

Combining State of the Art Technology and Advanced Training Theory to Achieve Maximal Training Benefits

Denise L. Smith and Susie Caron

Athletes and fitness enthusiasts know that heat stress impairs performance. Numerous laboratory studies have demonstrated that performance is impaired during different types of activity when heat stress is involved. The time to volitional exhaustion during constant work rate tests (cycling, running) is significantly shorter in a hot compared with a temperate or cold environment (Galloway et al. 1997; MacDougall et al. 1974). Importantly, individuals chose less intense effort during self-paced exercise performance (such as self-selected cycling speed) in a hot environment (Schlader et al. 2011; Ely et al. 2010; Peiffer et al. 2011). Findings from controlled laboratory studies are translatable to actual competitive events. Not surprisingly, marathon running performance results are inversely related to the wet bulb globe temperature (Ely et al. 2007) – a global measure of heat stress that combines the influence of temperature, humidity, wind speed, and sunlight. Furthermore, athletes participating in team sports (soccer) have also been shown to reduce their work intensity to cope with hot environmental conditions (Nassis et al. 2015).

Athletes and fitness participants have long used various strategies to prevent performance decrements due to exercising in the heat – working out early in the morning, seeking shade, and exercising in air conditioning. More recently, pre-cooling has been shown to improve performance. Pre-cooling strategies frequently include the external application of a cool air or water. Specific examples of cooling include exposure to cold air or ice, immersion of part or all of the body in cool water, or wearing of a cooling garment. Research generally shows that pre-cooling leads to improvements in constant-

intensity exercise to exhaustion (González-Alonso et al. 1999; Lee & Haymes 1995) and for self-paced exercise of a set distance (Arngrímsson et al. 1985; Kay et al. 1999) or set time (Booth et al. 1997). Although pre-cooling has been shown to be effective, most pre-cooling techniques involving external applications are cumbersome and not feasible during routine training or competition. To date, there has been no light-weight, portable, cooling devices that could be worn during training.



dhamaSPORT™

The dhamaSPORT™ is a first class cooling wristband. This state-of-the art technology provides wearable cooling that permits convenient pre-cooling and effective cooling during training. This newly patented technology provides powerful and effective cooling for up to 120 minutes. Because it is light-weight, compact, and ergonomically designed, it can be worn during most types of activity. This revolutionary

technology allows the exerciser to choose when to wear the device (before, during or after activity) and to select the desired level of cooling (44, 48, 52°F).

Cooling in dhamaSPORT™ is provided by a patented ClimaCon® technology that delivers constant cooling to the underside of the wrist. The light-weight cooling band can provide cooling for up to 2 hours before the batteries must be recharged. The device dissipates heat from the body to lessen the increase in body temperature during exercise or heat stress and simultaneously stimulates the sympathetic nervous system to help regulate the cardiovascular system and influence perceptual measures.

Orangetheory Fitness

Orangetheory Fitness studios are growing in popularity as thousands of exercisers seek the



benefits of this high-intensity training program. Orangetheory began in Fort Lauderdale in 2010 and there are now Orangetheory studios across the country. Much of the success of the Orangetheory fitness program is based on the fact that this program combines sound scientific principles of training and an environment that is supportive of individual goals while using group sessions to help achieve those goals. This high-

intensity program leads to rapid improvements in fitness and is very effective at weight management. The Orangetheory workout is a high-intensity workout that provides a benefit partly based on excess post-exercise oxygen consumption (EPOC), which is the excess oxygen uptake above rest following exercise. Participants complete a 60-minute workout during which they perform multiple intervals designed to produce 12 to 20 minutes of training at or above 84% of maximal heart rate, which corresponds with heart rate zones 4 and 5.

During training sessions individuals wear a heart rate monitor and POD. Logs are kept of average heart rate, calories burned, and a SPLAT score.

dhamaSPORT™ + Orange Theory

Recently, an Orangetheory studio agreed to examine the effect of the dhamaSPORT™ cooling wristband on workout performance. Orangetheory participants routinely use wearable monitors to document workouts but this study had them wear the dhamaSPORT™ to affect performance. Thirteen participants (8 women and 5 men), all of whom had been participating in Orangetheory training for over a year, agreed to participate in this study. Participants agreed to wear the dhamaSPORT™ wristband during their next 10 consecutive workouts. Data collected during the next 10 consecutive workouts were compared with data from the previous 10 workout periods. By comparing data over 10 exercise periods we were able to eliminate much of the effect of day to day variability and to overcome the effects that may have occurred due to the novelty of wearing the device.

