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IMPACT OF PHYSICAL ACTIVITY ON QUALITY OF LIFE IN PATIENTS WITH PULMONARY TUBERCULOSIS SEQUELAE: A LITERATURE REVIEW

IMPACTO DE LA ACTIVIDAD FÍSICA EN LA CALIDAD DE VIDA DE PACIENTES CON SECUELAS DE TUBERCULOSIS PULMONAR: UNA REVISIÓN DE LA LITERATURA

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Impact of Physical Activity on Quality of Life in Patients with Pulmonary Tuberculosis Sequelae: A Literature Review

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ABSTRACT

Introduction: Pulmonary tuberculosis (PTB) remains a significant cause of global morbidity and mortality. Despite successful treatment, chronic sequelae often diminish patients' quality of life. Physical activity has emerged as a promising therapeutic strategy in this context. Objective: The aim of this literature review is to synthesize scientific evidence regarding the impact of physical activity and pulmonary rehabilitation on the quality of life of patients with post-PTB sequelae. Methods: A narrative systematic review with a comparative approach was conducted, adhering to the PRISMA statement. Searches were performed in databases such as PubMed, ClinicalKey, and Scopus, using a combination of descriptors in English and Spanish. Studies in adults with post-TB sequelae that evaluated the impact of physical activity were included. Strict inclusion and exclusion criteria were applied, and the quality of evidence of the 15 final articles was assessed. Results: The reviewed studies consistently show a positive effect of physical activity in post-TB patients. Significant improvements were identified in pulmonary function (FEV_1), functional capacity (6MWT), and quality of life (measured with SF-36, SGRQ). The evidence also suggests benefits in mental health (reduced anxiety and depression) and indicates that short-duration programs (4-6 weeks) are effective. Conclusion: Physical activity and pulmonary rehabilitation are effective and cost-effective interventions to improve the quality of life of patients with pulmonary tuberculosis sequelae. Their inclusion in post-TB management guidelines is recommended, although more longitudinal research is needed.

***Keywords*:** pulmonary tuberculosis, post-tuberculosis sequelae, physical activity, pulmonary rehabilitation, quality of life

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Impact of Physical Activity on Quality of Life in Patients with Pulmonary Tuberculosis Sequelae: A Literature Review

RESUMEN

Introducción: La tuberculosis pulmonar (TBP) sigue siendo una causa importante de morbilidad y mortalidad a nivel mundial. A pesar del éxito del tratamiento, las secuelas crónicas suelen disminuir la calidad de vida de los pacientes. La actividad física ha surgido como una estrategia terapéutica prometedora en este contexto. Objetivo: El objetivo de esta revisión bibliográfica es sintetizar la evidencia científica sobre el impacto de la actividad física y la rehabilitación pulmonar en la calidad de vida de los pacientes con secuelas post-TBP. Métodos: Se realizó una revisión sistemática narrativa con un enfoque comparativo, siguiendo la declaración PRISMA. Se realizaron búsquedas en bases de datos como PubMed, ClinicalKey y Scopus, utilizando una combinación de descriptores en inglés y español. Se incluyeron estudios en adultos con secuelas post-TB que evaluaron el impacto de la actividad física. Se aplicaron criterios estrictos de inclusión y exclusión, y se evaluó la calidad de la evidencia de los 15 artículos finales. Resultados: Los estudios revisados muestran consistentemente un efecto positivo de la actividad física en pacientes post-TB. Se observaron mejoras significativas en la función pulmonar (FEV_1), la capacidad funcional (prueba de marcha de 6 minutos) y la calidad de vida (medida con el SF-36 y el SGRQ). La evidencia también sugiere beneficios en la salud mental (reducción de la ansiedad y la depresión) e indica que los programas de corta duración (4-6 semanas) son efectivos. Conclusión: La actividad física y la rehabilitación pulmonar son intervenciones efectivas y rentables para mejorar la calidad de vida de los pacientes con secuelas de tuberculosis pulmonar. Se recomienda su inclusión en las guías de manejo post-tuberculosis, aunque se necesita más investigación longitudinal.

