
Title

A systematic review and cluster analysis approach of 103 studies of high-intensity interval training on cardiorespiratory fitness

Abstract

Aims This study aims to systematically review the systematic reviews and meta-analyses examining the effect of high-intensity interval training (HIIT) protocols on improving cardiorespiratory fitness (CRF) and to characterize the main patterns of HIIT modalities using clustering statistical procedures to examine their potential differences on improving CRF. Finally, we aimed to develop a comprehensive guideline for reporting HIIT protocols. **Methods** A systematic review was conducted on PubMed and Web of Science from their inception to 31 October 2022 for systematic reviews and results and meta-analysis aimed at assessing the effect of HIIT on CRF in the entire study population. The Assessment of Multiple Systematic Reviews 2 tool was used to evaluate the risk of bias of each review. Additionally, a principal component analysis testing the data adequacy for the factor solution through the Kaiser-Meyer-Olkin procedure test was conducted. Once the number of factors was identified, in order to identify data patterns according to the main characteristics of the HIIT protocols, a two-step cluster analysis was conducted. Nineteen systematic reviews and/or meta-analyses comprising 103 studies were included. Clustering of systematic reviews and meta-analyses identified three HIIT modalities ('HIIT-normal mixed', 'HIIT-long running', and 'HIIT-short cycling') underlying the interventions across the included studies. Similar effectiveness in increasing CRF among the three HIIT modalities was observed. Subgroup analyses showed no significant differences in CRF by sex, weight status, study design, and baseline physical activity level ($P > 0.05$), but differences were observed by age group, and exercise intensity indicator was used in the HIIT

programmes ($P < 0.05$) Conclusion All three HIIT modalities produced significant improvements of CRF, although some modalities showed greater changes for some specific age groups or intensity indicators. Law summary • In this review, including data from more than 100 individual studies, 3 patterns of high-intensity interval training (HIIT), 'HIIT-normal mixed', 'HIIT-long running', and 'HIIT-short cycling', were characterized using a cluster analysis approach. • Independently of the sex, weight status, study design, and baseline physical activity level, all three proposed HIIT modalities improved cardiorespiratory fitness (CRF). However, for the age group of 20–44 years, the 'HIIT-long running' reported greater improvement in CRF than 'HIIT-short cycling'. Additionally, the heart rate as an intensity indicator reported higher CRF in 'HIIT-long running' compared with 'HIIT-normal mixed'. • A HIIT reporting guideline is provided to address the lack of information on HIIT protocols and provide transparency among studies. © The Author(s) 2023. Published by Oxford University Press on behalf of the European Society of Cardiology. All rights reserved.

Authors

Cadenas-Sanchez C.; Fernández-Rodríguez R.; Martínez-Vizcaíno V.; de los Reyes González N.; Lavie C.J.; Galán-Mercant A.; Jiménez-Pavón D.

Author full names

Cadenas-Sanchez, Cristina (55549295700); Fernández-Rodríguez, Rubén (57209739173); Martínez-Vizcaíno, Vicente (6602160941); de los Reyes González, Nicolás (58920073400); Lavie, Carl J. (57210721506); Galán-Mercant, Alejandro (55480630000); Jiménez-Pavón, David (16316165400)

Author(s) ID

55549295700; 57209739173; 6602160941; 58920073400; 57210721506;
55480630000; 16316165400

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Affiliations

Department of Physical Education and Sports, Faculty of Sports Science, Sport and Health University Research Institute (iMUDS), University of Granada, Granada, Spain; CIBER de Fisiopatología de la Obesidad y Nutrición (CIBEROBN), Instituto de Salud Carlos III, Granada, Spain; Department of Cardiology, Stanford University, Stanford, CA, United States; Division of Cardiovascular Medicine, Veterans Affairs Palo Alto Health Care System, Palo Alto, CA, United States; Edificio Melchor Cano, Centro de Estudios Socio-Sanitarios, Universidad de Castilla-La Mancha, Santa Teresa Jornet s/n, Cuenca, 16071, Spain; Facultad de Ciencias de la Salud,

Universidad Autónoma de Chile, Talca, Chile; Faculty of Nursing and Physiotherapy, University of Cádiz, Cádiz, Spain; Department of Cardiovascular Diseases, John Ochsner Heart and Vascular Institute, Ochsner Clinical School, The University of Queensland School of Medicine, New Orleans, LA, United States; MOVE-IT Research Group, Faculty of Nursing and Physiotherapy, Biomedical Research Innovation Institute of Cádiz, Cádiz, Spain; MOVE-IT Research Group, Department of Physical Education, Faculty of Education Sciences, Biomedical Research Innovation Institute of Cádiz, University of Cádiz, Cádiz, Spain; CIBER of Frailty and Healthy Aging (CIBERFES), Madrid, Spain

Authors with affiliations

Cadenas-Sanchez C., Department of Physical Education and Sports, Faculty of Sports Science, Sport and Health University Research Institute (iMUDS), University of Granada, Granada, Spain, CIBER de Fisiopatología de la Obesidad y Nutrición (CIBEROBN), Instituto de Salud Carlos III, Granada, Spain, Department of Cardiology, Stanford University, Stanford, CA, United States, Division of Cardiovascular Medicine, Veterans Affairs Palo Alto Health Care System, Palo Alto, CA, United States; Fernández-Rodríguez R., Edificio Melchor Cano, Centro de Estudios Socio-Sanitarios, Universidad de Castilla-La Mancha, Santa Teresa Jornet s/n, Cuenca, 16071, Spain; Martínez-Vizcaíno V., Edificio Melchor Cano, Centro de Estudios Socio-Sanitarios, Universidad de Castilla-La Mancha, Santa Teresa Jornet s/n, Cuenca, 16071, Spain, Facultad de Ciencias de la Salud, Universidad Autónoma de Chile, Talca, Chile; de los Reyes González N., Faculty of Nursing and Physiotherapy, University of Cádiz, Cádiz, Spain; Lavie C.J., Department of Cardiovascular Diseases, John Ochsner Heart and Vascular Institute, Ochsner Clinical School, The University of Queensland School of Medicine, New Orleans, LA, United States; Galán-Mercant A., MOVE-IT Research Group, Faculty of Nursing and Physiotherapy, Biomedical Research Innovation

Institute of Cádiz, Cádiz, Spain; Jiménez-Pavón D., MOVE-IT Research Group, Department of Physical Education, Faculty of Education Sciences, Biomedical Research Innovation Institute of Cádiz, University of Cádiz, Cádiz, Spain, CIBER of Frailty and Healthy Aging (CIBERFES), Madrid, Spain

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Correspondence Address

R. Fernández-Rodríguez; Edificio Melchor Cano, Centro de Estudios Socio-Sanitarios, Universidad de Castilla-La Mancha, Cuenca, Santa Teresa Jornet s/n, 16071, Spain; email: Ruben.Fernandez@uclm.es

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