



AFRL-RH-BR-TR-2008-0020

**IS PERFORMANCE OF INTERMITTENT INTENSE
EXERCISE ENHANCED BY USE OF A
COMMERCIAL PALM COOLING
DEVICE**

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January 2008

**Approved for public release; distribution
unlimited, May 2008.**

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REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188		
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1. REPORT DATE (DD-MM-YYYY) 12-01-2008		2. REPORT TYPE Technical Report		3. DATES COVERED (From - To) 30 Oct 2007 – 15 Nov 2007	
4. TITLE AND SUBTITLE Is Performance of Intermittent Intense Exercise Enhanced by Use of a Commercial Palm Cooling Device?			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S) Thomas Walker, Michael Zupan, Andrew Cantwell, Julia McGregor, and			5d. PROJECT NUMBER 7757		
			5e. TASK NUMBER P9		
			5f. WORK UNIT NUMBER 18		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Air Force Materiel Command 2485 Gillingham Drive Air Force Research Laboratory Brooks City-Base, TX 78235 Human Effectiveness Directorate Biosciences and Protection Division Biobehavioral Performance Branch			8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Air Force Materiel Command 2485 Gillingham Drive Air Force Research Laboratory Brooks City-Base, TX 78235 Human Effectiveness Directorate Biosciences and Protection Division Biobehavioral Performance Branch			10. SPONSOR/MONITOR'S ACRONYM(S) AFRL/RH, AFRL/RHP,		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S) AFRL-RH-BR-TR-2008-0020		
12. DISTRIBUTION / AVAILABILITY STATEMENT Distribution A: Approved for Public release; distribution unlimited					
13. SUPPLEMENTARY NOTES Human Use (Wright Site IRB) Protocol F-WR-2007-0003. P. A. Case file number for Distribution A-08-118					
14. ABSTRACT The purpose of this study was to determine if using the Core Control™ Rapid Thermal Exchange (RTX), a commercial palm cooling device, during active rest periods of multiple set training, is an effective means to increase performance. Ten subjects completed three interval running tests on a human powered treadmill. In those performances subjects completed eight 30-second intervals at a hard/fast pace followed by a 90-second walking or light jogging recovery period. During the recovery period, the subjects placed their hand on one of three media: the RTX held at 15°C (R); a 15°C standard refrigerant gel pack (P), or nothing at all (C.) Although there were differences in core temperature (T _c), subjective heat stress ratings, distance and power generated between intervals, there were no significant differences found between treatments for any of these variables nor was the interaction effect of interval*treatment found to be significant. We conclude that the RTX, in its current iteration, is ineffective at improving performance and/or mitigating thermal stress during high-intensity intermittent exercise.					
15. SUBJECT TERMS Core Control™ Rapid Thermal Exchange, palm cooling device, thermal stress					
16. SECURITY CLASSIFICATION OF: Unclassified			17. LIMITATION OF ABSTRACT SAR	18. NUMBER OF PAGES 27	19a. NAME OF RESPONSIBLE PERSON Maj Thomas Walker
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			19b. TELEPHONE NUMBER (include area code)

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

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Acknowledgments

This research was sponsored by the Air Force Research Laboratory, Brooks City-Base, TX and funded by the Air Force Research Laboratory.

Executive Summary

Purpose:

The purpose of this study was to determine if using the CoreControl™ Rapid Thermal Exchange (RTX), a commercial palm cooling device, during active rest periods of multiple set training, is an effective means to increase performance. Our hypothesis was that use of the RTX would lower or slow increase in core temperature (T_c), during activity, resulting in greater work and/or training volume per exercise session.

Methods:

Ten volunteers (5 male, 5 female) participated in this study. Each volunteer completed four sessions. Session one comprised of a medical examination followed by a VO_2 max test administered via treadmill. Data was collected in sessions two through four.

After a five-minute warm up, the subjects completed eight 30-second intervals at a hard to fast pace followed by a 90-second walking or jogging recovery period. During the recovery period, the subjects placed their hand on one of three mediums: the RTX held at 15°C; a 15°C standard refrigerant gel pack, or nothing at all. At the end of each recovery period, the subjects rated their level of heat stress using a 0-11 numerical scale. Internal body core temperature (T_c), distance covered, average speed, and average power per interval were also recorded.

Results and Conclusions:

The primary findings of this investigation indicate that the RTX device does not delay a rise in T_c or improve performance of high-intensity intermittent running compared with a refrigerant gel pack and control treatments. Additionally, subjects reported no difference in their subjective ratings of heat stress between conditions.