Results

The dhamaSPORT™ had a favorable effect on workouts. In fact, 12 out of 13 participants burned more calories when they were wearing the

dhamaSPORT™ than when they did not. The when considering the overall averages, participants had a higher heart rate (149 vs 154) higher calories burned (658 vs 684) and higher splat points (26 vs 30) when wearing the dhamaSPORT™. The greatest improvement in calories burned was a woman who increased her calories burned on average from 724 to 790 kcals while wearing the dhamaSPORT™ (almost a 10% increase).

As seen in Figure 1A, the 10 sessions before the participants wore the dhamaSPORT™ cooling band, the average training heart rate of the participants was 149 bpm. During the 10 sessions in which the dhamaSPORT™ cooling band was worn, the average heart rate of participants was 154 bpm. Because the participants felt cooler, they were able to push themselves harder during training.

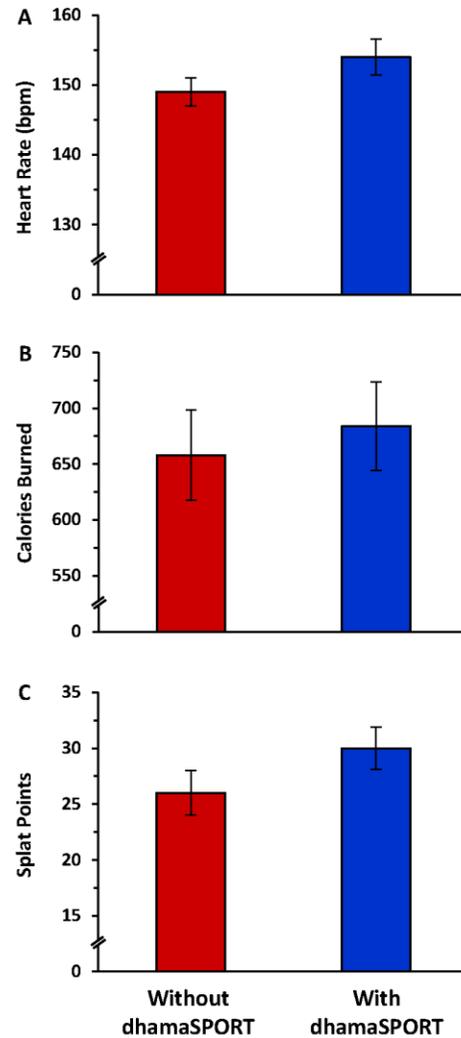


Figure 1: Average \pm standard error values of 13 participants during 10 consecutive workouts without the dhamaSPORT™ and 10 consecutive workouts with the dhamaSPORT™.

Corresponding to the higher intensity of work that was being performed, participants also expended more energy during the exercise session – translating to more calories burned (Figure 2B) and a higher SPLAT score (Figure 2C). On average participants burned an estimated 26 (or 4%) more calories during the workout when they were wearing the dhamaSPORT™ band. Although it was not measured in this study, higher energy expenditure during training also means more calories are burned following exercise, due to the

EPOC. Thus, the benefits documented in this study underestimate the full advantage of increasing the intensity of the workout by using the dhamaSPORT™.

Conclusions

The results of this study are good news for athletes and fitness participants looking to work out intensely and enhance the benefits of their training. When wearing the light-weight, convenient cooling device participants were able to work harder and achieve more benefits. Since Orangetheory workouts incorporate so many types of activity, this suggests that the wearable wristband will be well received by most athletes. Closely mirroring the physiological data that were recorded, the majority of participants had favorable comments about how the dhamaSPORT™ cooling band affected their mental state. The participants felt better while they were working harder – a WIN-WIN! In fact, after the study was completed several participants “refused” to return the dhamaSPORT™ band and instead worked with study organizers to find a way to purchase the units.

