This article systematically reviews previous research examining the influence of established precooling techniques on athletic performance. While the authors have chosen an interesting topic I feel that there are a number of issues with this manuscript that preclude it from publication in its current form. Most importantly, sections of the manuscript seem somewhat disjointed and the rational for the review is not well developed. The background and discussion sections need to be restructured to provide a greater focus on the aims/purpose of the review. I have a number of specific comments outlined below.

• There are currently three comprehensive literature reviews on this topic. While the methodology employed was systematic in identifying twelve related studies, of which are further characterised by their methodologies, it is questionable whether 5 studies on cold water immersion, 3 on ice slurry ingestion, 3 on cooling vests and 3 on mixed cooling methods is of sufficient critical mass to justify reviewing this literature.

• The Author has forgotten to associate respective authors with the King’s College. Please assign accordingly.

• There are a number of errors with use of terminology and in-text referencing.

• It is suggested that the Author finds a more relevant reference to provide evidence that running performance in the field setting is impaired as ambient temperature increases. If in line 1, that you determine the range for ‘hot’ conditions is >25°C, then this reference fails to support marathon performance is impaired in hot, compared with temperate or cool environmental conditions. This review probably should not be referred to as recent as it was published 5 y prior.

• It is not clear what is mean by ‘circulatory failure’

• The background section provided on pre-cooling is poorly described. The first
mention of pre-cooling featured two and a half pages into the background (Paragraph 7 out of 9). The Author fails to acknowledge two key reviews (5, 9), which provide a very comprehensive review of the literature. While these articles are acknowledged in the discussion, they should feature in the background section. The Background section covers many specific references pertaining to the thermoregulatory fatigue literature, whereas more focus should be given to the pre-cooling literature. For instance, mention of Central Governor theory, cognitive development in children, rating of perceived exertion and running speeds of Caucasian versus African runners should be condensed and their inclusion reconsidered. The author is advised to refer to Ulmer’s proposed model of teleoanticipation (14) rather than a similarly described concept by Noakes (2007).

• In paragraph 7, the Author is quick to transition straight to practical pre-cooling and in paragraph 8, makes reference to ‘considering practical limitations’. Insufficient information is provided to the reader as to what the limitations are, and why they need to be considered.

• The manuscript could be improved by making the delineation between tests of endurance capacity (externally paced) from exercise performance (internally paced). In the current submission, these terms are used interchangeably.

• The manuscript includes studies involving subjects of varying fitness level and experience. Would the Author expect uniform enhancements to endurance exercise across the range of athletic calibre? This maybe a potential discussion point for the Author to expand on.

• The stated aims could be improved by rewording the statements to clarify the meaning. For instance, the first aim was ‘to summarise the effectiveness of different pre-cooling procedures by comparing, critiquing and combining results from each study’. A limitation consistently identified in the pre-cooling literature (including this manuscript) is the difficulty in comparing the results of different studies, due to the range of research designs, pre-cooling methodologies, environmental temperatures and performance tasks. This should be addressed.

• The second aim proposed was to ‘enable evidence-based decisions on appropriate pre-cooling athlete management to be made’. The concluding statement of ‘... recommending one method over another to coaches and athletes is difficult and conclusions of efficacy tenuous’ does not sufficiently address this point of discussion.

• Despite sound methodology described, there are a number of pre-cooling studies that do not (but should) feature in the current review (1-3, 6, 8, 11, 13, 15). For instance, a recommendation for further research suggests a comparison between the efficacy of cold-water immersion and ice-slurry ingestion on endurance performance. This has recently been done (11). Likewise, the authors are encouraged to include the following relevant studies (7, 12, 16).

• The Results and Discussion sections include information pertaining to the methodological quality of the relevant studies performed using the Physiotherapy Evidence Database (PEDro) Scale. I am unfamiliar with this analysis tool, however, considering it is derived from a Physiotherapy setting, to assess the
validity of clinical trials, the Consolidated Standards of Reporting Trials (CONSORT) system may be more suited to this setting. Furthermore, it is advised that the assessment of methodological quality be added as an aim of the paper. Although Tables 1 and 3, and Figure 1 are important in the review process to show a comprehensive literature search was performed and the methodologies of included studies were of a certain quality, I am not sure that this information should be included in the manuscript.

- The Author comments on low participant numbers across the relevant studies. While this remains a limitation across the literature, a few considerations must be acknowledged: 1) researchers involve participants that are representative of the population they wish to study or transfer their findings to, so highly trained athletes are often desirable, 2) finding large numbers of well-trained endurance athletes (i.e., say thirty men, ~70 ml.kg\(^{-1}\).min\(^{-1}\)) that compliant volunteers is incredibly difficult, 3) small subject numbers (e.g., n=7) are appropriate if clear outcomes are found, 4) sample sizes that are too large represent needless waste of resources, 5) ethical obligations when more subjects are exposed to pain or risks of harm than are required. Large(r) sample sizes will not necessarily allow for between sex comparisons to be made, the inclusion of male and female participants will allow for this.

- The Author is encouraged to work on the flow of writing as the discussion reads like single sentences, joined together, listing outcomes from each study. For instance, each paragraph commences with ‘In one study…, One study showed…, One study reported…, None of the studies…, Some studies…’, etc. Systematic analysis of the relevant studies and their findings is required to improve the review.

- The Author uses inappropriate terminology through the manuscript that needs to be corrected. For instance, the following terms, ‘normal’, ‘normothermic’, ‘hyperthermic’, ‘above the human thermo-neutral zone of environmental temperatures (>29\(^\circ\)C)’ are used to categorize environmental conditions. The term ‘hotter’ is a relative term. For instance, 5\(^\circ\)C is hotter than 1\(^\circ\)C. Instead, use the word ‘hot’, ‘temperate’ or ‘cold’ and provide a suitable temperature reference range.

- The Author is asked to validate their categorisation of endurance athletes as ‘moderately- to well trained’ with subject characteristics, experience or training frequency/volume details.

- The Author raises concern over a ‘lack of safety’ and ‘adverse event reporting’ in the relevant precooling studies. Firstly, it is assumed that each study gained ethical clearance from an appropriate organisation, who would have considered the safety aspects of each study. Also, the lack of adverse event reporting may be indicative of a lack of adverse events occurring, and finally, precooling strategies are commonly used to lower the chance of heat-related injury as well as improve sports performance. This point of discussion may well need to be reviewed.

- Vests and jackets differ and should be referred to accordingly. These garments are not interchangeable (i.e., a vest is sleeveless and covers the torso whereas a
jacket is a vest with arms added. In some circumstances, a jacket can also include a hood. I am currently aware of only one study that uses a precooling ‘jacket’ (10), however the Author indicates in the results section that there are three studies. It is not entirely clear how the Author rates the effectiveness of a pre-cooling strategy. Is it the physiological perturbations induced or improvement in exercise performance? Please discuss.

- In relation to thermoregulatory research terminology, the Author should provide specific methods of core temperature measurement (i.e., rectal or gastrointestinal) where they can.

References


Quality of written English: Not suitable for publication unless extensively edited

Statistical review: No, the manuscript does not need to be seen by a statistician.

Declaration of competing interests:

I declare that I have no competing interests