Our results were disappointing considering that hand immersion in cool water has been shown to be an effective method for combating hyperthermia (Giesbrecht 2007, Livingstone 1989, House 1997.) There are two potential reasons why the RTX treatment was ineffective. Either the exercise/recovery bouts of 30 seconds hard, 90 seconds easy was not limited by hyperthermia and/or the RTX device did not provide a meaningful amount of heat extraction. This could be due to several factors including insufficient temperature gradient, insufficient surface area cooled, insufficient amount of time spent cooling, and/or insufficient vasodilation in the cooled area.

Based on our investigation, we conclude that the RTX, in its current iteration, is ineffective at improving performance and/or mitigating thermal stress during high-intensity intermittent exercise. Consequently, we do not recommend its adoption for use by USAF members who engage in such exercise nor do we recommend further research into its efficacy at this time.

INTRODUCTION

Objective

The purpose of this study was to determine the effect of using the CoreControl™ Rapid Thermal Exchange (RTX), a commercial palm cooling device, during active rest periods of high intensity interval training. Our hypothesis was that use of the RTX would mitigate the rise in core temperature (T_c) during exercise, resulting in greater work and/or training volume/duration per exercise session.

Background

Although it may be potentially advantageous to locally warm working muscle for high-intensity exercise performance (Sargeant 1987, Ball 1999, Linanne 2004), a large increase in core body temperature (T_c) may adversely affect such exercise and delay recovery. It is well established that hyperthermia during exercise increases cardiovascular strain (Gonzalez-Alonso et al., 1999) and elevates hormones associated with stress and fatigue (Radomski et al., 1998) such as cortisol, prolactin and catecholamines. Body core temperature greater than 40°C generally results in the inability to continue exercise despite the lack of other central fatigue causal factors (e.g. inadequate substrate, abnormal pH, etc.) (Nielsen et al., 1993; Parkin et al., 1999).

Thus it appears that delaying and/or limiting a rise in T_c during high intensity intermittent exercise (e.g. weight-training, interval training, etc) may provide the ability to exercise for a longer duration and/or at a higher intensity. Immersion of the hands in cold water has been demonstrated to be an effective method for mitigating exercise-induced increases in T_c (Giesbrecht et al., 2007, House et al. 1997, Livingstone et al. 1989), but may be tempered due to vasoconstriction. Generally, when exposed to cold, vasoconstriction occurs in the effected extremity, reducing blood flow and effectively limiting local heat exchange.

The RTX employs a proprietary combination of cooling the hand (to 15 – 28° C) while applying a 35 – 45 mmHg vacuum to open peripheral anastomoses and enhance hand circulation. The intended result is a greater heat exchange than with cooling alone. Two investigations (Grahm et al., 1999, Hsu et al., 2005) have reported that use of the RTX enhanced cooling and/or mitigated thermal stress during exercise more successfully than no cooling (Hsu et al., 2005) or hand cooling alone (Grahm et al., 1999). Additionally, the company that manufactures the RTX (AVAcare Technologies, Ann Arbor, MI) has reported anecdotal evidence of athletes increasing repetitive set training volumes by extremely large amounts when using the CoreControl™ between sets and/or intervals.

The Air Force Research Laboratory previously tested the efficacy of the RTX device under simulated pilot heat stress and found it to be slightly more effective than control conditions while less effective than a water-cooled vest (Balldin et al., 2007). The current study was designed to determine whether the RTX could enhance the physical training regimens of Air Force Special Operators (AFSO) due to their regular participation in high-intensity multi-set and multi-interval sessions as part of their physical fitness training.

METHODS

Volunteers

Ten volunteers (active duty and/or retired military), after signing an informed consent document and completing a medical screening questionnaire (Appendix A), participated in this 3-trial, repeated measures design.

The following inclusion criteria were used to determine participation in this study (See appendices A and B):

- 1) Meets American College of Sports Medicine definition of “Low Risk”
- 2) Currently and regularly runs > 15 mi/wk
- 3) No use of herbal supplements for past 30 days
- 4) Consumed < 100mg caffeine on the day of each trial

Volunteers visited the lab four times for a cumulative total time of 4.0 hrs.

Experimental Design and Assessment Overview

1st Visit

The AFRL Wright Site Institutional Review Board approved this research study to allow the use of human subjects. Prior to participation subjects were informed of the risks and discomforts associated with this study and their written consent was obtained. After consent was given, a medical screening/clearance was performed by the medical monitor. Once the volunteer was medically cleared, each completed an 8-12 minute, incremental treadmill VO_2 peak test. During the VO_2 peak test, each volunteer walked for two minutes at two miles per hour on a Woodway Desmo treadmill (Woodway, Waukesah, WI) and then began running at a pre-selected pace for an additional two minutes. This pace ranged from 8.8 to 13 km/hr (5.5 to 8.0 mi/hr) and was based on the training information provided by each volunteer (see Appendix B). This running speed was held constant for the remainder of the test. All additional intensity was imposed by increasing the grade 1 or 2% each minute until the volunteer reached volitional fatigue. Plastic facemasks were worn during the entire test to collect expired gases that were analyzed using the Parvo Medics' TrueOne[®] 2400 Metabolic Cart (ParvoMedics, Sandy, UT).

