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Immediate Effects of Cold Water Immersion on Vertical Jump and Perceived Exertion in Women

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Abstract

Objective: The purpose of this study was to determine the effect of cold water immersion on the vertical jump and the Subjective Feeling of Perceived Exertion (SFPE).

Design: A test-retest design with two-hour interval.

Setting: University Campus.

Participants: Seventeen physical education female students (mean±SD 21.29±4.52 yr, 163.61±6.02 cm, 56.29±6.68 kg) volunteered for this study.

Methods: All subjects performed a series of functional tests: Squat Jump (SJ), Countermovement Jump (CMJ), sprint 30m, and jogging (CC) 1000m, with registration of the subjective Rating of Perceived Exertion (sRPE) by Borg scale (Borg, 1970) at the end of the last test (Time 1, M1). The experimental group was treated with cold water immersion in a tank of ice water (13ºC) for 5 minutes while the control group reposed sitting. The experiment was repeated two hours later (Time 2, M2). Comparisons were made using a one-tailed, independent-samples t-test.

Results: Both flight time (p=.003) and height (p<.001) SJ test showed significantly higher in the experimental group. CMJ test findings were also significantly higher in this group compared to flight time (p=.001) and height (p<.001). The experimental group also offered superior figures in terms of sRPE, although the differences were not statistically significant (p=0.475).

Conclusion: Cold water immersion exerts a beneficial effect on vertical jump ability and allows a better and greater recovery of this capacity. Future research should help identify optimal parameters for cold therapy and its possible influence on different physical qualities.

Keywords: Cold water immersion; Vertical jump; Perceived exertion; Women

Introduction

Cryotherapy has been used for its beneficial effects on acute injuries for centuries. Cold water immersion has recently emerged as one of the most effective cold therapy agents [1]. The effects of cold have been demonstrated in numerous animal models [2] and human populations [3]. Cold reduces tissue temperature, blood flow, pain, and metabolism, showing a positive effect on the return to activity. However, application parameters, modality, duration, or optimal frequency have not yet been established.

The role of cold water immersion in accelerating post-effort recovery has been questioned [4]. The restoration of normal physiological parameters from exercise-related variables, and maintaining or improving the functionality of the assessed body region indicates an adequate recovery. On the one hand, a correlation between the perceived exertion and the aforementioned physiological variables has been previously exposed. On the other, certain functional performance tests have evolved into reliable tools and indicators of the function of the lower limb [5].

The purpose of this study is to quantify the influence of cold water immersion on the vertical jump and the subjective Rating of Perceived Exertion (sRPE) in female athletes.

Methods

Seventeen physical education female students voluntarily enrolled (mean±SD 21.29±4.52 years, 163.61±6.02 cm, 56.29±6.68 kg) in this study.

A test-retest design with a Control Group (CG) and Experimental Group (EG), with randomized allocation of each participant was used. Descriptive characteristics for each group are listed in (Table 1).

Table 1: Descriptive characteristics: Values are expressed as mean (SD).

	Control (n=9)	Cold (n=9)	p
AGE	21.11(5.04)	21.50(4.21)	0.866
WEIGHT	56.00(7.78)	56.62(5.71)	0.854
HEIGHT	164.28(4.96)	162.88(7.34)	0.647
FAT%	27.21(4.72)	26.40(5.98)	0.759
BMI	21.36(2.92)	21.43(2.56)	0.959

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Table 2: Intra subject variability for Borg: SJ, and CMJ tests in both groups. Values are expressed as mean±SD. Significances are shown intra-groups and inter-groups.

	Group	Time 1	Time 2	Change	p (intra)	p (inter)	IC95 for Change
SJ_FLIGHT	Control	46.12±0.75	44.29±1.29	-1.83±1.27	0.187	0.034	[0.291, 6.551]
	Cold	45.12±1.23	46.71±1.23	1.59±0.61	0.034		
SJ_HEIGHT	Control	27.34±1.35	24.21±1.45	-3.13±0.59	<0.001	<0.001	[3.018, 6.873]
	Cold	25.09±1.36	26.90±1.42	1.81±0.69	0.034		
CMJ_FLIGHT	Control	46.84±0.82	43.98±1.36	-2.87±0.81	0.008	0.002	[1.753, 6.080]
	Cold	46.40±1.39	47.45±1.04	1.05±0.57	0.106		
CMJ_HEIGHT	Control	26.92±0.99	24.32±1.60	-2.60±0.85	0.015	0.003	[1.449, 6.051]
	Cold	26.57±1.62	27.73±1.21	1.15±0.63	0.113		
BORG	Control	15.11±0.42	15.67±0.29	0.56±0.41	0.214	0.453	[-1.229,2.618]
	Cold	14.00±0.53	15.25±0.59	1.25±0.84	0.180		

SJ_FLIGHT: Squat Jump Flight Time; SJ_HEIGHT: Squat Jump Height; CMJ_FLIGHT: Counter Movement Jump Flight Time; CMJ_HEIGHT: Counter Movement Jump Height; BORG: Borg scale for subjective feeling of perceived exertion.

All subjects performed a series of functional tests: Squat Jump (SJ) –without counter movement–, Counter Movement Jump (CMJ), sprint 30m, and jogging (CC) 1000m, with registration of the sRPE by Borg scale (6-20) [6] at the end of the last test (Time 1, M1). The EG was treated with cold water immersion in a tank of ice water (13ºC) for 5 minutes while the CG reposed sitting. The experiment was repeated two hours later (Time 2, M2). A one-tailed, independent-samples t-test was employed as the main statistical tool for analysing the data.

Results

In the EG group a better effect for flight time (p=.003, CI95% 0.29-6.55) and height (p<.001, CI95% 3.02-6.87) in SJ tests was found. CMJ test findings gave better effects in this group for flight time (p=.001, CI95% 1.75-6.08) and height (p<.001, CI95% 1.45-6.05). In terms of sRPE, EG group also offered better results, although the differences were not statistically significant. Intra subject variability for SJ and CMJ tests, and Borg scale in both groups are expressed in (Table 2).

Discussion

The effects of temperature suppression on muscle spindle and myotatic stretch reflex are interesting from the standpoint of muscle physiology [7]. However, from a practical point of view, it is necessary to know the real and direct influence of cold water immersion on the functional capacity of the individual [8]. Cross et al. assess their effect on the jump and race series and offer lower figures in the leg vertical jump in the EG [9], findings consistent with those offered by Fischer et al. after applying ice packs [10].

To our knowledge, there are no previous studies linking cold water and sRPE. Chen et al. concluded in their meta-analysis that Borg scale has optimal validity in certain circumstances -male population assuming maximum efforts during unusual physical tasks- [11]. In this respect, the lack of statistical significance subtracts relevance to our findings.

Conclusion

The results of this study allow us to conclude that the cold water immersion exerts a beneficial effect on vertical jump ability and allows a better and greater recovery of this capacity. Practitioners should be aware of the individual responses of their athletes to different types of recovery protocols before athletic performance and the possible impact of accumulating certain loads. Future research should help identify optimal parameters for cold therapy and its possible influence on different physical qualities. Whether a relation between cold water immersion and sRPE exists is a question that remains unanswered.

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