

REVIEW ARTICLE (META-ANALYSIS)

Influence of Inspiratory Muscle Weakness on Inspiratory Muscle Training Responses in Chronic Heart Failure Patients: A Systematic Review and Meta-Analysis



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Abstract

Objective: To determine whether the impact of inspiratory muscle weakness on inspiratory muscle training (IMT) affects inspiratory function and exercise capacity in chronic heart failure (CHF) patients.

Data Sources: Electronic searches were performed using the Cumulative Index to Nursing and Allied Health Literature, Cochrane Central Register of Controlled Trials, Cochrane Systematic Review, Embase, MEDLINE, and Physiotherapy Evidence Database (PEDro) databases up to August 2013.

Study Selection: Articles were included if participants had CHF and were >18 years old; the design was a randomized controlled trial; intervention was IMT; measurements were of inspiratory muscle function or exercise capacity; and the articles were published in English, Portuguese, or Spanish. Of the 1455 articles identified in the database searches, 9 studies met the inclusion criteria.

Data Extraction: Two independent reviewers selected and extracted information from articles and assessed the quality of the studies using the PEDro scale. The 2 reviewers discussed disagreements until consensus was achieved.

Data Synthesis: Meta-analyses compared IMT with controls/sham for maximal inspiratory pressure, sustained maximal inspiratory pressure, 6-minute walk distance, peak oxygen consumption, and minute ventilation after IMT. Subgroup analyses compared those with and without muscle weakness. CHF with inspiratory muscle weakness showed greater gains in the 6-minute walk distance and peak oxygen consumption compared with those with normative maximal inspiratory pressure. The mean quality analysis score was 7.1, and scores ranged from 6 to 10.

Conclusions: The results emphasize the importance of evaluating the inspiratory muscles to identify patients with CHF and inspiratory muscle weakness; subgroup that showed better results after IMT.

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Patients with chronic heart failure (CHF) often present generalized muscle atrophy, including that of the respiratory muscles,^{1,2} that can manifest as reduced strength and endurance.^{1,3,4} When

present, weakness of the respiratory muscles limits ventilation during exercise in patients with CHF and can contribute to marked fatigue and dyspnea at low exercise intensities.^{1,5} Maximal inspiratory pressure (MIP), the most common measure of inspiratory muscle strength,⁶ is related to the severity of CHF and ventilatory limitation during exercise in these patients.⁷ It is also an independent prognostic indicator of CHF.⁷

Inspiratory muscle training (IMT) is an effective intervention that attenuates inspiratory muscle weakness⁵ and has been

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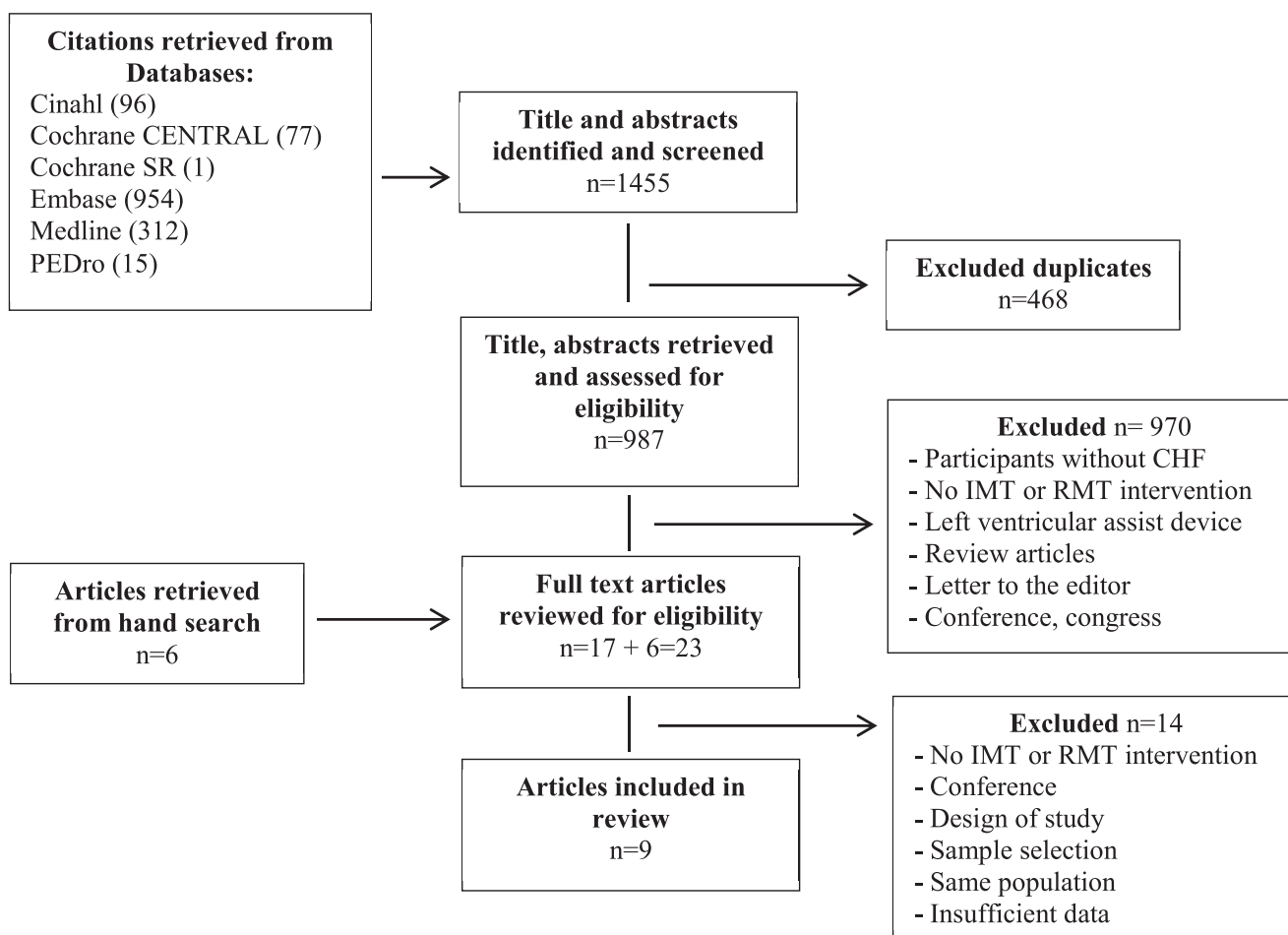


