

INPLASY PROTOCOL

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Effects of high-intensity interval training versus medium-intensity continuous training in cardiac rehabilitation: A systematic review and meta-analysis

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Review question / Objective: The primary purpose of our systematic review and meta-analysis is to explore the effects of three different high-intensity interval training models (Long-interval, medium interval, and short-interval) and medium intensity continuous exercise (MICT) on aerobic capacity (VO₂peak) of patients with cardiovascular diseases. Secondly, to explore the effects of HIIT and MICT on aerobic capacity of patients with cardiovascular diseases during different intervention duration (0-6weeks, 7-12weeks, more than 12 weeks).

Eligibility criteria: The inclusion criteria for this systematic review and meta-analysis are: (1) Randomized controlled trials in English. (2) High-intensity interval training and medium-intensity continuous training were compared. (3) The subjects were adult patients with cardiovascular disease and underwent cardiac rehabilitation. (4) Outcome measures must include VO₂peak. (5) Data were complete, and the mean standard and deviation of VO₂peak before and after intervention were reported. (6) The type, intensity, duration, intervention time, frequency, and interval of exercise intervention are clearly stated.

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 14 April 2021 and was last updated on 14 April 2021 (registration number INPLASY202140077).

INTRODUCTION

Review question / Objective: The primary purpose of our systematic review and meta-analysis is to explore the effects of three different high-intensity interval training models (Long-interval, medium

interval, and short-interval) and medium intensity continuous exercise (MICT) on aerobic capacity (VO₂peak) of patients with cardiovascular diseases. Secondly, to explore the effects of HIIT and MICT on aerobic capacity of patients with cardiovascular diseases during different

intervention duration (0-6 weeks, 7-12 weeks, more than 12 weeks).

Condition being studied: Cardiac rehabilitation is an important means of secondary prevention of cardiovascular disease, which consists of four parts: health education, lifestyle changes, social-psychological support, and supervised exercise. Studies have shown that exercise-based cardiac rehabilitation can improve the patient's cardiorespiratory fitness, improve cardiovascular function and cardiovascular risk factors of cardiovascular disease patients, and is an effective way to reduce total mortality and cardiovascular mortality in patients with coronary heart disease. Peak oxygen uptake, as the gold standard for evaluating aerobic capacity, has been identified as an important predictor of cardiovascular disease and all-cause mortality. This is because individual cardiorespiratory fitness increases one metabolic equivalent and all-cause mortality decreases by 8-17%. Despite the impact of exercise on human health, 31.3% of adults in the world still fail to meet the amount of exercise recommended by ACSM. Lack of time, low enthusiasm, and poor compliance are the main factors that impede people's exercise. Therefore, many researchers began to explore the effects of HIIT on the human body instead of MICT. High-intensity interval training takes less time but has similar benefits with medium-intensity continuous training. Numerous studies have shown that HIIT can significantly improve exercise performance, improve cardiovascular function and reduce cardiovascular risk factors in patients with cardiovascular disease compared with MICT. While some studies have shown that HIIT and MICT can improve the cardiorespiratory fitness of patients with cardiovascular diseases, but there is no significant difference between the two groups. This may be attributed to the different models and intervention duration of different studies, which have strong heterogeneity, limiting the interpretation of results and clinical application. High-intensity interval training alternatively consists of high-intensity exercise

interspersed by passive or low intensity active recovery. High-intensity interval training for patients with cardiovascular disease can be divided into three types according to different intervals. Long-interval HIIT may be composed of four sets of high intensity intermittent, each sustaining 4 minutes interspersed with 3 sets of active or passive recovery lasting 3 minutes. Medium-interval HIIT may include 1-2 min high-intensity exercise interspersed with 1-4min low-intensity recovery. Short-interval HIIT may consist of 15-60 seconds of high-intensity training interspersed by 15-120 seconds of low-intensity recovery. But which model is better than MICT, there are no clear explanation. Also, researches have shown that intervention duration is the key factor in determining the adaptive changes of body function and structure induced by exercise. Previous systematic review and meta-analysis by Amanda pointed out that 7-12 weeks HIIT was superior to MICT in improving the aerobic capacity of patients with cardiovascular disease, and there is no significant difference between HIIT and MICT for more than 12 weeks. Conversely, there are still some findings contradicting the results of the meta analysis. For this reason, the primary purpose of our systematic review and meta-analysis is to explore the effects of three different high-intensity interval models and medium-intensity continuous exercise on aerobic capacity of patients with cardiovascular diseases. Secondly, to explore the effects of high-intensity interval exercise and medium-intensity continuous exercise on aerobic capacity of patients with cardiovascular diseases during different intervention duration.

