Warming Up With an Ice Vest: Core Body Temperature Before and After Cross-Country Racing

J. Ty Hopkins
tyhopkins@byu.edu

Iain Hunter
iain.hunter@byu.edu

Douglas J. Casa

Follow this and additional works at: https://scholarsarchive.byu.edu/facpub

Part of the Exercise Science Commons

BYU ScholarsArchive Citation
https://scholarsarchive.byu.edu/facpub/985

This Peer-Reviewed Article is brought to you for free and open access by BYU ScholarsArchive. It has been accepted for inclusion in Faculty Publications by an authorized administrator of BYU ScholarsArchive. For more information, please contact scholarsarchive@byu.edu, ellen_amatangelo@byu.edu.
Warming Up With an Ice Vest: Core Body Temperature Before and After Cross-Country Racing

Iain Hunter*; J. Ty Hopkins*; Douglas J. Casa†

*Brigham Young University, Provo, UT; †University of Connecticut, Storrs, CT

Context: Athletes running in a hot, humid environment may have an increased risk of heat illness. In the 2004 Olympic Games, American and Australian athletes were provided with ice vests designed to cool their bodies before performance. The vest appeared to be effective in keeping body temperatures down and improving the performance of the marathoners. However, body temperatures have not been reported when the vest was used before an actual competition.

Objective: To determine if wearing the Nike Ice-Vest decreased core temperature (Tc) before and during athletic performance in warm (26°C to 27°C), humid (relative humidity = 50% to 75%) conditions.

Design: A 2 × 3 mixed-model design was used to compare groups (ice vest, no ice vest) across changes in temperature from baseline (10 minutes and 1 minute before the race and immediately after the race).

Setting: 2005 Big Wave Invitational 4-km race in Hawaii and 2005 Great American 5-km race in North Carolina.

Patients or Other Participants: Eighteen women from a National Collegiate Athletic Association Division I cross-country team who participated in either the Big Wave Invitational or the Great American Race.

Intervention(s): Four hours before the start of the race, the athletes ingested radiotelemetry temperature sensors. One hour before the start of the race, Tc was recorded, and half of the athletes donned a Nike Ice-Vest, which was removed immediately before the race.

Main Outcome Measure(s): Additional Tc readings were taken at 10 minutes and 1 minute before the start of the race and immediately after the race.

Results: Ten minutes before the start of the race, Tc was elevated by 0.84°C ± 0.37°C in the no-vest group, compared with 0.29°C ± 0.56°C in the ice-vest group (P < .01). This difference in Tc persisted at 1 minute before the start. Immediately after the finish, the increase in Tc averaged 2.75°C ± 0.62°C in the no-vest group and 2.12°C ± 0.62°C in the ice-vest group (P < .01).

Conclusions: Wearing an ice vest before cross-country performance in warm, humid conditions allowed athletes to start and finish the competition with a lower Tc than did those who did not wear a vest.

Key Words: thermoregulation, heat illness, cooling, environmental physiology

When athletes run in a hot and humid environment (wet-bulb globe temperature greater than 27.7°C), running performance may suffer and the risk of heat illness may increase as a result of increased body temperature.1

In the 2004 Summer Olympic Games in Athens, Greece, a few American athletes (distance runners) and all Australian Olympic athletes were fitted with Nike Ice-Vests (prototype; Nike, Inc, Portland, OR) designed to lower body temperature before performance. Although the finding was anecdotal and the vest only one of many strategies used by the American runners to enhance performance in the heat, this intervention appeared effective among the marathoners who used the vests. Deena Kastor and Meb Keflezighi of the United States, who wore the vests before competition, both earned Olympic medals, exceeding most people’s expectations.

Many authors2–7 have investigated the effect of various precooling methods in a laboratory setting. The results of precooling on performance and heart rate have been mixed, but decreases in body temperature were consistently found. However, the length of time the cooling effect lasts seems to be inconsistent. This may be due to the type of cooling method used or perhaps to insufficient statistical power to detect differences.