Palabras clave: tuberculosis pulmonar, secuelas post-tuberculosis, actividad física, rehabilitación pulmonar, calidad de vida

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INTRODUCTION

Pulmonary tuberculosis (PTB) remains one of the most prevalent infectious diseases and one of the greatest challenges to global public health. According to the most recent report from the World Health Organization (WHO), in 2023 approximately 10.6 million new cases and 1.3 million deaths from tuberculosis were reported, positioning this disease as the second leading cause of death from an infectious agent after COVID-19 (WHO, 2023). Although antituberculosis treatment achieves cure in most cases, many patients experience chronic respiratory sequelae, functional impairment, psychological disorders, and persistent social limitations that significantly reduce their quality of life after completing treatment [1].

Post-tuberculosis sequelae have been associated with the development of obstructive or restrictive patterns, reduced lung capacity, and the onset of conditions such as bronchiectasis or pulmonary fibrosis, which prevent full recovery of respiratory function [2]. In this context, physical activity and pulmonary rehabilitation have emerged as promising complementary therapeutic strategies, especially in chronic respiratory diseases such as COPD, asthma, or idiopathic pulmonary fibrosis. However, their systematic application in patients with a history of PTB has been scarcely documented, despite the physiological, psychological, and social benefits already demonstrated in other populations [3].

In the last past years, clinical studies and systematic reviews have begun to show that structured physical activity improves not only pulmonary function but also functional capacity, mental health, and quality of life in patients with pulmonary tuberculosis sequelae [4-5]. Despite these advances, gaps persist in the implementation of formal post-TB rehabilitation programs, partly due to the lack of specific guidelines and the limited visibility of this issue within health systems.

The purpose of this article is to review and synthesize recent scientific evidence on the impact of physical activity and pulmonary rehabilitation in adults who have recovered from pulmonary tuberculosis, with an emphasis on outcomes related to quality of life. To achieve this, a systematic review with a narrative-comparative approach was conducted, based on studies located in indexed databases such as PubMed, ClinicalKey, and Scopus. This review was developed in accordance with PRISMA guidelines, applying robust methodological criteria and using reference frameworks such as

EQUATOR and Oxford CEBM, with the goal of providing a critical and updated overview that contributes to the integration of more comprehensive therapeutic strategies in post-TB care.

METHODOLOGY

A literature review was conducted in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. A literature review was conducted in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.. The combinations of descriptors in English included "pulmonary tuberculosis", "rehabilitation", "exercise", "physical activity", and "quality of life". The search strategy was designed to maximize both sensitivity and specificity in retrieving relevant articles, combining terms through Boolean operators (AND, OR). For example, the PubMed search strategy was: ("pulmonary tuberculosis" [Mesh] OR "tuberculosis, pulmonary" [TIAB]) AND ("rehabilitation" [Mesh] OR "exercise" [TIAB] OR "physical activity" [TIAB]) AND ("quality of life"[Mesh] OR "quality of life" [TIAB]). Bibliographic references were managed using specialized software to identify and remove duplicates.

Selection and Quality Assessment Criteria

Rigorous inclusion and exclusion criteria were applied for the selection of studies.

The inclusion criteria were:

- Studies in human adults aged 18 years and older.
- Articles published in English or Spanish.
- Research evaluating the effects of physical activity programs or pulmonary rehabilitation in patients with pulmonary tuberculosis or its sequelae..
- Studies were excluded if they involved children, patients in the active phase of the disease who had not completed treatment, or did not report measurements of quality of life or functional outcomes.

The methodological quality of the studies was assessed using specific tools to mitigate the risk of bias. For clinical trials, the Cochrane Collaboration tool was used; for observational studies, the Newcastle-Ottawa Scale; and for systematic reviews, the AMSTAR 2 instrument. This rigorous assessment process ensured that the studies included were of moderate to high quality.

