The evidence regarding exercise training in the management of cystic fibrosis: a systematic review

Shoemaker MJ, Hurt H, Arndt L

CRD summary
This review concluded that there was strong support for aerobic and resistance training to improve aerobic capacity and strength. The effect of exercise on pulmonary function and HRQL were unclear. This review's methodological deficiencies and poor reporting raised concerns; given the lack of study details and results reported, it is not possible to determine the reliability of the conclusions.

Authors' objectives
To investigate the efficacy of exercise training in the management of cystic fibrosis.

Searching
English-language studies were identified through a computerised bibliographic search of PEDro, MEDLINE and CINAHL. Search terms were reported.

Study selection
Studies of exercise-related interventions where outcomes were related to longer term adaptations or outcomes (not acute effects of exercise) in patients with cystic fibrosis were eligible for inclusion. Studies in which exercise interventions were used in combination with non-exercise interventions were excluded.

Of the 12 included studies, six investigated aerobic exercise, one study investigated anaerobic training, two studies compared aerobic and resistance training, and three studies investigated a combination of aerobic and resistance training. Mean age of participants ranged from 10.5 years to 24.7 years. Follow-up duration ranged from one month to three years. Nine studies included children with a mean age of 10.5 to 16.7 years; three studies included patients with a mean age of 20 to 24.7 years.

The authors stated neither how the papers were selected for the review nor how many reviewers performed the selection.

Assessment of study quality
Study quality was assessed independently by two reviewers who used a modified version of a 10-item quality scoring system developed by Medlicott and Harris that dealt specifically with the following domains; randomisation; inclusion/exclusion criteria; similarity of groups at baseline; replicable treatment protocol; reliability and validity of outcome measures; blinding; dropouts; length of follow-up; and adherence. These criteria were used to assign a score from a possible 8 to 10 points dependant on the applicability of the item to the study. Scores were converted to percentages. Studies that scored 80% or more were considered strong, studies that scored 60% to 79% were considered moderate and studies that scored less than 59% were considered weak.

Data extraction
Data were extracted and reported in evidence tables on: aerobic capacity in terms of mean maximal oxygen consumption (VO_{2max}), mean peak oxygen consumption (VO_{2peak}) and mean maximum work capacity (W_{max}); strength; pulmonary function in terms of forced expiratory volume (FEV) and forced vital capacity (FVC); and health-related quality of life (HRQL). The scales used were reported in the text.

The authors did not state how many reviewers performed the data extraction.

Methods of synthesis
Data were reported narratively supported by tables. Results were grouped by outcome.
Results of the review

Twelve studies (n=373) were included in the review: five RCTs; five pre-post-test design; and two cohort studies. Study quality ranged from 50% to 89%. Three articles were rated strong, three moderate and six weak. Seven studies had less than 25 participants; the five other studies included no more than 75 participants.

**Aerobic capacity:** Five of seven studies demonstrated statistically significant improvements in peak oxygen consumption and six of seven studies demonstrated statistically significant improvement in other measures of exercise capacity and performance. One study investigated the effect of anaerobic training on aerobic capacity and found a prophylactic effect on peak oxygen consumption and an increase in peak work rate. Two studies that examined the effect of resistance training on aerobic capacity found no effect on peak oxygen consumption; one found an increase in peak work rate.

**Strength:** Two studies (one RCT) demonstrated significant improvement in lower extremity strength with aerobic training. Two RCTs showed significantly improved strength with resistance training.

**Pulmonary function:** One RCT demonstrated no benefit at three months. Another RCT showed a preservation benefit at three years. An RCT showed improvement at one month follow-up for exacerbation-associated hospitalisation and another at 12 months follow-up. Level two evidence failed to demonstrate improvements in pulmonary function with follow-up periods between two and 12 months.

**HRQL:** Six studies (four RCTs and two cohorts) reported outcomes for HRQL and all but one study showed improvement in HRQL measures. One RCT showed no change over a 12-month period.

Authors’ conclusions

There was strong support for the use of aerobic and resistance training to improve aerobic capacity and strength. The effect of exercise training on pulmonary function and HRQL, hospitalisation or health care utilisation were unclear.

CRD commentary

This review did not address a clear question. The authors reported that outcomes were to relate to long-term adaptations (not acute effects of exercise). Yet only 5 of the 12 included studies reported a follow-up time longer than 12 weeks. Relevant databases were searched and search terms were reported, but it appeared that no attempts were made to identify unpublished studies and the inclusion of only English-language studies, thus important information may have been missed. The potential influence of publication bias was not considered. The influence of reviewer error and bias in the study selection process and data extraction were not considered.

Effect sizes and precision data (p values and 95% CIs) were not reported for any of the included studies. Comparisons for individual studies were not reported, so it was not possible to verify whether results were complete; some reported results mentioned control group, some did not. The review reported significant results, but it was not possible to verify this; it was not always clear whether the authors were referring to statistically significant differences between groups or statistically significant changes within groups. There were some discrepancies between results reported in the text and table (the text reported seven studies with VO\textsubscript{2}peak results and the table showed data from nine studies that related to this outcome).

This review’s methodological deficiencies and poor reporting raised serious concerns. The authors’ conclusions appeared strong given the lack of study details and results reported. It is not possible to determine their reliability.

Implications of the review for practice and research

**Practice:** The authors stated that exercise training should continue to be considered an important part of an overall management plan for individuals with cystic fibrosis.

**Research:** The authors stated that future research was needed to provide greater clarity as to the effect of exercise training on pulmonary function, HRQL, hospitalisations, health care utilisation and mortality. The authors also stated that future research should include more longitudinal studies with specific inclusion criteria, training protocols and
HRQL measures. Additionally, the authors stated that studies were needed to investigate the efficacy of interventions in adults.

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