



Effect Of Upper Extremity Training On Health-Related Quality Of Life And Performance Of Activities Of Daily Living In Patients With COPD: A Brief Review

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ABSTRACT

Background: Most of the activities of daily living (ADLs) require the use of arms that leads to dyspnoea and early cessation of upper extremity (UE) activities in patients with COPD, therefore upper extremity training (UET) is a significant contributor to decreasing dyspnoea in COPD patients.

Objective: To evaluate the efficacy of UET in improving the health-related quality of life (HRQoL) and ADLs that involve UE in patients with COPD.

Methods: The Preferred Reporting Items for Reviews guidelines were used in this review. PubMed and google scholar databases were searched to identify review articles and randomized controlled trials (RCTs) involving adults with COPD who underwent UET, compared with those who underwent other types of exercise or no exercise, to assess the impact on HRQoL and ADLs that involve UE.

Results: Five studies, met the inclusion criteria. The results of selected studies showed that UET is safe, and can significantly improve HRQoL and ADLs that involve UE in patients with COPD. Nevertheless, there were discrepancies in the findings, particularly concerning the perception of symptoms during activities of daily living (ADLs). The limited number of included studies and their varying methodological quality prevent definitive conclusions from being drawn.

Conclusions: The findings of this review revealed that UET is a safe therapeutic approach, and can improve the HRQoL and ADLs that involve UE in patients with COPD, but results are unclear. Further investigation through well-designed RCTs is needed to determine the effectiveness of UET in improving the performance of HRQoL and ADLs that involve UE in COPD patients.

Keywords: Upper extremities; upper extremity exercise training, COPD; ADLs, Exercise therapy, Pulmonary Rehabilitation.

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a “common preventable, and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation due to abnormalities in the airway and (or) alveolar abnormalities usually caused by significant exposure to noxious particles or gases”.¹ The prevalence of moderate to particularly severe COPD varies among countries, but it has been documented to fall within a range of reported rates of 4% and 17%. COPD is a major cause of morbidity, mortality, and increased healthcare costs globally.²

Pulmonary rehabilitation (PR) is a cardinal component of COPD management. The pulmonary rehabilitation program includes individualized exercise training including lower-limb training combined with upper-limb training, therapeutic education, respiratory physiotherapy, combined with smoking cessation, and nutritional and psychosocial coverage.²

An important aspect of pulmonary rehabilitation is the inclusion of upper limb training. While COPD primarily affects the lungs, it can also lead to functional limitations in the upper limbs. Many ADLs, such as grooming, cooking, and household chores, require the use of the arms and upper body. However, patients with COPD often experience dyspnoea and fatigue while using their upper limbs, leading to reduced activity levels and limitations in performing these tasks. 3,4,8

Dyspnea is a significant symptom experienced by individuals with COPD, which hampers their ability to engage in physical activities and impacts their capacity to carry out the activities of daily living (ADLs). Activities that require elevation of upper extremities (UE) over the shoulder height may disrupt normal breathing and cause hyperinflation, which is associated with the occurrence of dyspnoea. In COPD patients, the difficulties encountered in performing ADLs tasks using the upper extremities are partly related to respiratory disease, and in particular to the fact that the muscles required to mobilize the upper extremities are also required for ventilatory mechanics.^{2,8,9}

Improving the performance of activities of daily living should be one of the most important goals of rehabilitation because it could affect the ability of patients to self-care.⁴ So, for these reasons, recent studies have suggested that upper extremities muscle strengthening in patients with COPD is necessary to reduce dyspnoea in daily living activities, improve quality of life, and improve strength and endurance of the upper extremities.^{2-5,8-9}

In summary, incorporating upper limb training as part of pulmonary rehabilitation in COPD is essential for addressing functional limitations and improving overall well-being. It can enhance upper limb function, reduce dyspnoea during daily activities, and contribute to improved health-related quality of life in patients with COPD

The inclusion of UET is not specifically suggested for patients with COPD, according to the British guidelines on PR in adults.¹¹ Recent systematic reviews have suggested that studies are necessary for clarifying standardized training protocols for upper extremity training in COPD patients. Also, concluded that it is unclear whether the gains in upper extremities function translated to improvements in other important health outcomes, such as symptoms of dyspnoea during activities of daily living, health-related quality of life, pulmonary functions and performance of activities of daily living in patients with COPD.²⁻⁴ This review article aims to synthesize the existing evidence on the efficacy of UET in improving HRQoL and arm activity levels involving UE in patients with COPD.^{2-4,5,7,11}

METHODS

The articles for the study were searched from the PubMed, Cochrane Library, and google scholar electronic databases. The selected keywords were related to COPD (chronic obstructive pulmonary disease); upper extremities (upper limb, arms); exercise training (training, exercise, physiotherapy, exercise therapy, physical therapy, strength training, endurance training); HRQoL (health-related quality of life, quality of life); arm activity levels; ADLs (activities of daily living). Articles retrieved were perused for other relevant references.