Data analysis

Due to the clinical and methodological heterogeneity of the selected studies, which included diverse populations, intervention designs, and measurement scales, a formal meta-analysis could not be performed. Instead, a comparative narrative review approach was adopted, in which the findings of each study were synthesized and discussed. To determine the relevance of the results, the concept of Minimal Clinically Important Difference (MCID) was applied, considering effects as significant when they exceeded predefined thresholds, such as an improvement of 30 meters in the 6MWT or a reduction of 4 points in the SGRQ. This strategy allowed for a critical and contextualized interpretation of the available evidence

Data Extraction and Synthesis

The primary and secondary outcomes of interest were grouped into five key domains to allow for a comprehensive assessment of the impact of physical activity. These included:

1. Pulmonary function: Forced Expiratory Volume in one second (FEV_1), Forced Vital Capacity (FVC), and Diffusing Capacity for Carbon Monoxide (DLCO).
2. Functional capacity: Six-Minute Walk Test (6MWT) and Incremental Shuttle Walk Test (ISWT).
3. Quality of life: Disease-specific and generic questionnaires such as the St. George's Respiratory Questionnaire (SGRQ), EQ-5D, Short Form-36 Health Survey (SF-36), and Generic Quality of Life Inventory-74 (GQOL-74).
4. Mental health: Anxiety and depression scales such as the Generalized Anxiety Disorder-7 (GAD-7) and Patient Health Questionnaire-9 (PHQ-9).
5. Nutritional parameters: Body Mass Index (BMI) and lean body mass

Data extraction and quality Assessment

Data extraction was carried out independently by two reviewers (B.R. and M.C.), who used a standardized form to collect key information from each study, including: authors, country of origin, methodological design, sample characteristics, type and duration of the intervention, and main outcomes. Any discrepancies between reviewers were resolved by consensus, or, if disagreement persisted, through the involvement of a third reviewer.

To assess the quality of evidence and risk of bias, validated tools specific to each study design were applied.

The Cochrane Collaboration tool was used for randomized clinical trials, the Newcastle-Ottawa Scale for observational studies, and the AMSTAR 2 tool for systematic reviews. This process confirmed that most of the included studies demonstrated moderate to high methodological quality.

