

Systematic Review

Physiotherapy management in patients with pulmonary tuberculosis: a systematic review

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ABSTRACT

Physiotherapy approaches like pulmonary rehabilitation, respiratory exercises, airway clearance methods, chest physiotherapy, organized physical training have been progressively included in PTB treatment. These interventions are designed to improve lung function, facilitate sputum clearance, boost physical conditioning, regain functional independence. To find various physiotherapy interventions for patients with pulmonary tuberculosis. A systematic review was carried out descriptively in accordance with PRISMA guidelines. Electronic databases such as PubMed, Google Scholar were explored using terms associated with pulmonary tuberculosis and physiotherapy treatments. research published over the past decade was included. Qualifying designs included randomized controlled trials, quasi-experimental studies, observational studies, and systematic reviews. Following the review of 50 records and the elimination of duplicates, 10 studies satisfied the inclusion criteria for qualitative synthesis. Studies in the review showed that physiotherapy methods—like pulmonary rehabilitation, breathing exercises, chest physiotherapy, effective coughing strategies, airway clearance techniques, organized exercise training—greatly enhanced lung function measures (FEV1, FVC), exercise capacity (6-minute walk distance), sputum clearance, fatigue levels, and overall physical well-being. Furthermore, decreases in dyspnoea, anxiety, respiratory rate, and symptom burden were noted, enhancements in quality of life and functional independence. Physiotherapy treatment acts as a beneficial complement to medical therapy in pulmonary tuberculosis. It improves respiratory effectiveness, functional ability, and life quality while lessening symptoms and physical deterioration. Additional rigorous randomized controlled trials are required to develop standardized protocols and enhance treatment results.

Keywords: Pulmonary tuberculosis, Physiotherapy management, Pulmonary rehabilitation, Breathing exercises, Chest physiotherapy, Airway clearance, Functional capacity, Quality of life, Systematic review

INTRODUCTION

Tuberculosis (TB) runs alongside the history of human evolution from the Stone Age to today. TB remains among the top 10 leading causes of global human death during that time. Though it has a lengthy history, TB was

gradually recognized as a primary source of illness, with advancements in understanding causation and major treatment approaches in the last 150 years. TB continues to be a significant obstacle for effective worldwide prevention and treatment³. According to WHO, in 2023, there were 1.25 million deaths from tuberculosis (TB),

including 161,000 individuals with HIV. Globally, TB may have once again become the top cause of death from a single infectious agent, after three years during which COVID-19 took its place. It was the top cause of death among individuals with HIV and a significant contributor to fatalities linked to antimicrobial resistance. In 2023, around 10.8 million individuals were afflicted with TB globally, which comprised 6.0 million men, 3.6 million women, and 1.3 million children. TB exists in every country and among all age groups. TB can be treated and avoided.

Pulmonary tuberculosis (TB) is a contagious infectious disease caused by bacteria from the *Mycobacterium tuberculosis* group.¹ It poses a significant public health issue, ranking among the top 10 causes of mortality globally. Currently, the incidence of TB is decreasing by 2% annually, yet the objective of the end TB strategy is to achieve a 4-5% yearly reduction. Individuals with active pulmonary tuberculosis might be asymptomatic, experience a mild or worsening dry cough, or exhibit various symptoms such as fever, fatigue, weight loss, night sweats, and a cough that yields blood-stained sputum.² The clinical manifestations of active TB can vary from a mild cough to more serious consequences, including permanent lung injury and, ultimately, death, contingent upon the advancement of the disease. Besides its clinical presentation, TB has been linked to various other disease-related systemic complications, including hyponatremia and glucose intolerance.⁵ The lung is the organ most frequently impacted by tuberculosis infection in immunocompetent individuals, with estimates indicating lung involvement in active tuberculosis cases ranging from 79-87%. Estimates of lung involvement are comparable in immunocompromised individuals, such as those infected with human immunodeficiency virus (HIV), with research from the 1980s to 1990s indicating that the rates of pulmonary involvement ranged from 70-92%. Nevertheless, these individuals are also more prone to having extrapulmonary disease too. In most cases of tuberculosis, the lung serves as the entry point. The initial interaction with the organism leads to minimal or no clinical symptoms or indications. Usually, the tubercle bacillus establishes a localized infection in the outer area of the lung, where it has been introduced through inhalation. The organism seems to experience minimal influence from body defences until the onset of tuberculin hypersensitivity (4 to 6 weeks). Currently, a slight fever and general discomfort occur, and at times, additional signs of hypersensitivity are observed.⁷

Tuberculosis is very common in the low-income demographic and among marginalized groups within the community. In India, the National Strategic Plan (2017-2025) aims to achieve the elimination of tuberculosis by the year 2025.⁴ The main method of tuberculosis treatment is drug therapy, but its use causes significant side effects of other body organs and systems. Therefore, among the therapeutic factors in this disease, of great importance is a complex functional therapy, which causes certain positive

reactions and changes in various physiological body systems.⁶

METHODS

Study design

The study was designed as a systematic review.

