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The Efficacy of Cold Water Immersion on Physiological Biomarkers in Post-Exercise Recovery: A Systematic Review

Abstract

Background: Exercise is purported to lead to transient and localized muscle damage due to systemic inflammation, which increases in inflammatory biomarkers. Cold water immersion (CWI) is theorized to reduce exercise-induced muscle damage due to its cryotherapeutic effects and, therefore, may be beneficial post-exercise. This systematic review aimed to examine the available evidence on the impact of CWI on post-exercise recovery by measuring inflammatory biomarkers in the blood.

Methods: Articles were reviewed using EBSCO and PubMed databases using the keywords cold water immersion, ice bath, and recovery. Inclusion criteria included English language, peer-reviewed journals, randomized control trials, and articles measuring biomarkers and inflammation post-exercise. Exclusion criteria included non-English language or peer-reviewed publications, articles without the use of CWI, articles without an exercise protocol, non-randomized control trials, participants under 18, articles that did not monitor biomarkers, and articles that did not provide sufficient information to evaluate the methodology.

Results: Twenty-eight studies met all criteria, and the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) framework was utilized to assess each article's methodological quality. Four studies were identified as low quality, twenty-two with moderate quality, and two with high quality.

Discussion: The application of CWI varied across studies, with a particular lack of standardization in the temperature, duration, and depth of submersion. Biomarkers used to measure recovery after exercise shared some commonality, such as creatine kinase. Still, overall, there was variation among studies, making it difficult to reach a consensus. Future studies should address the limitations of small sample sizes, lack of control groups, exercise protocol variations, and biomarker measurement differences. Future studies are also needed to examine the effects of participants' beliefs in the recovery process and the potential placebo effects of CWI.

Conclusion: While there was mild evidence for using CWI to enhance recovery 72 hours post-exercise, as measured by reductions in the biomarkers CK, C- reactive protein, and inflammatory cytokines such as IL-6 and TNF, its overall efficacy in clinical practice was mixed. Evidence also suggested that CWI may be detrimental to inflammatory biomarker levels. Therefore, recommendations on the widespread use of CWI cannot be made at this time.

Key words: muscle biomarkers, recovery, cold water immersion