Two reviewers independently conducted an initial screening of the search results to eliminate duplicate entries and evaluate the titles and abstracts of articles that could potentially be relevant. Full-text articles were obtained when the title or abstract did not provide enough information to determine whether the article should be included. In cases of disagreement, a consensus was reached by discussion based on the inclusion/exclusion criteria of the study.

In order to be included in our review, the articles had to meet criteria that were developed following the PICOS- an acronym for a population of interest, intervention, comparison, outcome, and study design approach.

In the present review, the criteria were as follows: P= men and women over 18 years of age, diagnosed with COPD (regardless of severity); I= any form of UET program; C= three types of comparison (UET vs. no UET; UET and lower extremities training vs. lower extremities training only; and comparison between two types of UET); O= health-related quality of life and arm activity levels; and S= review of studies.

It is worth mentioning that the primary outcome of the present review was the health-related quality of life among patients with COPD after upper extremity training. The ability to perform various daily activities is influenced by symptoms of dyspnoea in patients with COPD. Therefore, the secondary outcome measure is the improvement in the arm activity levels that in respect improves the ADLs that involve the upper limb in patients with COPD.



Authors journal year	Objective	Design	Outcome Measure	Results	Strength	Limitations
Zeng Y. et.al.,2013 international journal of COPD	To evaluate PR's application in clinical practice, this article summarizes the common methods of exercise measurement and exercise training for patients with COPD.	A literature review	Exercise assessments include the patient's symptoms, endurance, strength, and health-related quality of life. Exercise therapies involved endurance, strength, and respiratory training.	Different approaches and interventions have been employed in pulmonary rehabilitation (PR) for individuals with COPD. However, the primary objective is to create personalized exercise training plans tailored to each patient's specific needs.		Further research is necessary to substantiate the existing evidence and explore the long-term impacts of exercise training on individuals with COPD at different stages of the disease.
ZJ McKeough et.al. 2016 Cochrane Database of Systematic Reviews. ²	To determine the effects of upper extremities training (endurance or resistance training, or both) on symptoms of dyspnoea and HRQoL in people with COPD	Review using studies with randomized control trials (RCTs) in which upper extremities exercise training of at least 4 weeks duration was compared to no training, lower limb training, or another form of training.	<u>Primary outcomes</u> 1. Symptoms of dyspnoea measured using CRQ. 2. HRQoL measured using CRQ & SGRQ. <u>Secondary outcomes</u> 1. Peak upper extremities exercise capacity measured from a peak upper extremities exercise test. 2. Endurance upper extremities exercise capacity measured from an endurance upper extremities test. 3. Upper extremities strength measured using either hand-held dynamometry, upper extremities resistance machines (e.g., 1 RM) or scored from functional lifting tasks. 4. Respiratory muscle strength is measured from a pressure gauge. 5. Physical activity level from subjective measures or objective measures. 6. ADLs function is measured as the time or movement intensity during the performance of ADLs. 7. Psychological status measured using Hospital Anxiety and Depression Scale. 8. Healthcare utilization is recorded as hospitalization or length of stay.	Compared to no upper extremities training, incorporating upper extremities exercise training leads to a reduction in dyspnoea but does not significantly improve health-related quality of life (HRQoL) in individuals with COPD. Furthermore, limb training involving unsupported upper extremities exercises has a substantial impact on the endurance and capacity of the upper extremities.	Based on inclusion criteria there is a low risk of bias.	Insufficient research exists to determine the optimal upper extremities training program for individuals with COPD. However, endurance-focused upper limb training interventions have shown promise in improving outcomes for this population.
Michael J et.al. 2018 COPD: Journal of Chronic Obstructive Pulmonary Disease.	To compare in physical function and HRQoL in a group of COPD	Interventional trial	Pulmonary function testing and physical function was assessed using 6MWT and timed chair rise and the physical	The findings of this study indicate that both endurance training and strength training programs hold the potential for	There is very few studies which compare endurance training	The inclusion of only 11 patients who participated in both training interventions may have led to reduced statistical power

	patients completing both an endurance and a strength training programme.		function scale of the Medical Outcome Study 36 Item Short form (SF-36) and CRQ.	improving physical function in patients with COPD. Furthermore, endurance training seems to yield greater enhancements in health-related quality of life (HRQoL).	and strength training programmes.	in the study.
Kruapanich C et.al. 2019 Ann Rehabil Med. ⁷	To determine effects of different modes of upper extremities training on dyspnoea and quality of life of individuals with COPD having different disease severity.	A systematic review and meta-analysis on RCTs.	Primary outcomes- Dyspnoea and QOL measured using modified Borg Scale and total scores of QOL questionnaire. Secondary outcomes- UL fatigue, UL function and UL exercise tolerance using RPE scale and a total amount of time spent on UL activities.	ULE has demonstrated effectiveness in enhancing dyspnoea, upper limb fatigue, upper limb function, and upper limb exercise tolerance. Comparatively, ULE showed significantly greater improvements in dyspnoea and upper limb exercise tolerance compared to the control group. Additionally, ULC was notably more effective in improving upper limb fatigue compared to the control group.	This systematic review was the most updated and comprehensive one as it systematically rated the quality of evidence specific to each mode of UL training according to the GRADE approach to provide transparency of recommendations.	Limitations of study design (>25% of participants were from studies with a high risk of bias), inconsistency, indirectness, imprecision, and publication bias.
Karagiannis C. et.al., 2020 J Bras Pneumol.	To investigate the efficacy of upper extremities exercise training (ULExT) in improving the performance of activities of daily living (ADL) that involve the upper extremity (UE) in patients with COPD	The Preferred Reporting Items for Systematic Reviews and Meta-Analyses guideline were used in this systematic review	Study design, total duration of study, details of any run-in period, number of study centres and their location, study setting, withdrawals, and date of study); participants (number, mean age, gender, severity of COPD, diagnostic criteria, baseline lung function, smoking history, inclusion criteria, and exclusion criteria); interventions (intervention and comparison groups)	ULExT is a safe therapeutic approach for these patients, in addition significant improvements in the performance of ADL that involve the UL were found.	Number of studies were larger than the previous systematic reviews	Lack of Well-designed randomized controlled trials to determine the efficacy of ULExT and the proper parameters for this type of training in patients with COPD.

