

Effects of water immersion on the recovery of upper and lower body anaerobic power following a wrestling session

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Abstract

The aim of this study was to examine effects of cold-water immersion after exercise on powerresponses of wrestlers. Twenty elite male wrestlers were formed by similar age, height, weight and fitness parameters. The wrestling training session included a 60-minute of vigorous exercise. It consisted of warm-up exercises, standing technical and tactical exercises that mostly allocates arm and leg muscles. Vertical jump height, ropes climb height, and delayed onset of soreness was measured before, after, 24 h and 48 hors after the wrestling training. Cold-water immersion caused decrements in power loss at each follow-up time in comparison to a thermo neutral immersion. It can be suggested that the longer time needed for power to return to normal levels after cold treatment and assessment of varied contraction types may present a more broad demonstration of muscle function and consequential capacity for dynamic exercise following exercise-induced muscle damage.

Keywords: Cold water immersion, power, wrestling.

1. Introduction

Sports facilitators currently use many modalities of recovery techniques in an attempt to counteract the negative effects of vigorous exercise. Elite level athletic participation necessitates recovery from various physiological stressors (Leeder et al., 2012; Cheung et al., 2003; Bleakley et al., 2012). Vigorous exercise may also produce exercise induced muscle damage (EIMD) (Bleakley et al., 2012).

EIMD often occurs after unaccustomed exercise, especially after eccentric contractions (Ebbeling and Clarkson, 1989; Proske and Morgan, 2001; Stauber, 1989; Newham et al., 1987). Even though the exact mechanism responsible for damage is not known, previous studies have suggested that the initial disruption to skeletal muscle subsequent exercise is attributed to progressive deterioration of certain myofibrils (Jones et al., 1986).

EIMD is known to cause reductions in maximal strength and performance (Newham et al., 1983; Armstrong, 1984; Armstrong et al., 1991; Cheung et al., 2003). DOMS also results from high-intensity work relating eccentric muscular contractions (Knuttgen, 1986; Brassinnea, 2003) that induces muscle damage (Buroker and Schwane, 1987). It is also associated with loss of strength. In an attempt to lessen the symptoms of EIMD, several cryotherapy methods (Howatson et al., 2003)

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have been used by sports facilitators (Bleakley et al, 2012). Cryotherapy is anticipated to decrease tissue temperature, diminish inflammation and consequential edema, and reduce time to recovery.

While previous studies confirmed that cold-water immersion is beneficial on recovery of athletes' power (Bailey 2007; Montgomery 2008; Rowsell 2009; Skurvydas 2006, King 2009) in other sports, the findings about the effects of cold-water immersion (CWI) on DOMS is controversial (Kuligowski 1998; Ingram 2009; King 2009; Vaile 2008c, Ingram 2009). Also, there are limited studies providing evidence that cold-water immersion after unaccustomed exercise, intensely if the exercise involves a large amount of muscle lengthening contractions, improves subsequent power recovery of wrestlers. It is clear; therefore, that current literature addressing the treatment of EIMD with cold-water immersion in wrestling is limited and equivocal. Thus, the aim of this study was to explore effects of cold-water immersion after eccentric exercise on lower and upper power, and DOMS responses of wrestlers. It was expected that cold-water immersion exercise would help wrestlers recover faster when compared to thermo natural immersion (TWI).

2. Methods

2.1. Participants and Experimental Design

The subject characteristics were given in Table 1. Twenty elite male wrestlers voluntarily signed consent form to participate in the study. Each subject was required to complete a health questionnaire designed to screen out possible subjects who were contraindicated for inclusion in the study due to personal or familial health reasons. The purpose and nature of the study was explained to each subject prior to their participation. In addition, each subject read and signed a document that explained in detail the essence of the study. Local ethic committee of the university approved the study protocol. Two athletes from the same weight class served as experiment and control groups. The subjects were formed by similar age, height, weight and fitness parameters.

2.2. Experimental Design

Before the exercise test, physical characteristics of subjects (height, weight, and body composition) were measured. The wrestling training session included a 60-minute vigorous exercise. It consisted of warm-up exercises, standing technical and tactical exercises that mostly allocates leg and arm muscles. During the day 1, vertical jump values of the subjects were recorded prior, 30 minutes after, 24 hours after the training. During the day 2, which is after one week, rope climb times values of the subjects were recorded prior, 30 minutes after, 24 hours after the training.

2.3. Cold water and Thermo neutral immersions

Instantly subsequent to the training, wrestlers from the CWI group were fully immersed in a stirred cold-water bath for 10 min (Bailey et al., 2007). The water was maintained at a mean temperature of 10⁰C by the adding of crushed ice. Throughout the time of CWI, wrestlers in the TWI group stayed in the same long-seated position as their cryotherapy counterparts, completely immersing in a water bath at a mean temperature of 35⁰C (Rowsell et al., 2009).