Following the VO_2 peak test each volunteer had a 10-min recovery period. During this recovery, subjects were shown the CoreControl[™] Rapid Thermal Exchange (RTX) Device (AVAcare Technologies, Ann Arbor, MI) (See Figure 1) and practiced using it. The RTX is a small chamber that cools the hand by constantly circulating cooled water through a hollow conical handle upon which the hand rests while applying a slight vacuum to increase circulation.



Figure 1: CoreControl™ Rapid Thermal Exchange (RTX) Device

After the recovery period, each volunteer walked and ran on the Woodway Force treadmill (Woodway, Waukesah, WI) (See Figure 2) for about 10 minutes at several self-selected speeds/loads to gain familiarization with this unique treadmill. The Force treadmill is a human-powered treadmill in which the volunteer wears a harness that is connected to a force transducer that allows for the measurement of force and, therefore, work and power.



Figure 2: Woodway Human Powered Force Treadmill

2nd – 4th Visits

The volunteers' health status and current body weight was checked upon arriving for the remaining three visits. Each trial was separated by at least 48 hours and was conducted in a relatively normothermic environment of 21-23°C and 30-50% RH. Once cleared, the volunteer ingested a CorTemp™ Telemetry System (HQ Inc., Palmetto, FL) capsule (See Figure 3). This pill was taken in unison with a Power Bar® and 500ml of water to speed digestion. (The water

bolus also helped insure proper hydration.) The small capsule transmits a low-frequency radio signal that varies with body temperature, and the information is picked up by a hand-held recorder (See Figure 4). This system is widely-used in environmental physiology research, is less invasive and more comfortable than rectal or esophageal thermistors and has been demonstrated to be a valid, accurate tool (Gant et al., 2006.)

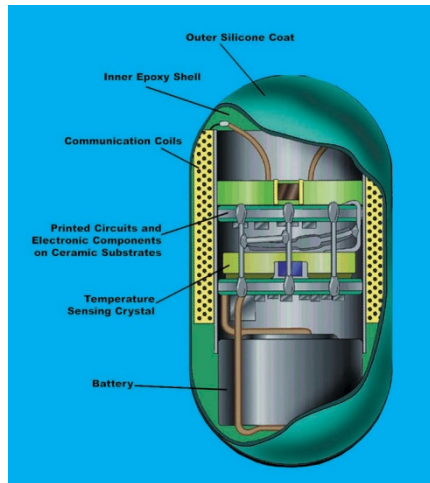


Figure 3: CorTemp™ Telemetry System Capsule



Figure 4: CorTemp™ Telemetry Recorder

Following a 30–60 min seated rest period to allow the capsule to reach the intestinal tract, each volunteer was fitted with a plastic facemask for expired gas collection, a waist belt used to connect the volunteer to the Force Treadmill, and a heart rate monitor. A one-minute pre-test rest period followed to check that all signals were being recorded properly.

Each volunteer then completed a 5-min warm-up at a very light to light intensity (10 on the Borg Scale) for 2.5 minutes and then moderate intensity (12 on the Borg Scale) for another 2.5 minutes. After the 5-min warm-up, volunteers completed the first of eight 30 s runs at a self-selected high intensity (between very hard to extremely hard or ~18 on the 6-20 Borg Scale)

while working against a treadmill load of 2.27 kg. After the 30-s “run interval”, each volunteer completed 1.5 minutes of walking/jogging recovery (~12 on the Borg Scale). During these recovery sections, the volunteers either rested their hand on an empty shelf (Control “C” trial), placed their hand in the 15°C RTX (RTX “R” trial), or laid their hand against a cold PolarPack® Standard Refrigerant Gel Pack (SCA Thermosafe) (Figure 5) having a temperature of 15°C (Ice Pack “P” trial). The PolarPack® was replaced after the fourth interval to maintain a constant 15°C. At the end of each recovery period, volunteers rated their level of heat stress using a 0-11 numerical scale. This 2 minute interval/recovery sequence was repeated 7 more times for a total of 8 complete intervals.



Figure 5: PolarPack® Standard Refrigerant Gel Pack

Data Analysis

An N of 10 was determined as appropriate to provide 80% power to detect a 0.5°C T_c difference between 3 repeated measures trials at an α level of 0.05. Standard deviations were taken from a recent study (Byrne, 2006) that utilized the CorTemp™ system to monitor T_c .

