Interval versus continuous training in individuals with chronic obstructive pulmonary disease: a systematic review

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CRD summary
This review found there were no differences between interval training and continuous training on outcomes related to exercise capacity and health-related quality of life in patients with chronic obstructive pulmonary disease. Some shortcomings mean that making judgements about the reliability of the authors' conclusions is difficult.

Authors' objectives
To compare the effects of interval training and continuous training exercise training modalities on measures of exercise capacity and health-related quality of life in patients with chronic obstructive pulmonary disease (COPD).

Searching
PubMed, EMBASE, CINAHL, PEDro and the Cochrane Library were searched from inception to May 2009 for relevant studies; search terms were reported. The PubMed "related articles" function and reference lists of retrieved articles were searched for additional studies. There were no language restrictions.

Study selection
Randomised controlled trials (RCTs) that compared interval exercise training with continuous exercise training (using standardised protocols) in patients diagnosed with chronic obstructive pulmonary disease (COPD) were eligible for inclusion. More than 90% of trial participants had to be diagnosed with COPD. Criteria for the definition of COPD used in the review was a clinical diagnosis of COPD with: a best recorded forced expiratory volume in one second (FEV\textsubscript{1})/forced vital capacity ratio less than 0.70; or a best recorded FEV\textsubscript{1} of less than 80% predicted. Trials published in abstract form only, with no other data available, were excluded.

The primary outcome measures evaluated included: peak power, peak oxygen uptake (VO\textsubscript{2}peak) measured during incremental tests on either a cycle ergometer or a treadmill; functional exercise capacity measured by a six-minute walk test or a 12-minute walk test; health related quality of life as measured by the Chronic Respiratory Questionnaire; and anxiety and depression measured by the Hospital Anxiety and Depression scale. In addition, physiological training effects, skeletal muscle adaptations, and tolerance (compliance, adverse events) were also assessed.

In included trials, the continuous training protocols consisted of moderate to high intensity (50 to 80% of baseline peak power) of durations ranging from 20 to 45 minutes. Interval training protocols typically used high intensity exercise (≥80% of peak power for durations of 20 seconds to three minutes) followed by recovery periods of low to moderate intensity exercise of (30 to 75% peak power) for 30 seconds to three minutes. All but one of the trials used cycle ergometers; the other trial included use of treadmills and cycle ergometers.

Two reviewers performed the study selection.

Assessment of study quality
Methodological quality was evaluated independently by two reviewers using the Jadad scale. Trials were assessed according to appropriateness of randomisation, randomisation description and concealment, double-blinding, and attrition rates in the groups. The PEDro 10-point scale was also used to assess quality in terms of blinding randomisation, withdrawals, similarity of baseline characteristics, and data reporting.

Data extraction
Two reviewers extracted data to calculate mean differences and corresponding 95% confidence intervals (CI). Point estimates and confidence intervals for the differences between groups were also assessed to establish if they exceeded the minimal important difference. The outcome measures were all treated as continuous variables. Where necessary, the authors of the included RCTs were contacted for missing data.
Methods of synthesis
Pooled weighted mean differences and 95% confidence intervals were calculated using a random-effects model. The $I^2$ statistic was used to evaluate statistical heterogeneity across the trials.

The authors stated that the small number of studies identified precluded the use of a funnel plot.

Results of the review
Eight RCTs (n=388 patients) were included in the review. The trials were assigned a mean Jadad score of 2 out of 5 (range 1 to 3 out of 5) and a mean PEDro score of 6 out of 10 (range 5 to 8 out of 10).

**Capacity and response:** There were no statistically significant differences between the interval training and continuous training for the pooled outcomes of: peak power (eight RCTs); peak oxygen uptake (six RCTs); changes in oxygen uptake at lactate threshold (four RCTs); skeletal muscle adaptations (two RCTs); total scores on the Chronic Respiratory Questionnaire (three RCTs); and depression and anxiety measured by the Hospital Anxiety and Depression scale (two RCTs). There was a non significant trend towards a benefit with continuous training shown in the dyspnoea scale of the Chronic Respiratory Questionnaire (weighted mean difference -0.2 units, 95% CI -0.5 to 0.0; four RCTs).

**Tolerance:** Attendance rates were reported in RCTs, ranging from 83 to 92%. There were no differences in drop-outs between the groups. Drop-out rates ranged from 0 to 40%. Exacerbation of symptoms was the most commonly cited reason for withdrawing (35 patients). Two trials reported significant reductions in leg discomfort and and dyspnoea during interval training compared with continuous training, but two other trials found no differences between the groups. One trial found significant differences favouring the interval training group for adherence and unintended rests of more than one minute duration.

There was no statistically significant heterogeneity reported for any of the pooled outcomes.

Authors’ conclusions
There were no differences in the effectiveness of interval training compared with continuous training for improving exercise capacity and health-related quality of life in patients with chronic obstructive pulmonary disease of varying severity.

CRD commentary
The review addressed a clear question. Criteria for the inclusion of trials were clearly stipulated. Appropriate databases were searched, with no language restrictions. However, no attempt was made to search for unpublished literature, which meant that there was a risk of publication bias. Some steps were taken to minimise errors and bias through most parts of the review process, but the authors did not state how disagreements were resolved.

The authors’ decision to pool the results of the included studies was justified, particularly given the lack of statistical heterogeneity across the trials of all the outcomes pooled. The sample sizes in the included trials were small, and drop-out rates were as high as 40%.

The results should be interpreted with some caution given the risk of publication bias, the small sizes of the included trials and high drop-out rates. Some shortcomings mean that making judgements about the reliability of the authors’ conclusions is difficult.

Implications of the review for practice and research
**Practice:** The authors stated that interval training may be considered as a training option or to complement continuous exercise in patients unable to tolerate high intensity continuous exercise. They also stated that patient preference should be considered when designing exercise rehabilitation for this population, as preference may have an impact on programme adherence.

**Research:** The authors stated that studies of high methodological quality, with large numbers of patients, are necessary to establish the efficacy of interval training protocols, and whether patients with COPD are capable of performing more
work at higher intensities with interval training; it is also important to evaluate training responses in particular subgroups of patients, particularly those with greater disease severity.

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