Type of study

This was a descriptive study.

Data extraction

Articles from eligible search engine including PUBMED and Google scholar using key words such as tuberculosis, Pulmonary tuberculosis, Intervention, Systematic Review, Respiratory Muscle Training, Breathing exercises.

Tool kit

Followed PRISMA scale, preferred reporting-items for systematic reviews and meta-analyses (PRISMA) standards for systematic reviews and meta-analyses in its design and reporting on how the study was carried out. We searched articles using search engines PubMed, google scholar using key words as “Pulmonary tuberculosis”, “physiotherapy management”, “Patients with pulmonary tuberculosis”. The articles were searched according to the inclusion and exclusion criteria of the study.

Selection criteria

Inclusion Criteria included, full text articles, case control study, prospective study, retrospective study, observational study, cross sectional study, controlled clinical trial, pre and post study, systematic review, randomized controlled trial.

Exact study period

The study included articles published over the last 10 years, from February 2015 to February 2025.

Exact study place

The study was conducted at Pravara Institute of Medical Sciences, Loni, Maharashtra, India.

The exclusion criteria included articles with only abstracts, studies containing no original data, and articles published in languages other than English.

Study strategy

Studies were selected according to above mentioned inclusion and exclusion criteria. The current study followed the preferred reporting-items for systematic reviews and

meta-analyses (PRISMA) standards for systematic reviews and meta-analyses in its design and reporting. On how the study was carried out, the graphic clearly specifies four phases: inclusion, eligibility, screening and identification. First records discovered through database searches (n=50) are followed by records obtained through sources (n=10). After that, carefully sorting the screening proceeds (n=40) with the duplicates with the exception of the exclusion (n=30). As we get further towards eligibility, were left with the final phase, which is crucial. There is a total of 10 studies that are included in the qualitative synthesis (n=10) which consisted of controlled trial, retrospective study, cross-sectional study, comparative study, case control study, Experimental, crossover design.

RESULTS

The results of the study showed that physiotherapy methods—like pulmonary rehabilitation, breathing exercises, chest physiotherapy, effective coughing strategies, airway clearance techniques, organized exercise training—greatly enhanced lung function measures (FEV1, FVC), exercise capacity (6-minute walk distance), sputum clearance, fatigue levels, and overall physical well-being. Furthermore, decreases in dyspnoea, anxiety, respiratory rate, and symptom burden were noted, enhancements in quality of life and functional independence.

Table 1: Systematic reviews.

Reference	Study design	Title	Intervention	Result
Nogas A et al (2021)⁶	A randomized controlled trial	Effect of physical therapy on general physical health of patients with pulmonary tuberculosis.	Morning hygienic gymnastics (MHG), therapeutic gymnastics (TG), therapeutic massage, physiotherapeutic procedures (UHF therapy), hydrotherapy, manipulative interventions and educational programs	In this study, the results showed statistically significant improvement of the general level of physical health of patients with pulmonary tuberculosis of the experimental group are highlighted and explained by the correctness of components and effectiveness of the proposed program of physical therapy. ⁶
Nur Basuki et al (2023)¹¹	Quasi experimental design	Effects of chest physiotherapy and effective cough exercise on sputum clearance and respiratory frequency in tuberculosis patients	Effective coughing, chest physiotherapy: passive and active therapeutic efforts such as irradiation, relaxation, postural drainage, percussion, vibration cough exercises, breathing exercises, and attitude correction.	In this study, sputum secretion and respiratory frequency are higher than before chest physiotherapy and cough exercises in TB patients. ¹¹
Andi Tenriola et al (2025)¹⁵	Systematic review	The effect of respiratory exercise therapy on improving lung function in tuberculosis patients: a systematic review	Pursed lip breathing, diaphragmatic breathing, deep breathing exercise, segmental breathing,	Breathing exercise therapy effectively improves lung function and quality of life in TB patients. ¹⁵
Beatrice Mahler et al (2019)⁸	Systematic review	Pulmonary rehabilitation and tuberculosis: a new approach for an old disease	Physical training including light and heavy exercises, bicycle exercises, breathing exercises, weight training psychological counselling, nutritional support, along with compliance with TB drug treatment	This study concludes that the pulmonary rehabilitation (PR) may be a useful tool in this patient's therapy in active and also in sequela phase. The benefits of PR are: reducing symptomatology, improving the degree of functional independence and quality of life, and increasing the ability to perform daily activities. ⁸
Munazzah Orooj et al (2025)¹²	A randomized controlled trial	Long-term effect of pulmonary rehabilitation in pulmonary tuberculosis patients	Supervised endurance and resistance training, breathing exercises, and patient education	This study states that an 8-week PR program delivers long-term benefits in respiratory function, exercise capacity, and QOL in post-PTB patients. ¹²
Risti Puji Listari et al (2025)¹⁶	Quasi experimental design	Combination of active cycle of breathing techniques (ACBT) and chest physiotherapy on the	Active cycle of breathing techniques (ACBT), chest physiotherapy	This study states that combination of active cycle of breathing techniques (ACBT) and chest physiotherapy on the effectiveness of airway clearing

