Cold Water Immersion Combined with β-Hydroxy-β-Methylbutyrate Free Acid Improves Performance Recovery following Damaging Resistance Exercise


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ABSTRACT
Recovery from high intensity exercise is key for athletes to overcome fatigue, regenerate skeletal muscle, and maintain athletic performance. PURPOSE: To examine the effects of cold water immersion (CWI) with and without the free acid form of β-hydroxy-β-methylbutyrate (HMB-FA) on indices of muscle damage, inflammation, and performance following four sets of up to ten repetitions of the squat exercise at 80% 1-RM and the dead lift and split squat exercises at 70% 1-RM. METHODS: Forty recreationally trained men (22.3 ± 2.4 y) were randomly divided into one of four groups: 1) Placebo (PL); 2) HMB-FA; 3) HMB-FA & Cold Water Immersion (HMB-FA-CWI); 4) Placebo & Cold Water Immersion (PL-CWI). RESULTS: No differences between groups were observed for CK, however, PL-CWI resulted in significantly greater elevations in myoglobin compared to HMB-FA-CWI (p=0.005) and PL (p=0.028). Only the HMB-FA-CWI group showed significantly greater improvements in average power per repetition (Figure 2). CONCLUSION: CWI treatment appeared to elevate an acute index of muscle damage (myoglobin) when compared to other groups, while HMB-FA treatment may have attenuated the increase in CRP when combined with CWI. Nevertheless, HMB-FA or CWI treatments did not appear to provide any benefit over PL on all measures of muscle recovery. Instead, the combination of CWI and HMB-FA did improve recovery performance compared to all the other treatment groups.

METHODS
Participants
• Forty recreationally resistance trained men (22.3 ± 2.4 y) were randomly divided into one of four groups:
  1) Placebo (PL)
  2) HMB-FA
  3) HMB-FA & Cold Water Immersion (HMB-FA-CWI)
  4) Placebo & Cold Water Immersion (PL-CWI)

Resistance Training Protocol
• Participants reported to the Human Performance Laboratory (HPL) on four separate occasions (T1 – T4). During the first visit (T1), participants were tested for maximal strength (1-RM) on the barbell back squat, dead lift, and barbell split squat exercises. Prior to the second visit (T2), participants were instructed to refrain from all forms of exercise for a minimum of 72 hours. Participants were also instructed to report to the HPL during T2 – T4 in a fasted state. During T2, participants performed a lower body resistance exercise session which consisted of four sets of the squat, dead lift, and barbell split squat exercises. The rest interval between each set and between all exercises was 45 s. The third visit (T3) was performed at 48 h after completion of exercise. The participants’ previously measured 1-RM, while the dead lift and barbell split squat exercises were performed at 70% of the participant’s previously measured 1-RM.

RESULTS
• Average power per repetition were recorded for each repetition and used for subsequent analysis. Average power per repetition was calculated as the average of the mean power outputs for each repetition performed divided by the number of repetitions performed. Test-retest reliability for the Tendo™ unit in our laboratory has consistently shown R> 0.90.

Blood Draw:
• Blood samples and subjective measures of soreness, pain, and recovery were obtained at five time points: baseline (BL), immediately post-exercise (IP), and 30 min post exercise (30P) following T2, and 24- to 48-h (p=0.02) post exercise on T4 post T2 (24P and 48P, respectively).

Blood Samples:
• C-reactive protein (CRP)
• Hemoglobin & Hematocrit
• Myoglobin
• Hemoglobin & Hematocrit
• C-reactive protein (CRP)
• Interleukin-6 (IL-6)
• Interleukin-10 (IL-10)

Statistical Analysis
• All data were analyzed using repeated measures analysis of covariance (ANCOVA) with IP or T2 as the covariate. One way analysis of variance (ANOVA) was employed for significant interactions using delta values followed by LSD post hoc for pairwise comparisons. To assess changes from PRE to 48P, a repeated measure ANOVA was used to detect changes within each individual experimental group across time points. Prior to analysis, all data were assessed to ensure normal distribution, homogeneity of variance and sphericity. Changes in dietary composition were analyzed using one way ANOVA. Results were considered significant at an alpha level of p ≤ 0.05.

SUMMARY & CONCLUSIONS
• Although the recovery modalities did not have a profound effect on muscle recovery, the main findings suggest that CWI treatment may elevate an acute index of muscle damage (myoglobin) when compared to other treatment groups, while HMB-FA treatment may have attenuated the increase in CRP when compared to CWI treatment. However, it appears that HMB-FA or CWI treatments by themselves did not provide any benefit over PL on all measures of muscle recovery. Rather, the combination of CWI and HMB-FA appears to improve recovery of average power per repetition when compared to all other treatment groups.

Future research should examine the effects of 3 g HMB-FA ingestion as a bolus prior to resistance training and the longitudinal effects of HMB-FA in conjunction with resistance exercise.

METHODS CONT.
HMB-FA supplementation
• HMB-FA (4 grams/day) or PL was consumed 30 minutes prior to each exercise session (T2 – T4). In addition, servings were also provided at 2- and 6- hours following the exercise sessions at T2 and T3. Therefore, participants in the HMB-FA groups received a total of 3 grams of HMB-FA on T2 and T3, while receiving 1 gram of HMB-FA on T4 (prior to resistance training only).

Cold Water Immersion
• Participants in the HMB-FA-CWI and PL-CWI groups were required to fully immerse their lower body into a metal tub (58 cm x 139.5 cm) filled 30 cm high with ice water at 10-12°C following exercise. Participants immersed in the water up to their umbilicus for 10-min post-exercise.

RESULTS
• Changes in serum concentrations, protein intake relative to body weight over the course of the study protocol.
• Analysis of dietary intake revealed no significant differences between the groups for total kilocalorie intake, macronutrient distributions, or protein intake relative to body weight. All data were assessed to ensure normal distribution, homogeneity of variance and sphericity. Changes in dietary composition were analyzed using one way ANOVA. Results were considered significant at an alpha level of p ≤ 0.05.

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