The dhamaSPORT™ band has been used by cyclists and runners to combat environmental heat stress and by firefighters to aid in cooling after firefighting. This study found that dhamaSPORT™ is also effect during high-intensity fitness workouts in a fitness studio. This revolutionary new technology is helping individuals realize their own potential and push beyond their previous limits.

For more information on Orangetheory Fitness please visit their website at: <http://www.orangetheoryfitness.com>

For more information on dhamaSPORT™ cooling band, visit the dhamaUSA site at: <http://dhamausa.com>

About Authors

Denise L. Smith, Ph.D., is a Professor of Health and Exercise Sciences at Skidmore College where she teaches Exercise Physiology and directs the First Responder Health and Safety Laboratory, and a Research Scientist at the University of Illinois Fire Service Institute. Dr. Smith has coauthored an Exercise Physiology textbook and an Advanced Cardiovascular Exercise Physiology textbook. She has conducted extensive research on heat stress and the cardiovascular strain associated with firefighting and has published over 100 research articles. Dr. Smith lectures extensively on health and safety issues in the Fire Service. She enjoys running, biking and hiking.

Susie Caron grew up in Southern California where she developed her drive for athletic competition very young. At the age of five, she became a competitive swimmer and for over 14 years, competed in various sports throughout her youth. She attended California State University, in Chico, where she obtained a B.A. in Education, with a minor in Business Administration. After college, she moved to the east coast of Florida in Jacksonville and was an elementary school teacher. She met her husband and helped raise two sons. She has never given up her athletic lifestyle and enjoys her new found passion in high intensity circuit training. Also, she thoroughly enjoys participating in various charity fitness events. Because of her love of the outdoors, especially the ocean, you will usually find her somewhere on the saltwater, fishing, paddle boarding, and swimming. Eventually, Susie hopes to live a true island lifestyle with her husband, sailing off into the sunset.

References

Arngrímsson SA, Petitt DS, Stueck MG, Jorgensen DK, Cureton KJ. Cooling vest worn during active warm-up improves 5-km run performance in the heat. *J Appl Physiol* (1985). 2004; 96(5):1867-74.

Booth J, Marino F, Ward JJ. Improved running performance in hot humid conditions following whole body precooling. *Med Sci Sports Exerc.* 1997; 29(7):943-9.

Ely MR, Cheuvront SN, Roberts WO, Montain SJ. Impact of weather on marathon-running performance. *Med Sci Sports Exerc.* 2007; 39(3):487-93.

Ely BR, Cheuvront SN, Kenefick RW, Sawka MN. Aerobic performance is degraded, despite modest hyperthermia, in hot environments. *Med Sci Sports Exerc.* 2010; 42(1):135-41.

Galloway SD, Maughan RJ. Effects of ambient temperature on the capacity to perform prolonged cycle exercise in man. *Med Sci Sports Exerc.* 1997; 29(9):1240-9.

González-Alonso J, Teller C, Andersen SL, Jensen FB, Hyldig T, Nielsen B. Influence of body temperature on the development of fatigue during prolonged exercise in the heat. *J Appl Physiol* (1985). 1999; 86(3):1032-9.

Kay D, Taaffe DR, Marino FE. Whole-body pre-cooling and heat storage during self-paced cycling performance in warm humid conditions. *J Sports Sci.* 1999; 17(12):937-44.

Lee DT, Haymes EM. Exercise duration and thermoregulatory responses after whole body precooling. *J Appl Physiol* (1985). 1995; 79(6):1971-6.

MacDougall JD, Reddan WG, Layton CR, Dempsey JA. Effects of metabolic hyperthermia on performance during heavy prolonged exercise. *J Appl Physiol.* 1974; 36(5):538-44.

Nassis GP, Brito J, Dvorak J, Chalabi H, Racinais S. The association of environmental heat stress with performance: analysis of the 2014 FIFA World Cup Brazil. *Br J Sports Med.* 2015; 49(9):609-13.

Peiffer JJ, Abbiss CR. Influence of environmental temperature on 40 km cycling time-trial performance. *Int J Sports Physiol Perform.* 2011; 6(2):208-20.

Schlader ZJ, Raman A, Morton RH, Stannard SR, Mündel T. Exercise modality modulates body temperature regulation during exercise in uncompensable heat stress. *Eur J Appl Physiol.* 2011; 111(5):757-66.