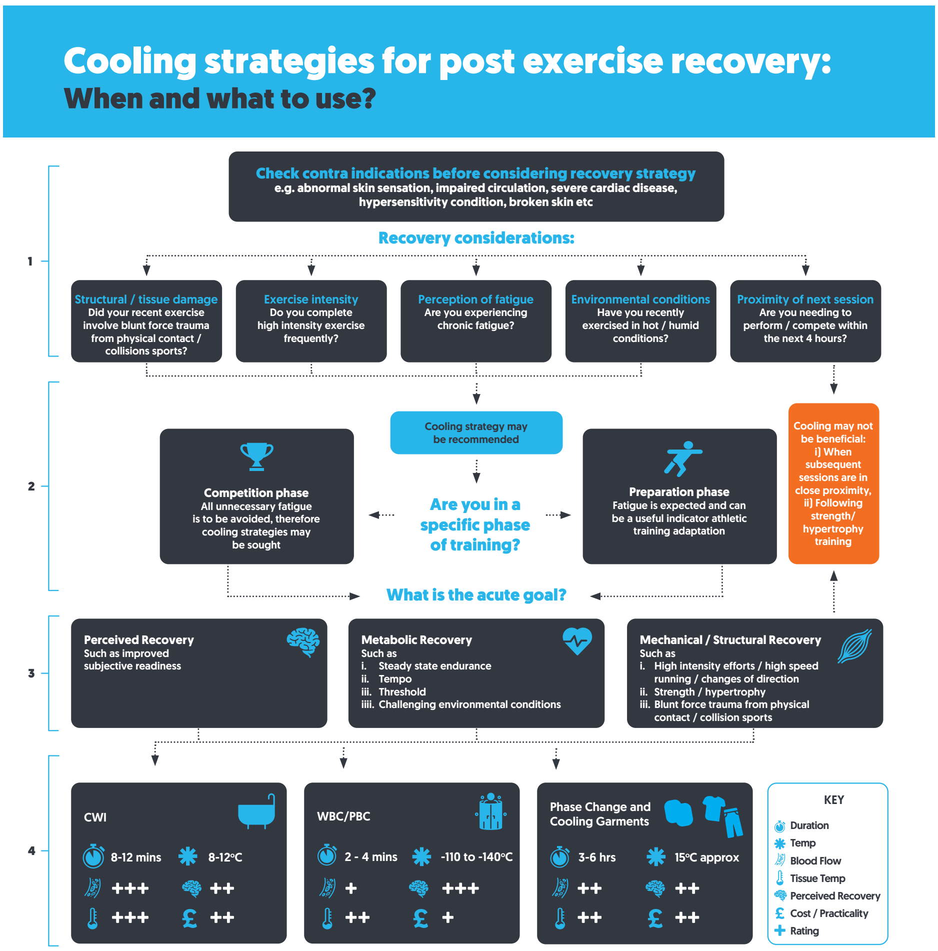

Figure 1. Decision tree to assist in the application of cooling strategies post-exercise.

isometric voluntary contraction and subjective muscle soreness) (Clifford **et al.**, 2018). The use of PCM post-exercise is an emerging recovery tool and at present there is limited empirical evidence to support their use. Few studies have directly compared the effects of popular cooling interventions (i.e., CWI vs WBC/PBC vs PCM), and there is a clear need for more randomised, multi-centred trials. Currently, choosing an optimal cooling mode is largely dictated by the athlete/team budget, access, and individual preference.

Considerations for using cold therapy

Stress caused by exercise often results in reduced muscular function, increased perception of soreness, and reduced performance capacity (Kellmann **et al.**, 2018). Regular training and competition can therefore compromise physiological function, directly impacting on sporting performance and/or reduce the capacity to train at the desired intensity. However, if there is sufficient time for recovery between exercise bouts and fatigue is not excessive, then athletes are encouraged to recover naturally without the need for additional cooling interventions. It must also be noted that when exercise sessions are in close proximity (<4 hours), the use of cooling therapies may actually hinder subsequent performance and are therefore not recommended (Murray **et al.**, 2015; Ihsan **et al.** 2021).

The benefits of cold therapy are also moderated by the phase of training. Ihsan **et al.** (2021) describe a paradox, where post-exercise cooling appears to enhance adaptation after sport-based high-intensity and endurance-based exercise, but it may be deleterious if used immediately after strength or resistance-based exercise. A cold-induced attenuation of exercise stress may reduce muscle adaptation, and blunt the training effect. Post-exercise cooling is therefore less relevant when the goal is to create higher levels of fatigue and stress, or to maximize muscle adaptation. A recent meta-analysis (Malta **et al.**, 2021) found further evidence that the regular use of CWI had a deleterious effect on resistance training adaptation, whereas aerobic exercise performance was unaffected. The decision to incorporate post-exercise cooling into a periodised recovery approach should be informed by several variables, including individual preferences, the training phase, the mode and intensity of training, environmental conditions (e.g., heat), alongside other mitigating factors (e.g., travel, nutrition, sleep). Importantly, and regardless of the circumstances, cooling therapies are not suitable for individuals with contraindications. Therefore, all athletes should seek guidance from a physician prior to undertaking any therapeutic cooling. This is particularly important where athletes have: a history of cardiovascular disorders, high blood pressure or arrhythmias, kidney disease, history of seizures, Raynaud's syndrome, bleeding disorders or any other contraindications. Coaches must also be cognisant of the paucity of evidence outlining the physiological implications of using cold therapies on pre- or peri-pubertal athletes (Murray **et al.**, 2015).

Conclusions and recommendations

This statement provides BASES members, and the wider scientific community, with guidance on the safe and effective use of cooling therapies for post-exercise recovery. Alongside the information presented in the decision tree (Figure 1), below is a summary of the key points raised in the present expert statement:

- Cooling therapies will be of most benefit to athletes who are regularly exposed to exercise stress
- Athletes undertaking multiple sessions in proximity (e.g. within 4 hours) and/or strength/hypertrophy training may not benefit from post-exercise cooling as it could be detrimental to adaptation and/or performance
- Athletes' choice of cooling mode should be largely driven by practicalities (e.g., budget, availability) and athlete preference
- There is a need for future research using large, multi-centred randomised controlled trials comparing CWI vs WBC/PBC vs PCM ■

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