Heart rate, oxygen consumption (VO_2), T_c , subjective heat stress ratings, distance achieved per interval and power achieved per interval were collected during the three trials (R, C and P). The measurements were compared between conditions in 2-factor repeated measures (interval and treatment) Greenhouse-Geisser Analyses of Variance (ANOVA) using SPSS 11.0 statistical software (SPSS, Inc., Chicago, IL). The level of statistical significance was set at $\alpha < 0.05$.

RESULTS

Five male and five female volunteer subjects, with a mean age of 29.9 years completed the study. There were no differences in individual subjects' body weights between trials. Subject descriptive characteristics are displayed in Table 1.

Although there were differences in T_{c} , subjective heat stress ratings, distance and power generated between intervals, there were no significant differences found between treatments for any of these variables nor was the interaction effect of interval*treatment found to be significant.

Total distance completed (m) per trial was $717.08\text{m} \pm 124.37\text{m}$ (Trial R), $724.81\text{m} \pm 130.25\text{m}$ (Trial P), and $728.58\text{m} \pm 110.6\text{m}$ (Trial C). Change in T_{c} ($^{\circ}\text{C}$) from baseline to end-test averaged $1.41^{\circ}\text{C} \pm 0.37^{\circ}\text{C}$ (Trial R), $1.41^{\circ}\text{C} \pm 0.39^{\circ}\text{C}$ (Trial P) and $1.41^{\circ}\text{C} \pm 0.59^{\circ}\text{C}$ (Trial C). There were no significant differences in T_{c} (fig. 6), HR (fig. 7), or VO_2 between intervals or treatments.

Subjective heat stress ratings are show in Figure 8. Because subjects' ratings of subjective heat stress at time = 0 were not uniform, we used the change from that baseline as our measure. Mean power generated and distance completed per interval for each of the three treatment conditions are displayed in Figures 9 and 10 (Please note that, in order to improve readability, bars representing standard deviation have been limited to 8-20 representative cases for all graph plots).

Table 1. Demographic characteristics of the participates (mean $\pm$ SD)

	Height (m)	Mass (kg)	Age (yr)	VO_2peak ($\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$)	Km train per week
Males	1.77 ± 0.09	$79.0 \pm .53$	31.9 ± 9.8	52.4 ± 2.3	30.2 ± 10.6
Females	1.62 ± 0.11	$61.5 \pm .48$	28.0 ± 7.0	44.8 ± 5.3	33.1 ± 3.4
Total	1.69 ± 0.11	70.6 ± 9.5	29.9 ± 8.6	48.6 ± 3.8	31.7 ± 7.8

Table 2. ANOVA table for heat stress rating

	df	<i>F</i>	<i>p</i>
Treatment	1.28	3.63	0.08
Interval	1.48	38.40	0.00
Treatment*Interval	3.78	0.96	0.44

Table 3. ANOVA table for mean power generated.

	df	<i>F</i>	<i>p</i>
Treatment	1.87	0.14	0.86
Interval	3.24	29.36	0.00
Treatment*Interval	3.33	0.96	0.45

Table 4. ANOVA table for T_c measured at the end of each recovery interval

	df	<i>F</i>	<i>p</i>
Treatment	1.63	0.32	0.69
Interval	1.59	94.37	0.00
Treatment*Interval	1.83	0.74	0.49

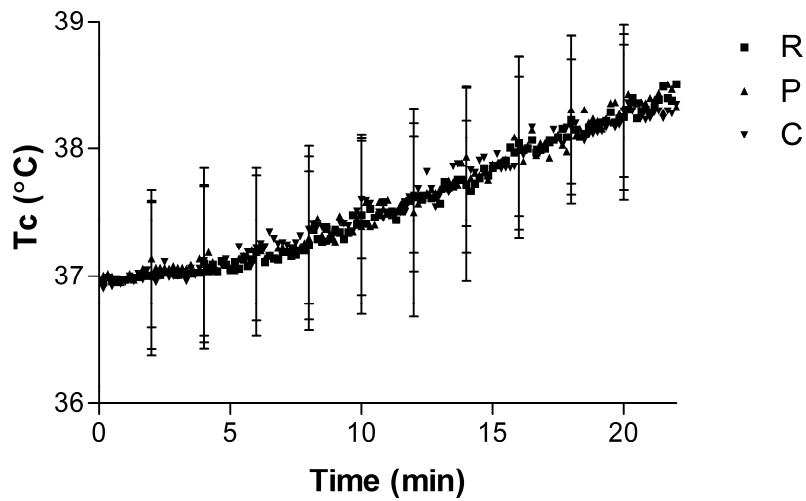


Figure 6. T_c over time for three treatments – RTX (R), Ice Pack (P) and Control (C).

