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THE ACUTE EFFECT OF COLD SHOWERS RECOVERY METHOD ON CORE TEMPERATURE, HEART RATE, AND THERMAL SENSATION SCALE AFTER EXERCISE IN HOT ENVIRONMENT

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ABSTRACT

The purpose of this study was to compare the acute effect of cooling recovery method using cold water showers and sit in 15 °C temperature on core temperature (T*c*), heart rate (HR) and thermal sensation scale (TSS) after exercise in hot environment. Nine subjects underwent 15 min of two recovery methods; sit in 15 °C room temperature (SIT15) and 15 °C water showers (CWS), after exercise at 65% $\dot{V}O_{2peak}$ for 45 minutes in hot environment (35 °C room temperature, relative humidity (rh) 40-60%). Measures of HR, and T*c* were recorded every 30 minutes (min) throughout the experiment. TSS was obtained every 15 min until the end of the experimental trial. Results found that the values of T*c* and HR were not different between SIT15 and CWS methods after 15 min intervention period. The values of HR but not T*c* found to decrease at post intervention period ($p < 0.05$) in both recovery methods. TSS was lower in SIT15 (-3; feeling cold) versus CWS (-2; feeling cool) ($p < 0.05$). Our results concluded that recovery method either taking cold showers or sit in 15 °C room temperature had the same acute effect on reducing HR but not changing T*c* of the subjects. However a comfortable sensation mediated benefit of CWS over SIT15 recovery method implicates taking a cold shower may be the good choice of an alternative recovery method after exercise in Thai athlete.

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KEYWORDS: cooling recovery method, core temperature, heart rate, thermal sensation scale

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INTRODUCTION

Exercise in hot environment induced the physiological strain that associated with an increased in core temperature (T*c*) and heart rate (HR).[1, 2] It is well known that the recovery from exercise involves the return of the body from a fatigued state to its normal physiological and performance baseline, therefore various recovery methods after exercise and sports, such as immersion, massage, active and passive recovery etc., have been carried out for those purposes.[3-6] The positive recovery effect of cold water immersion (CWI) has been study. CWI is commonly used to attenuate hyperthermia by reducing core as well as mean skin temperature after exercise in hot environment.[4, 5] At 15 °C water temperature, 15 minutes CWI intervention has found to reduce core and body temperature in well-trained and athletes when compare to passive recovery at room temperature.[2, 4] Therefore, the cold temperature of water is widely used for studying the recovery effect after exercise in sports studies.

Taking a shower is an activity that millions of people make a part of their daily routine. It is a fast, effective and refreshing way to get clean. Several benefits have been reported such as easier to use, more hygiene, and common available in every sports and fitness bathrooms. For these reasons, instead of full body immersion, taking a cold shower may be a good choice of an alternative recovery method after exercise in athlete. Unfortunately, there is no information of using a cold shower on this purpose.

Concerning about the methods for the recovery after exercise, up to date, no study has been reported on the recovery effects of cold water showers yet. Moreover whether this method affects the body T*c*, and HR is still needed to be explored. Therefore, this study aims to compare the effects of the recovery after exercise in hot environment using 15 °C water showers (CWS) and sit in room temperature 15 °C (SIT15) on T*c*, HR and thermal sensation scale (TSS).

MATERIALS AND METHODS

Subjects

Nine sedentary males volunteered to participate in this study. Inclusion criteria included subjects have been exercise at least 30 minutes of moderate exercise per day for a minimum of 3 days per week in the previous 3 months prior to study and no health problems. Exclusion criteria included hormone disorders, heat - cold related illness, injury and a history of smoking. Subjects were instructed to eat food 2-h before testing, did not drink caffeine 4-h, alcohol 24-h before testing. Subjects read the written instructions of the possible risks and benefits of their participation in the study and provided written informed consent, and all experimental protocols were approved by the local Ethics Committee on Human Experimentation of Research of Mahidol University.

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Experimental procedures

Subjects attended the laboratory on 3 separated occasions. On their first visit, subjects were collected the anthropometric data including, height (cm) body weight (kg), body mass index (kg/m^2), fat body mass (%,kg), and lean body mass (%,kg). Subjects were collected resting heart rate (HR; bpm), blood pressure (BP; mmHg). The $\dot{V}O_{2peak}$ was determined by graded maximal exercise test for estimation of cardiovascular endurance and setting intensity of exercise in next times [7] (Table 1). An experimental trial was undertaken 5–7 days after the incremental test to ensure recovery. Each participant was asked to attend the laboratory on two separate recovery intervention trials. During the trial, participants completed cycling for 45 minutes at the subjects' predetermined kilopond of 65% of $\dot{V}O_{2peak}$ in the control room under hot condition (room temperature (Tz) 35 °C, relative humidity (rh) 40-60%). At the end of exercise, participants randomly performed one of the two recovery interventions for 15 minutes (min); sat on the chair in room temperature at 15 °C (rh = 40-60%) (SIT15) and took a shower with water temperature of 15 °C (CWS). For CWS method, participants took a shower on two alternating positions (back side and chest of their body) and hold each position for 3 min until 15 min of intervention period. The angle of the shower was individually adjusted for each participant to allow the water hitting the body at base of the neck (above the cervical vertebra 6 (C6)) and the head was not wet [8]