Analysis and Synthesis of Evidence

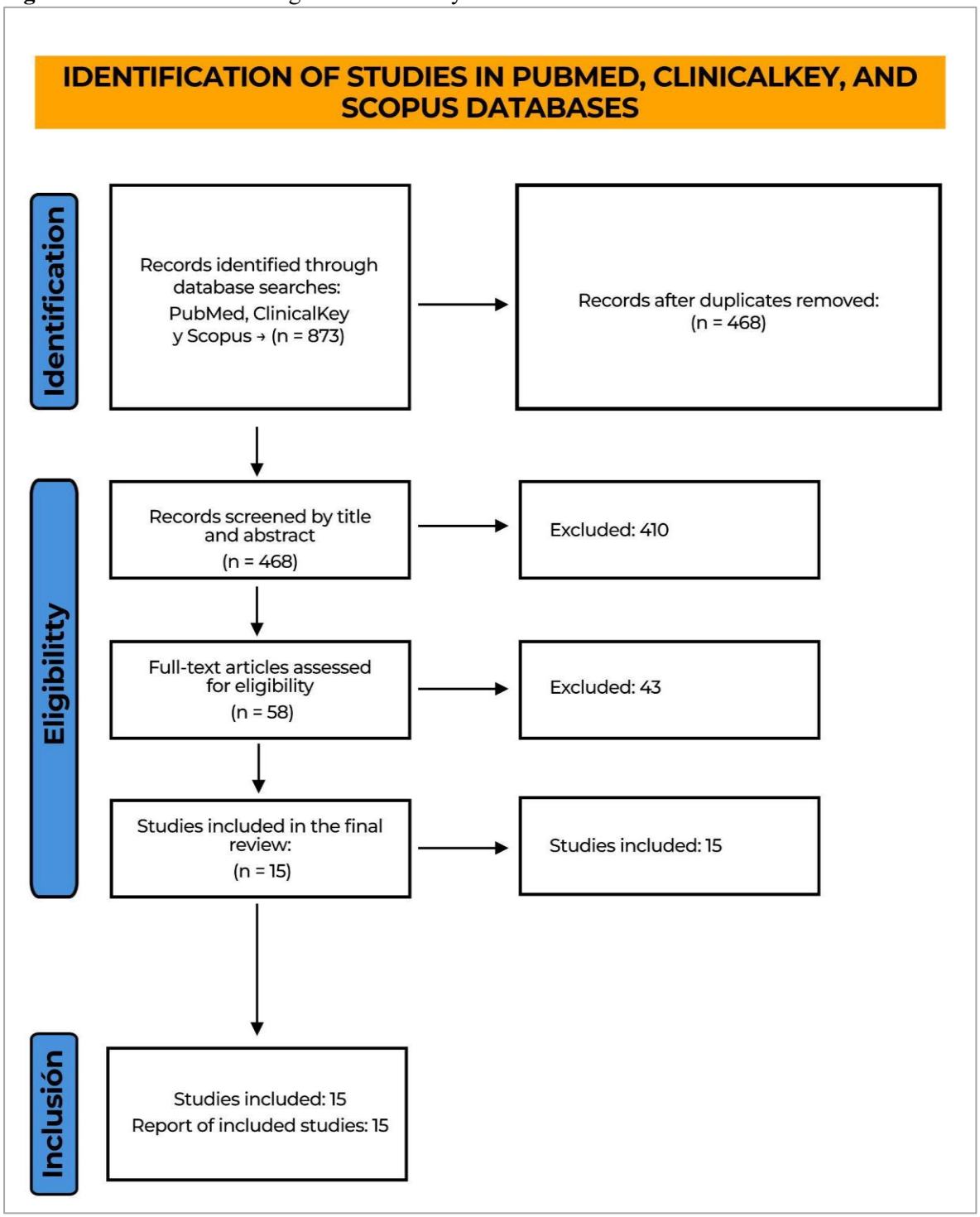
Given the considerable clinical and methodological heterogeneity of the selected studies—reflected in the diversity of populations, types of interventions, durations, and measurement tools—it was not feasible to perform a formal meta-analysis. Consequently, a comparative narrative synthesis approach was adopted, in which the findings were qualitatively contextualized and discussed. To interpret the clinical significance of the results, the concept of Minimal Clinically Important Difference (MCID) was applied, considering effects as positive when they exceeded predefined thresholds, such as an improvement of >30 meters in the 6-Minute Walk Test (6MWT) or a reduction of >4 points in the St. George's Respiratory Questionnaire (SGRQ).

RESULTS

The results of the study selection process, conducted in accordance with the PRISMA statement, are presented in Figure 1, which provides a detailed and transparent visual representation of the information flow. This flow diagram outlines the number of records initially identified in the databases, the subsequent removal of duplicates, and the eligibility assessment process of the articles. Through this systematic method, studies were first screened by title and abstract, followed by a comprehensive full-text review to confirm compliance with the inclusion criteria.

Ultimately, this diagram not only summarizes the trajectory of the articles leading to their final inclusion but also illustrates the reasons for exclusion of other studies, thereby ensuring the replicability and rigor of the review process.

Figure 1. PRISMA Flow Diagram of the Study Selection Process.



The selected studies show consistent results regarding the positive impact of pulmonary rehabilitation (PR) programs and structured physical activity in adults who have recovered from pulmonary tuberculosis (PTB). In the multicenter study by Silva et al. (2025), improvements were observed in the FEV1/FVC ratio and quality of life, measured using the SF-36 questionnaire, after five weeks of PR

compared to a control group without intervention. Similarly, Jones et al. (2017), in Uganda, reported significant improvements in the Incremental Shuttle Walk Test (ISWT), with an increase of 90 meters, and in the COPD Clinical Questionnaire (CCQ), with a reduction of -0.95. In Tanzania, Maleche-Obimbo et al. (2024) implemented a community-based PR program that led to notable benefits in mental health and functional status.