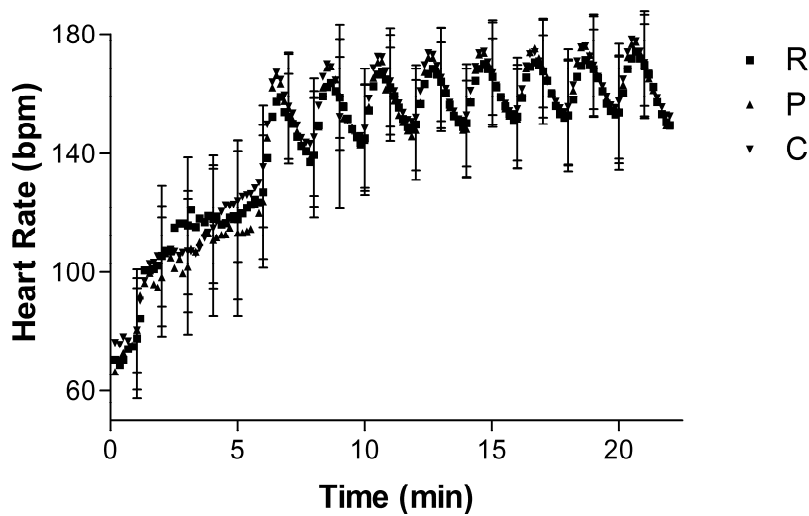


Figure 7. HR over time for all three treatments – RTX (R), Ice Pack (P) and Control (C)

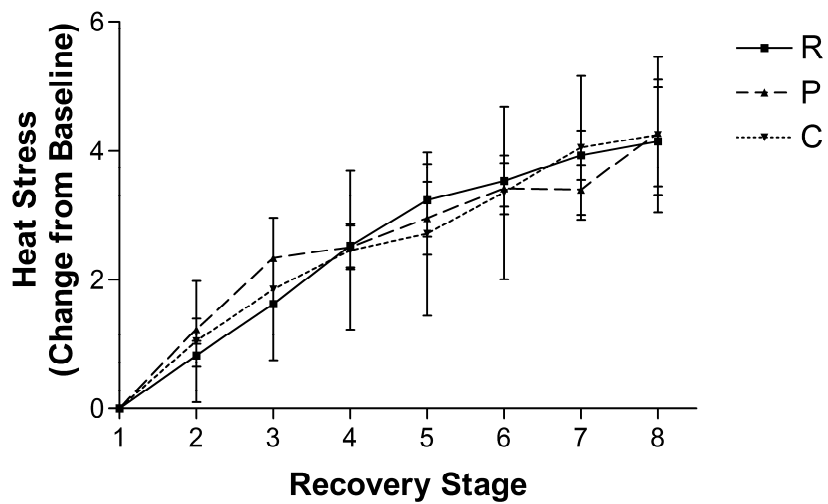


Figure 8. Heat Stress Ratings expressed as difference from baseline rating per recovery interval for each treatment condition – RTX (R), Ice Pack (P) and Control (C).

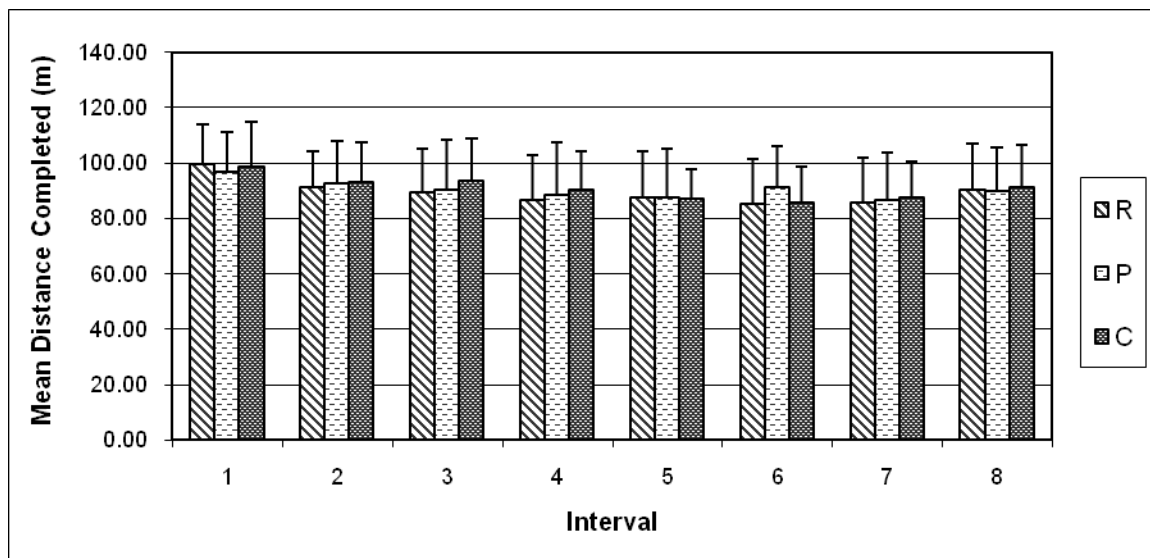


Figure 9. Distance completed per interval for each treatment condition – RTX (R), Ice Pack (P) and Control (C).