METHODS

The HR was determined with a chest strap and wrist watch receiver (FS1; Polar Electro Oy, Kempele, Finland). The HR was measured every 5 minutes until the end of the experimental trial. The *Tc* was monitored through an ingestible temperature device with radio transmitter (CoreTemp®, HQInc, USA). Participants took the capsule 5-h before exercising.[2] The T*c* was measured every 5 minutes until the end of the experimental trial. Thermal sensation scale (TSS) was measured using 9-point analog scales. (-4 = Very cold, -3 = Cold, -2 = Cool, -1 = Slightly cool, 0 = Neutral, 1 = Slightly warm, 2 = Warm, 3 = Hot, 4 = Very hot) [9] and measured every 15 minutes until the end of the experimental trial.

Statistical analysis

Kolmogorov-Smirnov test was used for testing normality of distribution. A two-way repeated-measures analysis of variance was performed to compare the differences between conditions. Significance was accepted at $p < 0.05$.

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RESULTS

Characteristics of subjects, including age (years), weight (kg), height (cm), BMI (kg/m²), %fat mass, and $\dot{V}O_{2peak}$ (ml/min/kg) were reported in **Table. 1**

Variable	Mean ± SD
Age (years)	21 ± 1.0
Weight (kg)	72.3 ± 11.0
Height (cm)	174 ± 8.0
BMI (kg/m²)	23.7 ± 2.5
%fat mass	16.6 ± 6.1
$\dot{V}O_{2peak}$ (ml/min/kg)	32.63 ± 4.07

Table. 1 Descriptive subject characteristics (n=9). Data were reported as mean values ± standard deviation (SD).

Heart rate (HR)

The result shown that HR was not significantly different when compare between CSW and SIT15. At 15 min of intervention period, HR was significantly reduced when compare to the beginning of intervention ($p < 0.05$). **(Fig.1 a)**

Core temperature (T*c*)

The result shown that T*c* was not significantly different when compare between CSW and SIT15. Within the trials of experiment comparison, at 15 min intervention period, T*c* values were not change when compare to the starting point of the intervention period ($p < 0.05$). **(Fig.1 b)**

Thermal sensation scale (TSS)

At post-intervention period, TSS value was significantly decreased when compare to the beginning point of intervention for both CSW and SIT15 methods ($p < 0.05$). The decreased value of TSS for SIT15 (-3; feeling cold) was significantly lower than for CWS (-2; feeling cool) ($p < 0.05$). **(Fig.1 c)**

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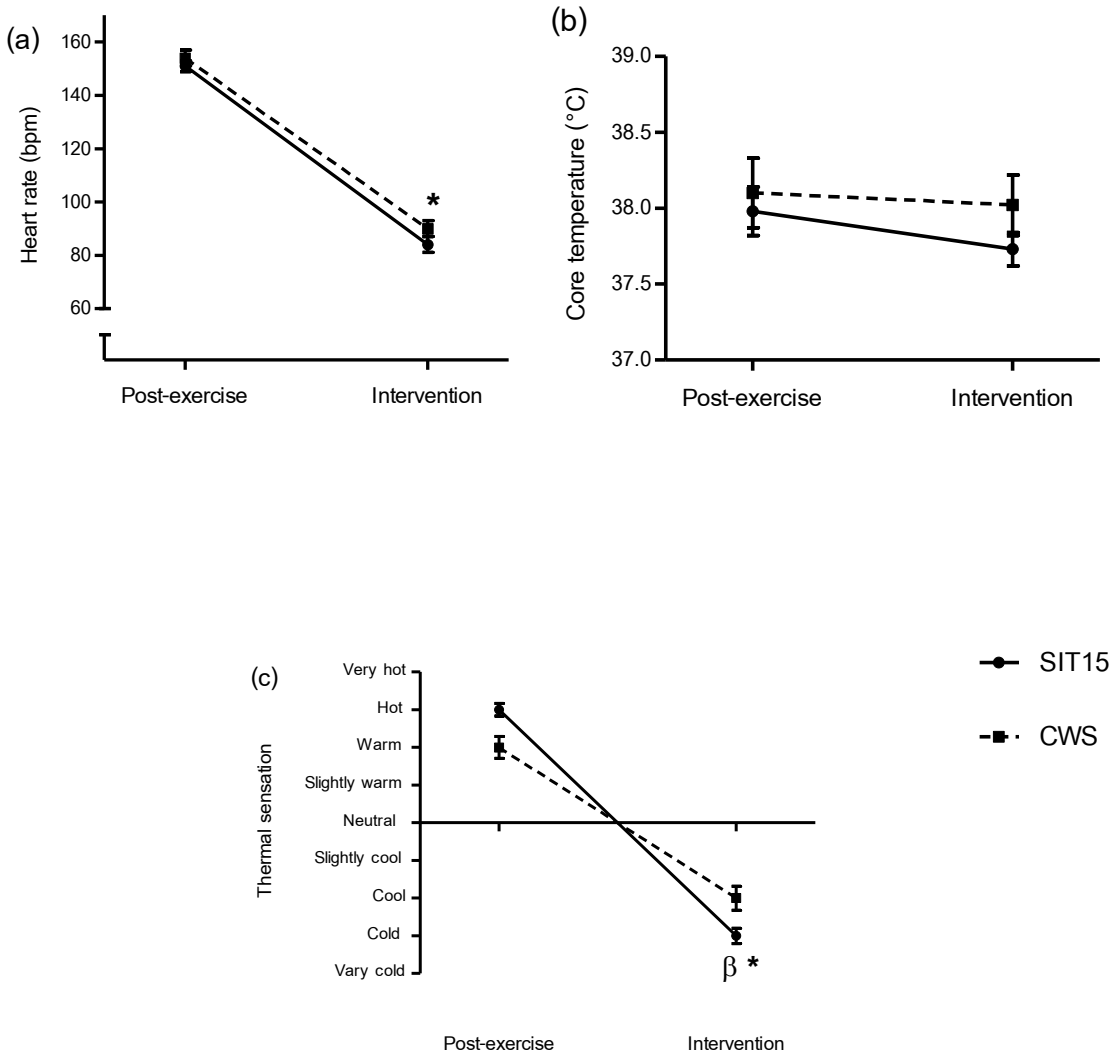