METHODS

Participant or population: Adult patients with cardiovascular diseases and willing to undergo cardiac rehabilitation will be included.

Intervention: High-intensity interval training.

Comparator: Medium-intensity continuous training.

Study designs to be included: Randomized controlled trials will be included.

Eligibility criteria: The inclusion criteria for this systematic review and meta-analysis are: (1) Randomized controlled trials in English. (2) High-intensity interval training and medium-intensity continuous training were compared. (3) The subjects were adult patients with cardiovascular disease and underwent cardiac rehabilitation. (4) Outcome measures must include VO₂peak. (5) Data were complete, and the mean standard and deviation of VO₂peak before and after intervention were reported. (6) The type, intensity, duration, intervention time, frequency, and interval of exercise intervention are clearly stated.

Information sources: PubMed, Web of Science and Cochrane Library databases from its inception up to March 2021 using the following terms: ((High-intensity interval training) OR (High-intensity interval exercise) OR (High-Intensity Intermittent Exercise) OR (Sprint Interval Training) OR (High-Intensity Intermittent Exercises) OR (Anaerobic interval exercise) OR (Exercise, High-Intensity Intermittent) OR (HIIT)OR(HIT)OR(HIIE)) AND ((Cardiac rehabilitation) OR (Rehabilitation, Cardiac) OR (Cardiovascular Rehabilitation) OR (Rehabilitation, Cardiovascular)). Moreover, we also searched the literature in other ways, like retrieving grey literature, manually retrieving in the library, and related researches from references.

Main outcome(s): Changes of peakVO₂.

Quality assessment / Risk of bias analysis: Study quality was assessed using Cochrane Collaboration's tool and the Physiotherapy Evidence Database (PEDro) Scale. Items of the Cochrane Collaboration's tool were evaluated in three categories: Low risk of bias, unclear bias, and high risk of bias. The following characteristics will be evaluated: random sequence generation (selection bias),

allocation concealment (selection bias), blinding of participants and personnel (performance bias), incomplete outcome data (attrition bias), selective reporting (reporting bias), other biases. The PEDro-scale included the following 11 items: eligibility criteria and source, random allocation, concealed allocation, baseline comparability, blinding of participants, blinding of therapists, blinding of assessors, adequate follow-up (>85%), intention-to-treat analysis, between-group statistical comparisons, reporting of point measures and measures of variability. The item of Eligibility criteria and source affects the external validity of the experiment without affecting the internal validity and statistical validity of the experiment, so this item is not used to calculate the PEDro score. The item 'blinding of participants and blinding of therapists' did not apply to the cardiac rehabilitation intervention studies. We removed these two items in the quality assessment, so after this revision, the total score is 8, the higher the score, the higher the quality of the study.

Strategy of data synthesis: A random-effects model was used to combine the outcome due to the anticipated heterogeneity of included studies. Besides, mean difference (MD) is used to count the effect size of continuous variables, and the corresponding 95% confidence intervals are calculated. Heterogeneity of included studies was assessed by Cochrane's Q and I² static. If I² < 25%, there is no significant heterogeneity; if 25% < I² < 50%, there is low heterogeneity; if 50% < I² < 75%, there is medium heterogeneity; if I² > 75%, there is high heterogeneity. This systematic review and meta-analysis was conducted using Review Manager 5.4 and Stata. The bilateral test was used for statistical analysis, and P < 0.05 was defined as statistical difference.

Subgroup analysis: Based on our research purpose, studies were collated according to the model of HIIT (long-interval mode, medium-interval mode, and short-interval mode) and duration of the intervention (up

to 6 weeks, 7-12 weeks, more than 12 weeks).

Sensitivity analysis: A method of eliminating one article one by one was used for sensitivity analysis using Review Manager 5.4.

Country(ies) involved: China.

Keywords: High-intensity interval taring; Medium-intensity continuous training; cardiac rehabilitation; aerobic capacity; cardiovascular diseases.

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