

# INPLASY PROTOCOL

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None declared.

## Effects of contrast therapy on post-exercise recovery: an updated systematic review and meta-analysis

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**Review question / Objective:** **P** – Individuals who engage in physical exercise or sports. **I** – Contrast therapy, which involves alternating between hot and cold temperatures or immersing the body in hot and cold water. **C** – Another type of post-exercise recovery intervention, such as active & passive recovery; cold, hot, or thermal-neutral water immersion, etc; or no intervention at all. **O** – Recovery of exercise/physical performance and physiological variables after exercise. The research questions are as follows: Association between contrast therapy and post-exercise recovery in physically active participants.

**Eligibility criteria:** Inclusion criteria: Individuals who engage in physical exercise or sports; Published in English; Other recovery methods had to be used as a comparison to contrast therapy; The studies had to measure exercise/physical performance before and after intervention. Exclusion criteria: conference abstracts that did not contain primary data; reviews; editorials; letters to the editor; case reports with less than five cases.

**INPLASY registration number:** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 15 April 2023 and was last updated on 15 April 2023 (registration number INPLASY202340047).

### INTRODUCTION

**Review question / Objective:** **P** – Individuals who engage in physical exercise or sports. **I** – Contrast therapy, which involves alternating between hot and cold temperatures or immersing the body in hot

and cold water. **C** – Another type of post-exercise recovery intervention, such as active & passive recovery; cold, hot, or thermal-neutral water immersion, etc; or no intervention at all. **O** – Recovery of exercise/physical performance and physiological variables after exercise. The

research questions are as follows: Association between contrast therapy and post-exercise recovery in physically active participants.

**Condition being studied:** Effects of contrast therapy on post-exercise recovery for physically active participants. Titles and/or abstracts of studies retrieved using the search strategy and from the reference lists of systematic review will be screened independently by three review authors to identify studies that potentially meet the inclusion criteria outlined above. The full text of these potentially eligible studies will be retrieved and independently assessed for eligibility by three review authors. Any disagreement between them over the eligibility of particular studies will be resolved through discussion with a third review author. A standardized, pre-piloted form will be used to extract data from the included studies for assessment of study quality and evidence synthesis. Extracted information will include: Publication details(author; year of publication; study design; sample size), Participant information(age; sex; BMI; types of sport participation; training status), Recovery method information(intervention types; water temperatures; repetitions of total immersion; duration of immersion; extent of water immersion), types of assessment(exercise and/or physical performance; physiological variables), time points of measures; physiological stressor by exercise(in other words, exercise protocol); risk of bias. Three authors will independently assess risk of bias, discrepancies will be identified and resolved through discussion (with a third author where necessary). Missing data will be requested from study authors.

## METHODS

**Participant or population:** Individuals who engage in physical exercise or sports.

**Intervention:** Group of intervention that post-exercise contrast therapy on various exercise.

**Comparator:** Groups receiving recovery modalities other than contrast therapy in various exercise.

**Study designs to be included:** Randomized cross-over design, randomized controlled trials will be included. Inclusion criteria: Individuals who engage in physical exercise or sports; free from injury or illness population; post-exercise recovery interventions of contrast therapy are compared to those of at least one other group.Exclusion: who is physically or mentally injured; evaluated exercise/physical performance without a recovery intervention; adaptation to a training protocol; used combined interventions that may confused contrast therapy results(ex: combining CWT with compression garments or active recovery).

**Eligibility criteria:** Inclusion criteria: Individuals who engage in physical exercise or sports; Published in English; Other recovery methods had to be used as a comparison to contrast therapy; The studies had to measure exercise/physical performance before and after intervention.Exclusion criteria: conference abstracts that did not contain primary data; reviews; editorials; letters to the editor; case reports with less than five cases.

**Information sources:** We will search the following electronic bibliographic databases: EBSCOhost ASC, MEDLINE, Cochrane, Web of science and CINAHL. The search strategy will include terms relating to or describing contrast therapy, exercise performance and recovery. Only studies written in English will be included. All studies until the date of the last search(27/03/23) will be sought.

**Main outcome(s):** Recovery of Exercise performance.

**Quality assessment / Risk of bias analysis:** Quality assessment of the selected studies was performed using the AMSTAR 2 and the Newcastle-Ottawa Scale for assessing risk of bias. Contains the following 16 items of AMSTAR 2: question and inclusion, protocol, study design, comprehensive

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search, study selection, data extraction, excluded studies justification, included studies details, risk of bias, funding sources, statistical methods, risk of bias on meta-analysis, risk of bias in individual studies, explanation for heterogeneity, publication bias, conflict of interest. And the Newcastle-Ottawa Scale is a tool used to assess the quality of non-randomized studies, and it consists of a series of questions(selection; comparability; results). Possible total points are 4 points for selection, 2 points for comparability, and 3 points for outcomes. A score of more than 7 out of a maximum score of 9 is considered indicative of high quality. In other words, the scale employs a set of questions to evaluate the quality of a study, and studies that score higher than 7 out of 9 are considered to be of high quality.

**Strategy of data synthesis:** Data analysis will be conducted by SPSS 26.0 software. Standardized mean differences(mean difference between recovery intervention and control groups divided by pooled standard deviation) were calculated with a 95% confidence interval across exercise performance and physiological variables. We will choose either a random-effects model or a fixed-effects model to combine the data based on the outcome of the heterogeneity test. If the I-square statistic, which measures heterogeneity in meta-analysis, is found to be less than 50%, a fixed-effects model will be used for data synthesis. However, if the I-square statistic is equal to or greater than 50%, indicating significant heterogeneity among studies, a random-effects model will be employed for data synthesis.

**Subgroup analysis:** If there is considerable heterogeneity among the studies and the data needed are obtainable, subgroup analyses will be conducted to investigate potential factors contributing to the variability in the results.

**Sensitivity analysis:** We will conduct sensitivity analyses to examine the reliability and stability of the decisions made during the review process, in order to evaluate the robustness of our results.

**Country(ies) involved:** South Korea.

**Keywords:** Contrast therapy; exercise performance; recovery.

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