Figure 1. Heart rate **(a)**, core temperature **(b)**, and thermal sensation scales **(c)** immediately after exercise (post-exercise), and immediately post -intervention (Intervention) in SIT15 and CWS (n=9, mean ± SEM).

(*) Significant different from post-exercise ($p < 0.05$).

(**β**) Significant different between SIT15 and CWS ($p < 0.05$)

DISCUSSION

This study compared the effect of 15 min CWS and SIT15 recovery methods on T*c*, HR and TSS after exercise in hot environment. Our study showed no change in T*c* for CWS and SIT15 methods after intervention period. Similary, Dunne et al. also found the intestinal temperature was not statistically significant different among 8 °C cold water immersion (CWI), 15 °C CWI, and passive un-immersion seated rest in 22 °C

temperature during 15 min recovery intervention period.[10, 11] Gregson et al. found that after steady-state exercise at 70% $\dot{V}O_{2peak}$, rectal temperature declined at immediately post immersion but there was no significant difference between 8 °C CWI and seated in normal room temperature.[12] In contrast, Minett et al. studied the effects of recovery methods on T*c* following 70 min intermittent sprint exercise in hot environment, they reported the significant decreased of T*c* value after 10 min of intervention period for 10 °C CWI and MIX (cool pack) when compare to sit in 32 °C room temperature.[2] These rather contradictory results might be caused from the different in intensity and duration of exercise - induce stress as well as the details of recovery method used for each individual study. Therefore our data indicated that either taking a cold shower or sitting at 15 °C room temperature for 15 min could not exert its acute recovery effect on reducing T*c* of the subjects after exercise in hot temperature.

HR was decreased after 15 min intervention period in CWS and SIT15 methods. This result was consistency with the previous study done by Rezaee et al. who reported HR for 23 °C CWI was significant decreased lower than contrast water immersion (40 °C for 2 min and 23 °C for 1 min) and 40 °C HWI (hot water immersion) during 15 min intervention period after 100 meter front crawls sprint swimming [13]. Dunne et al. also found that HR was significantly lower in 15 °C CWI than passive un-immersion seated rest in 22 °C temperature after exercise to exhaustion, indicated the beneficial effects of cold temperature using in recovery intervention.[10] The possible explanation is that the reduction of HR during cooling temperature recovery method can induce vasoconstriction of peripheral surface vessels which causes an increase in peripheral resistance and then in turn increase of MABP. The raising of MABP activates arterial baroreceptors resulted a decrease in HR.[14] Therefore our data indicated that 15 °C of water showering and room temperature can effectively use to reduce HR for cooling recovery method after exercise in hot temperature. Moreover the within group comparison in HR values for both methods indicates cooling recovery method using CWS and SIT15 have the same acute effect on reducing HR after 15 min of recovery intervention. Thermal sensation (TSS) is the condition of mind that expresses satisfaction with complex thermal factors. Considering for method comparison between sitting and showering with the same temperature (15 °C), the result showed the TSS for SIT15 was lower than for CWS, indicated subject who was in the recovery method for sitting in 15 °C room temperature felt colder than in the recovery method for cold showers. Since rating of TSS has been shown to be influenced by skin temperature.[15] Therefore this result conclusively demonstrate a comfortable sensation mediated benefit of CWS over SIT15 recovery method, however more information using the other objective measurements such as the Borg's rating of perceived exertion (RPE) and thermal comfort scale (TCS) may need for supporting this result in further study.

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CONCLUSION

The cooling recovery methods using CWS can be effectively used for reducing the HR and thermal perceptual sensation but it had no acute effect on changing T*c* of subject after exercise in hot environment. An implication of this finding is that the recovery method for taking a cold shower may be the good choice of an alternative recovery method after exercise in Thai athlete since it is hygienic and comfortable method, fast and easy to use, as well as commonly available in every sport and fitness bathrooms.

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