One group8 evaluated a cooling interval in athletes running a 2-mi (3.22-km) race outdoors after a 90-minute run in the heat and documented lower heart rates after the race, lower core body temperatures, and improved running time. However, no authors have investigated the application of an ice vest during the prerace routine and measured its effect on core temperature (Tc) before, during, and after a race in the field. Our purposes were to determine the effectiveness of the Nike Ice-Vest in reducing Tc before cross-country racing and to assess whether any Tc changes were still present immediately after the race.
The Nike Ice-Vest includes 20 pouches for ice packs. Fully loaded with ice packs, the vest weighs 4.4 kg. The inner layer of the vest is Nike Dri-Fit material, which provides a layer between the skin and the ice packs. Adjustable straps allow for a relatively tight fit to avoid excessive movement of the vest while the athlete warms up. A wet Race-Day Tee was worn under the vest, following Nike’s recommendations.
women had increases of more than 3°C in Tc from the initial reading to the postrace reading. Three others showed Tc increases of less than 2°C throughout the race. One possible reason for some of the variability in temperature responses may be fitness levels, because athletes with greater fitness levels are often better at dissipating heat from the body.11–13 Although these athletes were all Division I cross-country athletes, interindividual differences may still be enough to affect thermoregulation. Body fat, skin, muscle, and other tissues may also influence the effectiveness of the vest. Athletes who have difficulty dissipating heat from the body may benefit more than others from wearing an ice vest. An additional potential benefit that extends beyond the physiologic function and exercise performance enhancement issues of high-level athletes is that reduced core body temperature before the start of a race may decrease the likelihood of an exertional heat illness.

One issue in wearing the vest during a warm-up is the mass of 4.4 kg. Because the vest is relatively heavy, it must fit quite tightly to avoid any excessive movement during running. A few athletes mentioned how the vest fit tightly around the underarm and was somewhat uncomfortable. Modifications may need to be made in the warm-up because of the extra weight and tightness of the vest.

Analyzing both races together somewhat limited our results, given that temperature, humidity, and race distances were slightly different at each location. However, average Tc measurements were no different between races at any of the measurement times (P = .21); we pooled data from both races. Although we recorded race times, subjects were too few to allow us to accurately determine whether the ice vest had an effect on performance or simply prevented Tc from rising as much as it normally would.

We did not investigate performance in our subjects, but other authors2,4,5,7,8,10,14–16 have tested the effects of precooling on performance, observing improved performance. Improved performances in these studies involved running a fixed distance with a lower metabolic cost or running a fixed speed for a longer time after precooling. Underwater submersion, ice vests, and water-circulating suits were used to cool the body in these studies. However, other authors6,17–21 found decreased performance when subjects used a cooling vest before participating. Generally, the performance improvements were observed in studies of endurance events, whereas performance decrements were observed in short, power events. In the future, researchers will need to determine whether the ice vest has any performance benefits.

Wearing an ice vest before cross-country performance limited the increases in Tc before the races, and the effect of the precooling persisted after the races finished. Subject numbers were too low to determine any performance improvements due to the ice vest. However, one potential limitation of performance, elevated Tc, was identified and was shown to be limited by using the ice vest.

REFERENCES

16. White AT, Davis SL, Wilson TE. Metabolic, thermoregulatory, and per-

Table 2. Temperature Changes from Initial Reading (°C: Mean ± SD)

<table>
<thead>
<tr>
<th>Group</th>
<th>10 Minutes Before Start of Race</th>
<th>1 Minute Before Start of Race</th>
<th>At Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ice vest</td>
<td>0.29 ± 0.56</td>
<td>0.39 ± 0.41</td>
<td>2.12 ± 0.62</td>
</tr>
<tr>
<td>No vest</td>
<td>0.84 ± 0.37</td>
<td>0.86 ± 0.32</td>
<td>2.75 ± 0.62</td>
</tr>
<tr>
<td>P value</td>
<td>.013</td>
<td>.008</td>
<td>.023</td>
</tr>
</tbody>
</table>

Figure 2. Temperature changes. Significant differences denoted with * (α = .05).