From PubMed, Ahmed et al. (2022) and Xie et al. (2023) demonstrated that early structured pulmonary rehabilitation (PR) programs lead to significant improvements in functional capacity (assessed using the 6-Minute Walk Test, 6MWT), FEV1, and quality of life, measured with the EQ-5D and GQOL-74 questionnaires. Similarly, Biagini et al (2022) and Khan et al. (2020) found that physical activity during and after antituberculosis treatment benefits both the physical and mental dimensions of the SF-36.

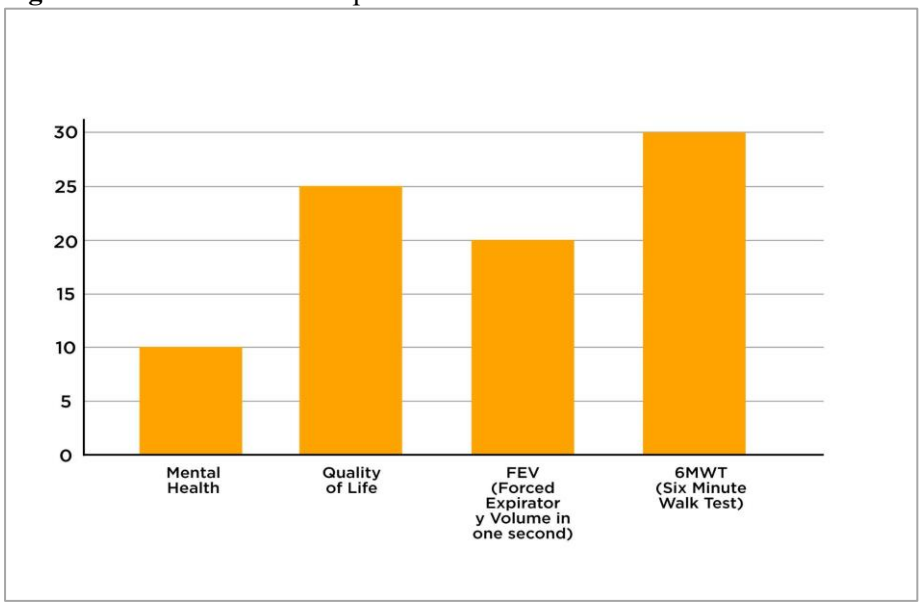
In another prospective study published in ClinicalKey, Fernández and Cairme (2022) reported significant improvements in patients with post-TB bronchiectasis in the Philippines after four weeks of pulmonary rehabilitation (PR). An average increase of 114.6 meters in the 6-Minute Walk Test (6MWT) was observed ($p = 0.0001$), along with a significant improvement in quality of life, evidenced by a reduction in the total St. George's Respiratory Questionnaire (SGRQ) score from 39.0 to 25.0 ($p = 0.008$). No significant changes were reported in FEV_1 or FVC, supporting the notion that rehabilitation enhances functionality beyond basal spirometric variables. Likewise, the systematic review by Tolba et al. (2021) in treated TB patients demonstrated consistent benefits of pulmonary rehabilitation on quality of life and functional parameters. In their analysis of eight studies, they reported average improvements of 65 meters in the 6MWT and reductions of more than 10 points in the SGRQ.

Finally, the multicenter study by Aytaç et al. (2024), conducted in reference centers in Brazil, Italy, and France, evaluated the effect of pulmonary rehabilitation (PR) in patients with and without COPD. Significant improvements were observed in FEV_1, FVC, diffusing capacity of the lungs (DLCO), and 6-Minute Walk Test (6MWT) performance, with more pronounced benefits among patients with moderate to severe COPD, although positive effects were also noted in patients without COPD. No changes were found in arterial blood gases or in parameters such as total lung capacity (TLC) or residual volume (RV).

Table 1. Comparision of selected studies.