2.4. Procedures for power measurements

Rope Climb: The rope climb (RC, 5.1 m) test was used to evaluate upper body muscular power and endurance. The test started with the wrestler in a seated position with both hands holding the climbing rope. They were allowed to employ their legs to perform the climb. Time was recorded to the nearest 0.1 second (Callan, 2000)

Vertical Jump: Lower-body muscular power was evaluated using a VJ protocol (Vertec, Questek Corp., Northridge, CA). As soon as assessing initial reach, the wrestlers were required to position

below the Vertec with his feet shoulder width apart. From this stationary position, the subjects jumped explosively and pushed away as many vanes as possible. The wrestlers were not permitted to take a step. Subsequent to completing a jump, the subjects were given two trials to advance this jump. The number pushed away on the maximum effort was recorded (Callan, 2000). The jump height was calculated as: VJ 5 maximal jump height - initial reach height.

2.5. Statistical analysis

Results were analyzed using the SPSS version 22.00 (SPSS Inc., Chicago, USA). The average and standard deviation of all parameters were calculated. It was determined that the data are normally distributed. A repeated (ANOVA) was used to institute differences between treatments over time. For single comparisons, a paired sample t -test was used to verify whether there were differences between groups. Statistical significance was accepted at an alpha -level of 0.05.

3. Results

There were not any significant differences between age, height, body weight, and BMI values of two groups (Cold-water immersion vs. Thermo neutral immersion).

Table 1. Descriptive statistics for all subjects.

	CWI (N=10, Mean \pm SD)	TWI (N=10, Mean \pm SD)
Age	22.40 \pm 2.50	22.87 \pm 2.87
Height (cm)	175.76 \pm 6.86	176.23 \pm 5.26
Body Weight (kg)	75.78 \pm 8.71	75.34 \pm 9.01
BMI	22.02 \pm 4.53	21.26 \pm 2.41

Data are shown as means \pm SD.

The VJ measured lower-body muscular power while the RC test indicated the level of upper-body muscular power and endurance. They were presented in Table 2.

There were not significant differences between the resting vertical jump (VJ) values of two groups. ($P > 0.05$), but VJ (post) and VJ (24 h) values were significantly different from each other ($P < 0.05$). There were not significant differences between the resting RC (rope climb) times of two groups. ($P > 0.05$), but RC (post) and VJ (24 h) values were significantly different from each other ($P < 0.05$).

Table 2. Vertical jump and Rope climb before, after 30 minutes, and after 24 hours of exercise.

	Treatment	Pre-Training	Post-Training	24 Hours
Vertical Jump (cm)	CWI	54.10 \pm 5.76	52.40 \pm 5.58 ^{ac}	53.85 \pm 5.87 ^{bc}
	TWI	54.00 \pm 5.89	51.15 \pm 5.20 ^a	51.03 \pm 5.07 ^a
Rope Climb (sn)	CWI	7.87 \pm 1.22	8.52 \pm 1.17 ^{ac}	8.31 \pm 1.15 ^{abc}
	TWI	7.80 \pm 1.23	9.34 \pm 1.14 ^a	9.21 \pm 1.03 ^a

CWI = Cold water immersion. TWI= Thermo natural-water immersion.

a Values are significantly different from pre values ($p < 0.05$).

b Values are significantly different from post values ($p < 0.05$).

c Values are significantly different from TWI values ($p < 0.05$).

4. Discussion

This study aimed to inspect the effect of immediate post-exercise CWI on power after 24 h recovery after a one-wrestling session. It was stated that maximal voluntary force generating capability might be the most interrelated sign of muscle damage (Warren, 1999; Morton et al., 2005). Present study resulted in that CWI reduced power loss at each follow-up time in comparison to a TWI. It was hypothesized that, as a result of cold treatment, vasodilatation and vasoconstriction of the peripheral blood vessels or “pumping action” has been anticipated to increase lactate clearance, increase blood flow (Cochrane, 2004) and consequent reduced the myocellular damage (Vaile, 2007).

It was stated that vertical jump in wrestling is used during many techniques to oppose attacks by the challenger. (Callen, 2000) but not many studies used rope climbing as a routine of assessing upper-body muscular endurance in combative sport athletes except Callen, et al (2000) study. They found similar results as the findings of the present study (9.sec. vs. 8.1 sec). At 24-hour follow-up, the findings from three studies (Bailey, 2007; Montgomery 2008; Rowsell, 2009) measuring maximal jump height indicated no difference between groups. Only Montgomery 2008 found no differences between groups at 48 hours. Skurvydas (2006) found no differences between groups immediately post intervention, but jump height was considerably superior in the CWI group at 24 hours, 48 hours, and 72 hours follow-up. King (2009) measured the percentage drop in jumping performance during five consecutive jumps; this was significantly lower and in favor of CWI at 24 hours. Several studies also confirmed that cold-water treatment significantly reduced muscle strength reduction at each follow-up time (6, 24, 48, 72 and 96 hours) in comparison to passive recovery (Ingram et al., 2009). Maximal strength in three studies Vaile et al. (2008), Kuligowski et al. (1998) Pournot et al. (2011) showed significantly lower changes from baseline in the CWT group. It was also reported that significant decreases in peak quadriceps strength were observed in the TWI group at 24 h and 48 h and in the CWI group at 48 h. However, quadriceps strength was significantly greater at 24 h in the CWI than in the TWI group (Ascensao et al., 2011). It is likely that the disagreements between studies may be attributed to the environment of cryotherapy method and the length of the cold application (Eston and Peters, 1999).

5. Conclusion

The present study confirmed that that CWI reduced power loss at each follow-up time in comparison to TWI

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