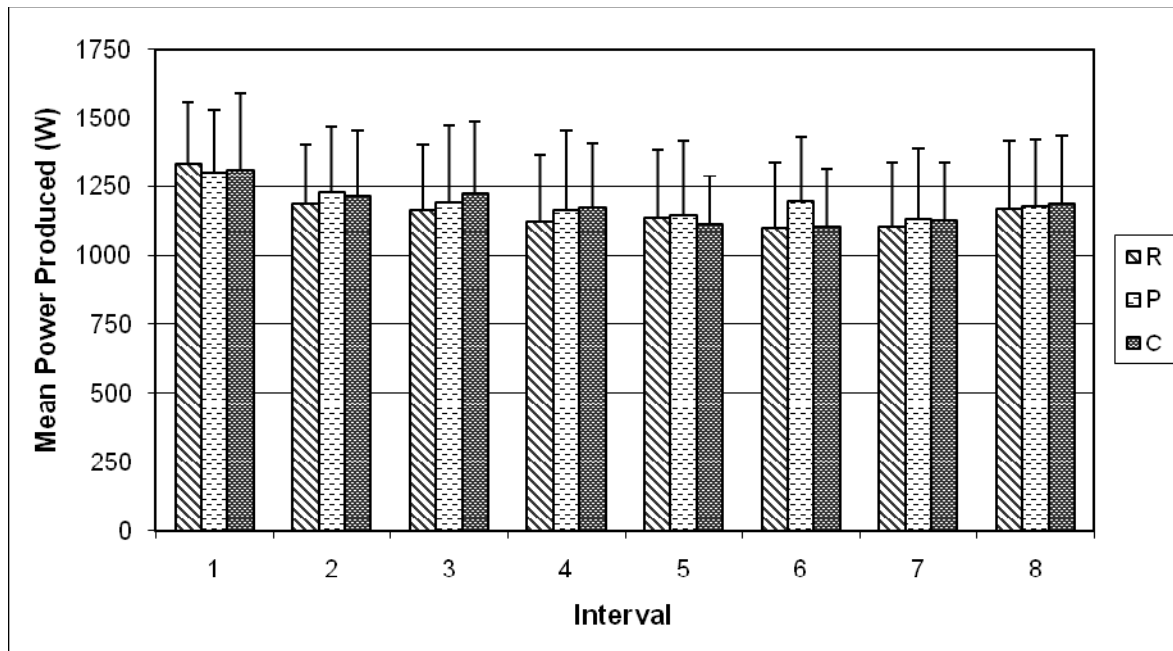


Figure 10. Mean power generated per interval for each treatment condition – RTX (R), Ice Pack (P) and Control (C).

DISCUSSION

The primary finding of this investigation is that use of the RTX device during recovery periods did not delay a rise in T_c nor did it improve performance of high-intensity intermittent running as compared with ice pack and control treatments. Additionally, subjects reported no difference in their subjective ratings of heat stress between conditions.

Our results were disappointing given that hand immersion in cool water has been shown to be an effective method for combating hyperthermia (Giesbrecht 2007, Livingstone 1989, House 1997.) There are two potential reasons why the RTX treatment was ineffective: a) this exercise bout of 30 s hard running, 90 s easy walking/jogging was not limited by hyperthermia; b) the RTX device did not provide a meaningful amount of heat extraction.

The capacity for hyperthermia to impair performance of high-intensity intermittent exercise has yet to be determined with complete certainty. Cheung and Robinson (2004) found no benefit to pre-cooling subjects prior to repeated cycling sprints in a normothermic environment. Conversely, but with a similar implication on the capacity for hyperthermia to impair performance of high-intensity intermittent exercise, Linnane et al. (2004) asked subjects to complete two 30 s cycle sprints at an environmental temperature of 20.6°C with 4 min recovery between sprints after undergoing immersion up to the neck in 43°C water for 16 min and then sitting in an environmental chamber at 44.2°C for 30 min. This treatment increased T_c by 1°C

over control. The authors theorized that such a difference accounted for an improved first sprint in the pre-heated trial. However, there were no differences in sprint performance in the second sprint in the hot trial compared to the control trial. Moreover, mean power was significantly reduced from the first to second sprint in the hot condition but not in the control condition, suggesting that environmentally-induced hyperthermia might decrease performance in repeated efforts. As the current study employed a running test rather than cycling our mean power per sprint (1180 W) was substantially greater than observed by Linnane et al. (664 W.) However, the effort levels emitted by the subjects were similar. In the current study mean power was reduced between sprints 1 and 2 in all conditions and generally declined over the course of the 8 intervals.