Continued.

Reference	Study design	Title	Intervention	Result
		effectiveness of airborne cleaning in pulmonary TB patients		in pulmonary TB patients and is easy to do. ¹⁶
Da Silva et al (2022)¹⁷	Systematic review	Effect of pulmonary rehabilitation on functional capacity in individuals treated for pulmonary tuberculosis: a systematic review protocol	Physical training, breathing exercises, respiratory muscle training	This study shows improvement in functional capacity. ¹⁷
Ja Rivera et al (2015)¹⁸	A randomized controlled trial	Pulmonary rehabilitation on aerobic capacity and health related quality of life in patients with sequelae of pulmonary TB	Upper and lower limb strengthening and aerobic component, activities of daily living training, a training protocol for the lower limbs with an initial intensity load of 60%, and increased up to 85% and 90% of the peak oxygen consumption (VO ₂ peak), three times a week for 8 weeks	Eight weeks of pulmonary rehabilitation in eight patients with sequelae of pulmonary TB resulted in significant improvements in both aerobic capacity and quality of life. ¹⁸
Jaspreet Kaur et al (2021)¹⁴	Quasi experimental design	The effectiveness of breathing exercises on the physiological and psychological variables of patients with pulmonary tuberculosis	Pursed lip breathing exercise, diaphragmatic breathing exercise, deep breathing exercise and segmental breathing exercise	It can be concluded that breathing exercises are effective in reducing the dyspnoea, anxiety, HR and RR. Breathing exercises are effective in improving the O ₂ saturation, blood pressure and quality of life among pulmonary tuberculosis patients. ¹⁴

Systematic reviews have highlighted the effectiveness of various physiotherapy techniques, including breathing exercises, morning hygienic gymnastics (MHG), UHF therapy, hydrotherapy, effective coughing, postural drainage, and physical training including light and exercises in mitigating issues such as obstructed airways, reduced sputum secretion, functional capacity. These non-invasive treatments provide an alternative complementary option to traditional tuberculosis therapy, especially in mild to moderate cases. However, despite these positive findings, further high-quality randomized controlled trials and long-term studies are essential to fully assess the efficacy of physiotherapy interventions and to determine the most effective treatment protocols for different patient populations. Such research would help guide clinicians in incorporating physiotherapy into comprehensive management strategies for pulmonary tuberculosis.

DISCUSSION

Nogas' study provides strong evidence that a comprehensive physical therapy program improves physical health in patients with pulmonary tuberculosis. Compared to standard care alone, the experimental group showed significantly better outcomes ($p < 0.05$), with more patients achieving average or above-average physical health. The program combined exercises, massage, physiotherapy (UHF therapy, hydrotherapy), manual techniques, and patient education, targeting respiratory function, muscle strength, circulation, and overall conditioning. These findings suggest that early and

consistent physical therapy helps reduce deconditioning, supports functional recovery, and should be integrated into routine tuberculosis treatment to enhance rehabilitation outcomes.⁶ This quasi-experimental study by Nur Basuki shows that chest physiotherapy combined with effective coughing exercises improves sputum clearance and respiratory rate in patients with pulmonary tuberculosis. After three sessions, increased sputum volume indicated better airway clearance, reduced secretion buildup, and improved breathing efficiency. Although no control group was included, the significant pre-post improvements support chest physiotherapy as a useful, simple, and non-invasive adjunct to medication, helping enhance lung function and overall recovery in TB patients.¹¹