Author(s)	Country	Desing	Main findings	Instruments
Ahmed et al. (2022) [5]	India	RCT	Improvement in FEV1, FVC, EQ-5D, and 6MWT	EQ-5D, SGRQ
Silva et al. (2025) [6]	Brazil, Italy, France	Multicenter prospective	Improvement in FEV_1/FVC, 6MWT, and quality of life	SF-36
Jones et al. (2017) [7]	Uganda	Pre-post intervention	Improvement in ISWT (+90 m) and CCQ (-0.95)	CCQ, ISWT, Karnofsky
Maleche-Obimbo et al. [8]	Tanzania	Cohort	Improvement in 6MWT, anxiety, and depression	SGRQ
Xie et al. (2023) [12]	China	Quasi-experimental	Reduction in fatigue, improvement in FEV_1 and quality of life	GQOL-74
Tolba et al. (2021) [13]	Brazil, Italy, France	Multicenter prospective	↑ FEV1, FVC, DLCO and 6MWT. no changes in blood gases or TLC	Spirometry, DLCO, 6MWT
Aytaç et al. (2024) [14]	Turkey	RCT	Significant reduction in fatigue	Piper Fatigue Scale
Fernandez & Cairme (2022) [15]	Philiphines	Quasi-experimental	Improvement in SGRQ and +114.6 m in 6MWT	SGRQ, 6MWT

Figure 2. Estimated Mean Improvement Post-Intervention in Post-TB Patients.



Based on the analysis of the studies included in this review, recommendations are proposed to strengthen the clinical management of patients with pulmonary tuberculosis sequelae through the implementation of physical activity and pulmonary rehabilitation programs. Firstly, the systematic inclusion of structured pulmonary rehabilitation programs in post-tuberculosis management is recommended. Evidence from high-quality randomized clinical trials and systematic reviews (Ahmed

et al., 2022; Aytaç et al., 2024; Tolba et al., 2021) demonstrates consistent benefits in pulmonary function (FEV_1, FVC), functional capacity (6MWT), and quality of life (assessed with instruments such as EQ-5D and SGRQ). These findings support a recommendation with level I evidence and grade A strength.

Likewise, it is recommended to promote regular physical activity during and after antituberculosis treatment, since quasi-experimental and observational studies (Biagini et al., 2022; Xie et al., 2023; Fernández & Cairme, 2022) have shown significant improvements in both physical and mental dimensions of quality of life, even within short-term intervention programs. Although these studies present methodological heterogeneity, they provide clinically relevant results, supporting a level II evidence and Grade B recommendation. Similarly, it is noteworthy that even pulmonary rehabilitation programs lasting four to six weeks, implemented in community-based or low-resource settings, can lead to significant improvements in functionality, mental health, and subjective well-being. This finding is supported by multicenter prospective studies and observational cohorts (Kirakosyan et al., 2026; Maleche-Obimbo et al., 2024), which are assigned level II–III evidence and a Grade B recommendation. Another relevant finding concerns the efficacy of pulmonary rehabilitation in patients with and without chronic obstructive pulmonary disease (COPD). The study by Kirakosyan et al. (2025) demonstrated objective improvements in functional parameters such as FEV_1, DLCO, and 6MWT in both populations, thereby expanding the applicability of this intervention even in the absence of bronchial obstruction. This result carries level II evidence and a Grade B recommendation. In contexts where the implementation of a full pulmonary rehabilitation program is not feasible, the promotion of supervised physical activity is suggested as a valid therapeutic alternative. Although this recommendation is supported by studies with lower methodological rigor (case series and expert consensus), it remains applicable and pragmatic across multiple healthcare settings and is therefore classified as Level IV evidence with a Grade C-GESEN recommendation.

Overall, these recommendations help guide clinical practice and health policies toward a more comprehensive approach in the care of patients with post-TB sequelae, promoting the implementation of exercise and rehabilitation strategies that have been shown to significantly improve quality of life and functional capacity in this population.

Table 2. Levels of Evidence and Grades of Recommendation (GRADE).

