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The Effectiveness of Metabolic Resistance Training versus Traditional Cardio on Athletic Performance: A Systematic Review and Meta-Analysis

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ADMINISTRATIVE INFORMATION

Support - The meta-analysis has not received any form of financial support or whatsoever incentive from any organization, institution, or sponsor.

Review Stage at time of this submission - Preliminary searches.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 6 November 2024 and was last updated on 6 November 2024.

INTRODUCTION

Review question / Objective Can similar athlete performance outcomes be achieved through metabolic resistance training (MRT) traditional cardio approaches.

Rationale The "no pain, no gain" philosophy has long dominated fitness training approaches, particularly in high-intensity workouts like metabolic resistance training (MRT). Exercise and practice coupled with resilience are at the core of athletic performance; however, the MRT paradigm and proponents argue that athletic excellence can be effectively achieved through high-intensity training (Chulvi-Medrano et al., 2017; Moro et al., 2020; Steele et al., 2019). While there are secluded studies assessing the efficacy of MRT; there is a need to consolidate and vindicate postulations because the paradigm's necessity for achieving optimal athlete performance outcomes remains questionable. This systematic review with meta-

analysis aims to challenge this conventional wisdom by examining whether high-intensity, often discomfort-inducing exercises are truly necessary for achieving optimal athlete performance outcomes. The review will provide evidence-based insights into whether effective training and long-term athletic success n.

Condition being studied The review will examine physical fitness and athletic performance conditions, specifically focusing on cardiovascular fitness levels, muscular strength and endurance, body composition changes, power output capabilities and training adherence and sustainability.

METHODS

Search strategy The following databases will be searched: PubMed/MEDLINE, Web of Science, Scopus, SPORTDiscus, Google Scholar and CINAHL. Search terms will include combinations

of: "metabolic resistance training", "MRT", "high-intensity training", "resistance exercise" combined with "traditional cardio" and "aerobic exercise" focusing on the following outcomes "performance", "strength", "power", "endurance", "body composition", "adherence", "injury" targeting "athletes" and "players". The search strategy will be refined for each database.

Participant or population Studies involving healthy trained athletes of both genders will be considered in the analysis. However, studies with individuals with acute or chronic injuries and contraindications to exercise will be excluded.

Intervention The intervention will be metabolic resistance training (MRT) defined as high-intensity interval-based resistance exercises.

Comparator Traditional cardio training will be the comparator denoted by steady-state aerobic exercise, Standard cardiovascular exercises, traditional endurance training and moderate-intensity continuous training.

Study designs to be included Randomized controlled trials (RCTs), controlled clinical trials and cross-over studies.

Eligibility criteria Inclusion criteria: (1) RCTs or controlled clinical trials or cross-over studies; (2) healthy athletes; (3) metabolic resistance training (MRT) intervention; (4) comparison with traditional cardio exercises; (5) report at least athletic performance outcome; (6) articles published from 2004 to date (20 years).

Exclusion criteria: (1) studies on injured athletes; (2) studies without a control group; (3) nonhuman studies; (4) non-English language publications; (4) studies with no quantitative performance outcome measure.

Information sources The review is premised on PRISMA guidelines for the search strategy, eligibility criteria, article selection and data extraction.

Main outcome(s) The primary outcome will constitute several performance outcomes such as maximal strength (1RM tests); power output (Wingate test, vertical jump); cardiovascular fitness (VO₂max, time to exhaustion); body composition changes (lean mass, fat mass) and training efficiency (time to achieve specific fitness goals).

Additional outcome(s) Secondary outcomes may include exercise adherence rates; psychological responses (RPE, satisfaction); recovery time

requirements; injury rates and types; long-term program sustainability and quality of life measures.

Data management Two independent reviewers will screen titles/abstracts based on the search strategy followed by full-text screening by two independent reviewers where disagreements will be reconciled through a panel review discussion.

Quality assessment / Risk of bias analysis Cochrane Risk of Bias Tool 2.0 for randomised controlled trials will be used to assess the risk of bias while the Grades of Recommendation, Assessment, Development and Evaluation (GRADE) approach for evidence quality assessment. Funnel plots and Egger's test will be used to assess the for-publication bias.

Strategy of data synthesis Statistical analysis will involve a random-effects model for meta-analysis; standardized mean differences (SMD) for continuous outcomes; risk ratios (RR) for dichotomous outcomes; I² statistic for heterogeneity assessment and meta-regression for potential effect moderators assessed at 95% confidence intervals.

Subgroup analysis Subgroup analyses subject to available data will include training experience (novice vs. experienced); age groups; gender; training duration (<12 weeks vs. ≥12 weeks); exercise intensity levels and training frequency.

Sensitivity analysis Sensitivity analyses will assess the impact of study quality/risk of bias; publication status; statistical model choice and missing data handling methods.

Language restriction Only studies published in English will be included.

Country(ies) involved China.

Keywords Metabolic Resistance Training; Traditional Cardio; Exercise Performance; Athletic Training; Systematic Review; Meta-Analysis; Exercise Adherence; Training Effectiveness.

Contributions of each author

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