



REVIEW

Exercise training modalities and strategies to improve exercise performance in patients with respiratory disease



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Abstract Pulmonary rehabilitation is an evidence-based, multidisciplinary, comprehensive intervention for patients with chronic respiratory diseases who are symptomatic and whose daily living activities are often restricted.

Pulmonary rehabilitation programs are designed to improve the physical and emotional condition of people with chronic respiratory disease and to promote long-term adherence to health-enhancing behavior.

Exercise training is at the core of pulmonary rehabilitation (PR) programs. The benefits of exercise training include decreased dyspnea, improved health-related quality of life, fewer days of hospitalization, and decreased health-care utilization.

To gain PR benefits, patients should be able to complete an exercise training program, preferably with high intensity exercise, and it is likely that these benefits will translate into a change from a pattern of a sedentary lifestyle to a physically active lifestyle.

Chronic respiratory patients, namely COPD patients, have a low exercise tolerance due to multiple factors, such as dynamic hyperinflation and peripheral muscle dysfunction.

In this article, the authors describe a variety of modalities and strategies to overcome exercise limitations and improve the effects of exercise training.

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PALAVRAS-CHAVE

Reabilitação pulmonar;
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Doença pulmonar obstrutiva crónica

Modalidades e Estratégias de Treino Físico para Melhorar o Desempenho durante o Exercício em Pacientes com Doenças Respiratórias

Resumo A reabilitação pulmonar é uma intervenção abrangente, multidisciplinar e baseada em evidências, para doentes com doenças respiratórias crónicas que são sintomáticas e cujas actividades da vida diária são frequentemente limitadas.

Os programas de reabilitação pulmonar estão concebidos para melhorar a condição física e emocional de pessoas com doenças respiratórias crónicas e promover a adesão a longo prazo a comportamentos benéficos para a saúde.

O exercício físico está no cerne dos programas de reabilitação pulmonar (RP). Os benefícios do exercício físico incluem redução da dispneia, melhor qualidade de vida em termos de saúde, menos dias de hospitalização, e utilização reduzida dos cuidados de saúde.

Para obter os benefícios da RP, os doentes deverão ser capazes de completar um programa de exercício físico, de preferência com exercícios de alta intensidade, e é provável que esses benefícios se traduzam numa mudança de um padrão de estilo de vida sedentário para um estilo de vida fisicamente activo.

Doentes com doenças respiratórias crónicas, nomeadamente com DPOC, têm uma baixa tolerância ao exercício devido a uma diversidade de factores, como a hiperinsuflação dinâmica e a disfunção muscular periférica.

Neste artigo, os autores descrevem uma variedade de modalidades e estratégias para superar as limitações de exercício e melhorar os efeitos do treino físico.

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Introduction

Exercise training (ET) is a mandatory component of pulmonary rehabilitation (PR), it is at the core of PR programs and improves patients exercise tolerance and functional capacity, fatigue and dyspnea symptoms and health-related quality of life.¹⁻⁴

Pulmonary rehabilitation also has benefits for health-related costs, reducing the number of exacerbations and hospitalizations, days in hospital and mortality in COPD patients.⁵

Although highly recommended by scientific societies, at present, less than 5% of eligible patients have access to pulmonary rehabilitation.⁶ There is a need to optimize availability, accessibility and quality of PR in Europe, and that includes Portugal.

According to GOLD, exercise training has benefits for all categories of COPD, but PR programs are mainly directed at the most symptomatic and severe patients: grades B, C and D.⁷

Exercise intensity is a key element in improving outcomes. Therefore, high intensity training is recommended for its physiological benefits.²

In this article, authors describe a variety of modalities and strategies to overcome exercise limitations and improve the effects of exercise training.

Exercise training components

Exercise training modalities include:

1. Endurance training:
 - (a) Lower and upper limbs
 - (b) Continuous or interval training

- (c) High and moderate intensity. Relevance of total dose (combining training intensity, training session duration and frequency)
2. Strength training: lower and upper extremities
3. Neuromuscular electrical stimulation (NMES)

Limiting factors of exercise performance in COPD patients are multifactorial,⁸ but dynamic hyperinflation and peripheral muscle dysfunction are the most relevant ones, particularly in severe patients.

Strategies to enhance exercise tolerance

Multiple strategies to improve tolerance to high intensity exercise training in severe patients have been presented in literature⁹:

- Pharmacological treatment optimization^{10,11}
- Non-invasive ventilation (NIV)^{12,13}
- Oxygen supplementation (O₂)¹⁴⁻¹⁸
- Heliox¹⁹⁻²¹
- Aerobic training modalities: interval training,²²⁻²⁸ bicycle interval training,²⁹ nonlinear exercise training³⁰
- Localized muscle training: a few muscle groups are active at each moment³¹⁻³² bicycle single-leg (unilateral),³² progressive strength training (or isolated quadriceps training)^{33,34}
- Neuromuscular electrical stimulation (NMES)³⁵⁻³⁷
- Eccentric exercise training (experimental)^{38,39}
- Walking aids utilization^{40,41}

In all above strategies, *pharmacological treatment optimization* with inhaled bronchodilators is highly recommended to improve symptoms and dynamic lung hyperinflation and to enhance exercise tolerance. It is

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