Title: The Efficacy of Brief Cryostimulation of the Soles on Exercise Performance and Thermoregulatory Function During an Inter-exercise Rest Period in a Hot Environment

Presenting author name: Prof. Takashi Kawabata

Affiliation details of Presenting author: International Pacific University, Dept. of Physical Education, Lab. for Environmental Physiology for Exercise, Okayama, JAPAN

Co-authors' details: XiaoYue Hu1, Kazuyuki Kanatani2,3, Kosaku Tanaka

2 Affiliation details of Co-authors :

1; Graduate School of Humanities and Social Sciences, Hiroshima University, Hiroshima, 7398511, Japan 2; Department of Physical Education, International Pacific University, Okayama, 7090863, Japan

3; Graduate School of Health and Well-being, Kansai University, Sakai, 5908515, Japan

Abstract:

Introduction:

This study investigated whether brief cryostimulation of the soles of the feet during a rest period could enhance exercise performance and reduce thermal and cardiovascular strain in a hot environment. Eight physically active adults (6 males, 2 females; mean age ~25) participated in a randomized crossover trial. Each session included 15 minutes of steady-state cycling at 70% VO_2max, followed by 15 minutes of maximal effort, a 10-minute rest period, and a time-to-exhaustion (TTE) test at >70% VO_2max. During the rest, participants either sat quietly (control) or received 2 minutes of sole-cryostimulation using a −50 °C ice pack.

Method:

All sessions were conducted in a hot, humid environment (35 °C, 60% relative humidity). During the experiment, esophageal temperature (Tes), skin temperature (Tsk), thigh muscle temperature (TMT), skin forearm blood flow (Skin FBF), heart rate (HR), stroke volume (SV), and cardiac output (CO) were continuously monitored. The ratings of perceived exertion (RPE) and thermal sensation (TS) were recorded every 2-min.

Results:

TTE was significantly longer with sole cryostimulation (3.92 vs. 3.23 min, $p < 0.01$). While Tes, TMT, HR, SV, and CO did not differ significantly between conditions, Tsk and skin FBF were significantly lower in the cryostimulation condition during rest. Participants also reported significantly reduced RPE and TS during exercise after cryostimulation.

Conclusion:

The present study supports the idea that skin temperature and thermal perception—more than core temperature— play key roles in regulating performance in the heat. Elevated skin temperature stimulates peripheral thermoreceptors, influencing perceived exertion and pacing decisions. Cooling the soles improved comfort, delayed fatigue, and enhanced endurance. In summary, brief, localized foot cooling during rest can improve endurance without affecting core or cardiovascular responses. This simple intervention has practical applications for athletes, laborers, and others working in hot conditions, where managing thermal perception is crucial to maintaining performance.

Biography:

Prof. Takashi Kawabata is currently conducting research in the field of environmental physiology for exercise, focusing on the physiological significance of blood volume on thermoregulatory function and exercise performance in athletes and the general public at the University of the Pacific, Japan. He received his Ph.D. from Kyoto Prefectural University of Medicine. Recently, he has developed a strong interest in research on heat stroke in the hot climate of Japan.

He loves playing and watching football!