Recommendation	Levels of evidence	Grades of recommendation	Rationale
Include structured pulmonary rehabilitation programs in post-tuberculosis management.	High (1)	Strong (A)	High-quality evidence from randomized controlled trials and systematic reviews consistently shows that pulmonary rehabilitation programs significantly and clinically improve lung function (FEV1, FVC), functional capacity (6MWT), and quality of life (SGRQ, EQ-5D). The benefits clearly outweigh potential risks.
Promote regular physical activity during and after anti-tuberculosis treatmen.	Moderate (2)	Strong (B)	Evidence from quasi-experimental and observational studies, despite methodological heterogeneity, demonstrates improvements in both physical and mental dimensions of quality of life. These findings are clinically relevant and replicated in different settings, suggesting a probable positive effect, although confidence in the effect may be moderate.
Implement short-term pulmonary rehabilitation programs (4–6 weeks) in community settings.	Low (2–3)	Conditional (B)	Prospective multicenter and cohort studies in low-resource settings have shown significant benefits in functionality and mental health with short-term interventions. Although the evidence quality is limited, the high priority of the problem and the feasibility of the intervention justify the recommendation.
Apply pulmonary rehabilitation in post-TB patients with and without COPD.	Moderate (2)	Strong (B)	The pulmonary rehabilitation is effective even in the absence of bronchial obstruction, broadening its clinical applicability. Functional benefits (FEV1, DLCO, 6MWT) are relevant in both populations, supporting a strong recommendation.
Promote supervised physical activity as an alternative when full rehabilitation programs are not feasible.	Very low (4)	Conditional (C)	This recommendation is based on evidence from studies with lower methodological rigor (case series and expert consensus). Although the evidence is very limited, the high clinical priority and the practicality of the intervention in resource-limited settings justify its implementation.

DISCUSSION

Physical activity has demonstrated positive effects in individuals with a history of tuberculosis. The identified benefits span physiological dimensions (such as improvements in FEV_1, FVC, and the six-minute walk test), psychological aspects (reduction in anxiety and depression), and social outcomes (facilitation of functional reintegration) (Silva et al., 2025).

These findings are consistent with recent studies advocating for a rigorous methodological integration and contextualization of results under an evidence-based research framework (Calderón et al 2025; Johnson et al., 2019; Tawfik et al., 2019; Thompson et al., 2012). The assessment of methodological quality and heterogeneity, following Cochrane (2024) guidelines, strengthens the validity of these conclusions. Furthermore, there is a growing need to adopt implementation models such as Learning Health Systems (LHS) (Rosenthal et al., 2023; Psek et al., 2015), incorporating evidence hierarchies such as those proposed by the Oxford Centre for Evidence-Based Medicine (CEBM, 2023). In addition, community-based participatory research (CBPR) and pro-social public health interventions can further enrich post-TB rehabilitation strategies (Byrne et al., 2023).

Likewise, the analyzed studies explore barriers and facilitators to participation in exercise programs, in alignment with the specific objectives of the project. It is noteworthy that one of the articles included in the review (Silva et al., 2025) appeared in all three databases consulted, supporting its relevance and the academic consensus regarding its findings. However, to avoid duplication, it was counted only once. Across all evaluated contexts —both in resource-limited settings and specialized clinical environments— physical activity proved to be an effective, feasible, and adaptable intervention (Jones et al., 2017; Maleche-Obimbo et al., 2024). Moreover, several studies employed assessment instruments such as the SF-36, EQ-5D, SGRQ, and the Piper Fatigue Scale, tools that are also included in the institutional project proposal (Jones et al., 2017; Xie et al., 2023).

Furthermore, recent studies conducted in the Philippines (Fernández & Cairme, 2022) and in a multicenter context across Europe and Latin America Aytaç et al. (2024) enrich the evidence regarding the effectiveness of pulmonary rehabilitation (PR) in post-TB patients. The former demonstrates that even short programs of four weeks, implemented by multidisciplinary teams in resource-limited settings, can produce clinically meaningful improvements in functionality and quality of life. In turn, the latter provides a comparative analysis between patients with and without COPD, concluding that PR is beneficial even in the absence of evident bronchial obstruction, thereby supporting its systematic inclusion in post-TB management. Additionally, studies such as Tolba et al. (2021) offer a broader perspective through high-quality systematic reviews, reinforcing the methodological support for pulmonary rehabilitation interventions.