This systematic review by Andi Tenriola highlights that pulmonary rehabilitation using structured breathing exercises is an effective way to address persistent functional limitations in tuberculosis patients, even after medical treatment. Techniques such as diaphragmatic breathing, pursed-lip breathing, and incentive spirometry performed regularly for 6-12 weeks significantly improve lung function (FEV₁, FVC), exercise capacity, and quality of life. Adequate duration and consistency are essential for benefits, supporting the inclusion of breathing exercises in routine and post-TB care, though larger trials are needed for standardized guidelines.¹⁵

Mahler's review highlights that pulmonary rehabilitation is a vital but often neglected component of tuberculosis care. Even after microbiological cure, TB can cause lasting

respiratory, physical, nutritional, and psychosocial impairments that medication alone cannot address. A multidisciplinary program—including exercise training, breathing techniques, airway clearance, nutrition, education, and psychological support—helps reduce symptoms, improve exercise capacity, enhance quality of life, and support social reintegration. Early, individualized rehabilitation is especially beneficial, making it a cost-effective and evidence-based approach for both active and post-TB patients.⁸

Munazzah Orooj's randomized controlled trial shows that pulmonary rehabilitation provides both immediate and long-term benefits for patients with post-pulmonary tuberculosis sequelae. An 8-week structured program significantly improved exercise capacity, lung function (FEV₁), and quality of life, with gains maintained up to 12 months. Increased 6-minute walk distance and reduced SGRQ scores reflected better endurance and fewer symptoms. As no similar changes occurred in the control group, the results confirm pulmonary rehabilitation as an essential part of long-term post-TB care to reduce disability and support lasting recovery.¹²

Sema Aytaç's randomized controlled trial shows that structured breathing techniques are an effective non-pharmacological method to reduce fatigue in tuberculosis patients. Four weeks of diaphragmatic and pursed-lip breathing significantly lowered Piper Fatigue Scale scores in the intervention group, while no improvement was seen in controls. Improved ventilation, oxygen delivery, and reduced breathing effort likely explain the benefits. These findings support incorporating simple, low-cost breathing exercises into routine TB care to enhance symptom control and quality of life.¹³

Risti Puji Listari's study shows that combining Active Cycle of Breathing Techniques (ACBT) with chest physiotherapy significantly improves airway clearance in patients with pulmonary tuberculosis. Compared to controls, the intervention group had better secretion mobilization and removal, helping reduce dyspnoea, improve ventilation, and prevent complications. These findings support this simple, cost-effective physiotherapy approach as a valuable adjunct to medical treatment to enhance respiratory function and recovery in TB patients.¹⁶

Da Silva's protocol highlights that although drug therapy cures pulmonary tuberculosis, many patients continue to experience long-term respiratory, physical, and functional limitations. It aims to systematically evaluate the effectiveness of pulmonary rehabilitation—especially exercise training combined with breathing exercises, respiratory muscle training, and education—in improving recovery. With a strong and structured methodology, the review supports viewing pulmonary rehabilitation as an essential part of post-TB care to enhance functional capacity, lung function, and quality of life.¹⁷

Pulmonary tuberculosis remains a major global health problem due to persistent respiratory and musculoskeletal impairments even after successful treatment, especially in young working-age individuals. These long-term limitations reduce work capacity and quality of life. Pulmonary rehabilitation shows promise in improving exercise tolerance, lung function, and overall well-being; however, unlike its established role in Chronic obstructive pulmonary disease, its benefits in TB-related sequelae are less studied. This highlights the need for more high-quality research to define the role and effectiveness of pulmonary rehabilitation in post-TB care.¹⁸

This study shows that structured breathing exercises are an effective adjunct therapy for patients with pulmonary tuberculosis, improving both physical and psychological outcomes. Regular practice reduced dyspnoea, anxiety, heart rate, and respiratory rate, while improving oxygen saturation, blood pressure, and quality of life. These benefits likely result from better ventilation, lung expansion, gas exchange, and relaxation. Overall, simple and low-cost breathing exercises can be integrated into routine TB care to support respiratory function, emotional well-being, and holistic recovery.¹⁴

CONCLUSION

In conclusion, physiotherapy interventions present a promising approach in the management of pulmonary tuberculosis, showing significant improvements in respiratory function, exercise capacity, functional capacity, sputum secretion, quality of life and reductions in symptom severity.

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