Some of the most compelling evidence to date regarding the influence of hyperthermia on intermittent exercise comes from Drust et al. (2005) in a study wherein subjects completed 40 min of intermittent cycling (alternating 15 s high intensity exercise and 15 s rest), followed by 5 x 15 s maximal cycle sprints in both normal and hot environments. They observed significant declines in power over the course of the sprints in both conditions with a significantly larger decline in work during the last four sprints in the heat versus in the normal temperature environment. This decline corresponded with a 2.5°C increase in T_c . (In the control condition, a 1.2°C increase was observed.) Based on this evidence it appears that hyperthermia does limit performance of high-intensity intermittent exercise. Morris et al. reported similar results from a study in which subjects performed a sequence of walking, sprinting, cruising (85 % $\dot{V}O_{2max}$), jogging (45 % $\dot{V}O_{2max}$) and resting, repeated until volitional exhaustion. Subjects were able to repeat this sequence significantly longer at 17°C than at 33°C.

We conducted our trials at a relatively normothermic temperature (~22°C), largely to represent conditions commonly experienced during voluntary physical fitness training, and therefore did not impose as great a thermal burden as did the “hot” trials of Morris et al. and Drust et al. Although we did not attempt to determine what extent hyperthermia, versus other factors, e.g. acidosis, contributed to the erosion of performance we observed in the current study, the fact that we did see such erosion supports the conclusions of those studies. Further, the performance decrease we observed, coupled with the observed significant increases in T_c (1.4°C above baseline) and subjective heat stress, over the progression of intervals indicates that thermal stress was a limiting factor to performance.

If hyperthermia limits the performance of high-intensity intermittent exercise yet there were no differences in performance between our treatments, we must not have induced meaningful heat extraction in any treatment/condition. This could be due to several factors including insufficient temperature gradient, insufficient surface area cooled, insufficient amount of time spent cooling, and/or insufficient vasodilation in the cooled area.

Insufficient time. Duffield et al. (2003) failed to observe a difference between performance of subjects wearing an ice cooling jacket both before (for five minutes) and in the recovery periods (2 x 5 min and 1 x 10 min) of an 80 minute intermittent, repeat sprint cycling exercise protocol inside a climate chamber set at 30°C and 60% RH. They suggested that longer periods of cooling may be necessary to produce a change. Likewise, Grahn et al. (2005) reported that the RTX had little effect on the rise in T_c early in their exercise bouts but substantially attenuated the

rise in T_c in the later bouts. Our 1.5 minute recovery periods were substantially shorter than those employed by Duffield et al. and may not have been long enough to have a measureable action.

Insufficient surface area. The RTX, in its current design, cools the palm of one hand. That may not be sufficient surface area to induce a reduction in T_c . Although both Hsu (2005) and Grahn (2005) observed the RTX to be effective while cooling a single palm, Giesbrecht et al. (2007) observed that during rest periods following heavy work in hot, humid conditions, hand immersion in 20°C water did not reduce core temperature as compared with control. However, including forearm immersion with hand immersion did significantly decrease core temperature below control values. Similarly, Balldin et al. (2007) observed that a cooling vest circulating 20°C water had a significantly greater effect on T_c , HR and subjective ratings of heat stress than did use of the RTX circulating 20°C water.

Insufficient temperature gradient. House et al (2007) demonstrated that the colder the water used in the cooling process, the better it effectively cools. Their subjects, after 45 minutes of work at 40°C, rested in the heat for 30 minutes while their hands were immersed in cooled water. After 20 minutes of hand immersion, mean T_c dropped from 38.5°C to 36.9°C using 10°C water, to 37.3°C using 20°C water, and to 37.8°C using 30°C water. Livingstone et al. (1989) had previously conducted a similar investigation and also concluded that the amount of heat lost during immersion was greatest if the immersion bath was set at 10°C and heat loss decreased as the temperature was set at higher levels (up to 30°C.) The RTX used in the current study has a temperature range of 15-28°C and was set at 15°C during recoveries in hopes of creating an effectual gradient. Despite this relatively low setting, we failed to observe any perceptible cooling.

Insufficient vasodilation. Grahn et al. (2005) observed that the effectiveness of the RTX decreases in an exponential manner with increasing exercise intensity. The exercise protocol in the current study was of a much greater intensity for a shorter duration than the protocols that have reported a significant cooling effect of the RTX. For example, in the study conducted by Hsu et al (2005), subjects cycled at a 60% VO_{2peak} for approximately 60 minutes, while in the study by Grahn et al. (2005), subjects walked at moderate rate until their HR reached 90% of the predicted maximum, which occurred between 34 and 57 minutes of continuous exercise. The intensity of the exercise protocol in the present study was very high. It is possible the high stress of the sprint bouts may have caused arteriovenous anastomoses in the hand to constrict during the sprints and remain constricted throughout active recovery periods despite the vacuum produced by the RTX.