Fig 1 Flowchart of search strategy and retrieval of articles. Abbreviations: CENTRAL, Cochrane Central Register of Controlled Trials; Cochrane SR, Cochrane Systematic Review; RMT, Respiratory Muscle Training.

considered an adjunctive treatment to exercise and pharmacologic interventions in CHF, despite its underuse in clinical practice.⁸ IMT has demonstrated a positive impact on respiratory strength,^{5,9-14} respiratory endurance,^{5,11-14} maximal and submaximal exercise capacity,^{5,9-13,15} dyspnea,^{5,9-15} pulmonary function,^{5,10-12,15} quality of life,^{5,9-11,16} and inflammatory markers¹² in patients with CHF. Furthermore, it is safe and effective in people with CHF and can be maintained as a home training program.¹ Despite its underuse in clinical practice, IMT could at least improve the management of CHF in patients showing weakness.

Patients with chronic obstructive pulmonary disease who have inspiratory muscle weakness appear to demonstrate greater improvement in respiratory muscle function and dyspnea sensation at rest and during exercise compared with those with normative MIP.¹⁷ Although no consensus exists in this regard in patients with CHF, a similar pattern may be observed. Recently, systematic reviews¹⁸⁻²⁰ have evaluated the effectiveness of IMT in

patients with CHF; none of these articles have evaluated whether inspiratory muscle weakness influences inspiratory function or exercise capacity results. Therefore, we performed a systematic review to address this issue. We also conducted meta-analyses on measures when data were available.

Methods

The methodology described by the Cochrane Collaboration protocol was used in this systematic review.²¹ Electronic searches were performed on the following databases: Cumulative Index to Nursing and Allied Health Literature, Cochrane Central Register of Controlled Trials, Cochrane Systematic Review, Embase, MEDLINE, and Physiotherapy Evidence Database (PEDro) up to August 2013. Examples of the search terms are provided for the MEDLINE search strategy (appendix 1), which was modified according to the requirements of the other databases. We also searched relevant articles to identify potential articles for inclusion.

Articles were included in this systematic review if participants had CHF and left ventricular ejection fraction decreased and were >18 years old; the design was a randomized controlled trial; the intervention was only IMT; the study included measures of inspiratory muscle function and/or exercise capacity; and the articles were published in English, Portuguese, or Spanish.

Two independent reviewers (D.M., W.D.R.) screened titles and abstracts of all retrieved citations for eligibility. Full-text articles

List of abbreviations:

- CHF** chronic heart failure
- CI** confidence interval
- IMT** inspiratory muscle training
- MIP** maximal inspiratory pressure
- PEDro** Physiotherapy Evidence Database
- SMIP** sustained maximal inspiratory pressure

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