CONCLUSION

The importance of upper limb training in COPD lies in its potential to enhance overall functional abilities (ADLs) and health-related quality of life. By UET there is improved strength and endurance, and patients with COPD can perform ADLs more efficiently and with reduced dyspnoea. This, in turn, enhances their independence and ability to engage in meaningful activities, ultimately improving their health-related quality of life.

Furthermore, upper limb training can have a positive impact on respiratory muscle function. The muscles involved in upper limb movements, such as the shoulder girdle and upper torso muscles, are also important for ventilatory mechanics. By training these muscles, individuals with COPD may experience improved respiratory muscle strength and coordination, leading to better breathing control and reduced dyspnoea.

The findings of this review concluded that UET helps in improving the health-related quality of life and arm activity levels that in respect improve the ADLs that involve the UE in patients with COPD, but the results are not clear. Further investigation is needed through well-designed randomized trials with a proper pulmonary rehabilitation exercise protocol to determine the benefits of UET in improving the performance of health-related quality of life and arm activity levels that involve the UE in patients with COPD.^{2,3,4,5,7,8}

In order to assess the variations in patient-relevant outcomes among endurance upper limb training, resistance upper limb training, and the combination of endurance and resistance upper limb training, future randomized controlled trials (RCTs) need to include a larger number of participants, better methodological quality for dyspnoea, HRQoL, and arm activity levels. and the well-designed exercise protocol for UET during pulmonary rehabilitation is needed in patients with COPD.^{2,3,4,5,7,8,9,10,11}

DISCUSSION

The aim of the present review was to synthesize the potential effectiveness of UET in improving the HRQoL and arm activity levels that involve the upper limbs in patients with COPD. Our findings indicate that UET has significant improvements in the HRQoL and arm activity levels in patients with COPD when compared with baseline or compared with the control group.²⁻⁶ However, UET has shown contradictory results in symptom perception during ADL that involve the UL.^{3,8,9}

The findings of the studies proved that UET is a safe therapeutic approach and can improve the performance of ADL. Examining the effect of UET in UE-related ADL simulation tests showed that UET can provide significant improvements and can improve the performance of ADL that involves the UE in patients with COPD, there was a significant reduction in the total time taken to complete the ADL tasks but the results are unclear. UET when compared to no upper extremities training or a sham intervention shows improvement in dyspnoea but not HRQoL in patients with COPD. Studies also proved that UET

shows improvement in arm activity levels by reducing dyspnoea as a symptom with respect improves ADLs involving the upper extremities.²⁻⁹

Several studies have clearly demonstrated that dyspnoea is a complex and multi-dimensional symptom influenced by various factors, including emotions, cognition, context, and underlying pathophysiology. According to previous findings, it seems logical that arm training and breathing exercises can improve hyperinflation and pulmonary function during UET.

A patient's QoL is an important outcome measure to demonstrate whether or not an intervention will essentially have a significant impact on the patient. Unfortunately, the previous studies did not demonstrate a significant effect of UET on QoL compared to the control. It might be attributable to a limited number of studies and a small sample size. A major goal of pulmonary rehabilitation, especially UET, is improving the performance of ADL and HRQoL in patients with COPD. Pulmonary rehabilitation can significantly improve muscle capacity and reduce dyspnoea by a significant decrease in metabolic and ventilatory demand both of which can lead to improved QoL and ADLs in individuals with COPD.^{4,5,7,11}

Although significant improvements were found in previous studies included in the present review, the aforementioned findings cannot be generalized because of some quantitative and qualitative limitations of those studies. The number of studies included was small, which seems quite insufficient to provide clear results.

In order to assess the variations in patient-relevant outcomes among endurance upper limb training, resistance upper limb training, and the combination of endurance and resistance upper limb training, future randomized controlled trials (RCTs) need to include a larger number of participants, better methodological quality for dyspnoea, HRQoL, and arm activity levels. and the well-designed exercise protocol for UET during pulmonary rehabilitation is needed in patients with COPD.^{2,3,4,5,7,8,9,10,11}

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