CONCLUSIONS

Based on our investigation, we conclude that the RTX, in its current iteration, is ineffective at improving performance and/or mitigating thermal stress during high-intensity intermittent exercise. Consequently, we do not recommend its adoption for use by USAF members who engage in such exercise nor do we recommend further research into its efficacy at this time. Through discussions with the manufacturer, we understand that the RTX is being reengineered to

improve its efficacy. If the RTX engineering improves substantially to potentially induce a greater heat exchange, it may be practical to review the improved product.

Appendix A. Medical Screening Form.

Volunteer Number _____ Date: _____

Initial Medical History Screening

Please answer Y or N for the following health history questions:

- | | | |
|---|---|---|
| - Father or brother suffered a heart attack before age 55: | Y | N |
| - Mother or sister suffered a heart attack before age 65: | Y | N |
| - Have you smoked tobacco within the past 12 months? | Y | N |
| - Have you been diagnosed with any of the following? | | |
| -- High Cholesterol (>200 mg/dL) | Y | N |
| -- High Blood Pressure | Y | N |
| -- Diabetes | Y | N |
| - Are you currently taking any medications? | Y | N |
| - Do you have a medical condition that restricts your ability to perform actions such as running/jumping/cycling? | Y | N |
| - Are you pregnant? | Y | N |
| - Do you suffer any chronic joint or muscle pain? | Y | N |

Volunteers who answer “Y” to any questions will be referred to the medical monitor for further determination of their eligibility to be a volunteer. Signature of Investigator or Medical Monitor below indicates that this volunteer is medically cleared.

Signature of Investigator

Signature of Medical Monitor (if applicable)

Appendix B. Inclusion Questionnaire

SUBJECT INFORMATION

For “Is Performance of Intermittent Intense Exercise Enhanced by Use of a Commercial Palm Cooling Device?”

Name _____ ID # _____ Date ____/____/____

Date of Birth ____/____/____ Age____ Gender____

Height_____Weight_____

Phone _____

How did you hear about this study? _____

[illegible][illegible]

PHYSICAL TRAINING

Physical Activity (Minutes/Days per week)

_____/_____
Resistance Training average

_____/_____
Aerobic Training

Running Training

How long (approximately) have you exercised at these levels? _____

Appendix C. Subject Information Sheet

SUBJECT INFORMATION SHEET for “Is Performance of Intermittent Intense Exercise Enhanced by Use of a Commercial Palm Cooling Device?”

Introduction: We greatly appreciate you considering volunteering to be a subject. This research should provide valuable insight as to the ability of the Rapid Thermal Exchange Device to provide optimal cooling. If you participate, expect to spend about 60 minutes here for each of your 4 visits. Your informed consent document has detailed information about what you will do during the visits.

Directions to the Air Force Research Lab on Brooks City-Base: We are located in Bldg 170 near the corner of Gillingham Drive and Dave Erwin Drive.

- From Lackland, take 90 east to I-37 south. Exit I-37 at exit 135 (Military Drive) Take Military across Goliad and turn left on City-Base Landing.
- From Randolph AFB, take I-35 S or I-10 W to 410 S. Exit 410 at exit 39, and go right on WW White to the light. Turn left (west) on SE Military Dr. Take Military across Goliad and turn left on City-Base Landing.
-
- Enter Brooks City-Base at the Main Gate off City-Base Landing Road, just west of Wal-Mart. Follow Sidney Brooks Dr. for ~0.5 miles, turn right on Dave Erwin. Your first left is Gillingham. Park in the parking lot on the corner. Go to the double glass doors at the north end of the parking lot and ring us.

DO:

- Call us as soon as possible if you need to reschedule
- Follow your normal pre-run eating, drinking and activity routine (be hydrated!)
- Bring or wear your normal running attire (we have showers available if you wish to shower here following your trial)
- Make sure your chain of command knows you are a paid research subject

DO NOT:

- take herbal supplements within 10 days prior to each trial
- exercise strenuously within 12 hours prior to each trial
- have more than one serving of caffeine within 12 hours prior to each trial
- consume a heavy, high-fat meal within 3 hours of your trial

Call or Email Us! For questions about any of the above, to volunteer to be a subject, or to discuss any aspect of the study, contact us at Major Thomas Walker (thomas.walker@brooks.af.mil) at 536-6372 or MSgt Torrance Norris (torrance.norris@brooks.af.mil) at 536-5010.

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