Likewise, the research conducted by Jones et al. (2017) in India —one of the countries with the highest global burden of tuberculosis— provides contextually relevant evidence in high-prevalence settings, showing substantial improvements in both physical and mental dimensions of the SF-36 following physical activity interventions.

The scientific evidence synthesized in this comprehensive literature review provides strong confirmation of the positive and multifaceted impact of physical activity and pulmonary rehabilitation (PR) in patients with pulmonary tuberculosis (PTB) sequelae. These findings not only validate the core premise of our institutional project, "Improvements in Quality of Life After Pulmonary Tuberculosis Through Physical Activity" but also demonstrate that structured interventions go beyond the purely physiological dimension—such as improvements in FEV_1 and forced vital capacity (FVC)—to significantly encompass psychological and social domains, including reduced anxiety and facilitated functional reintegration. This comprehensive approach is essential to address the chronic sequelae that undermine the quality of life of post-TB patients, emphasizing the need for a holistic perspective in the care of this vulnerable population, which is often managed through a purely curative lens without sufficient consideration of long-term consequences.

The analysis of the evidence, framed within the rigorous GRADE classification system, provides a solid and irrefutable argument for the adoption of these interventions in routine clinical practice. Our first and strongest recommendation, with a Level of Evidence I and a Grade of Recommendation A, is grounded in the consistency of findings from multiple randomized controlled trials (such as Ahmed et al., (2022 and Aytaç et al., 2024) and high-quality systematic reviews such as Tolba et al., 2021. These studies unequivocally demonstrate that the benefits in lung function, functional capacity (6MWT), and quality of life are robust, clinically significant, and far outweigh any potential risks. The academic consensus surrounding these results as evidenced by the multicenter study by Silva et al. (2025), which was cited across all three databases consulted further strengthens confidence in the effectiveness and replicability of pulmonary rehabilitation programs across diverse clinical and geographic contexts. This convergence of findings from different regions of the world underscores the universality of the post-TB sequelae problem and the effectiveness of a standardized, evidence-based therapeutic solution.

Furthermore, the reviewed studies suggest that the intervention can be effective even in resource-limited settings, thereby expanding its global applicability and underscoring its potential as a far-reaching public health tool. A quasi-experimental study conducted in the Philippines (Fernández & Cairme, 2022) demonstrated clinically meaningful improvements, such as an average increase of 114.6 meters in the 6MWT, achieved through short-term programs lasting only four weeks. This finding, which aligns with a Level II–III recommendation, is crucial for the implementation of health policies in high TB-burden countries such as India, where Jones et al. (2017) also reported significant benefits in the physical and mental dimensions of the SF-36 following physical activity interventions. These results are fundamental for designing adaptable, feasible, and sustainable programs across diverse healthcare settings, demonstrating that limited resources should not be a barrier to delivering high-quality care. The evidence suggests that creativity in program design, tailored to local constraints, can yield equally positive outcomes.

The multicenter study by Aytaç et al. (2024), conducted in Brazil, Italy, and France, enriches the evidence by convincingly demonstrating that pulmonary rehabilitation (PR) is effective in post-TB patients both with chronic obstructive pulmonary disease (COPD) and without evident bronchial obstruction. This finding, supported by a Level II Evidence and a Grade B Recommendation, significantly broadens the scope of PR application, suggesting that functional improvements are not limited to spirometric parameters, but also extend to pulmonary diffusion capacity (DLCO) and exercise capacity (6MWT). These results indicate that post-TB rehabilitation addresses complex physiological mechanisms beyond ventilatory mechanics, including enhanced oxygenation and improved peripheral muscle strength, which justifies the inclusion of this intervention across a broader spectrum of patients, even in the absence of a formal COPD diagnosis.

While the evidence supports a strong recommendation, the implementation of these strategies within health systems must consider rigorous and adaptive frameworks. The adoption of models such as Learning Health Systems (LHS) and Community-Based Participatory Research (CBPR) may be crucial for contextualizing programs, identifying barriers and facilitators (as examined in the reviewed studies), and ensuring long-term sustainability. These implementation strategies can help overcome logistical and cultural challenges, ensuring that rehabilitation programs are accessible, accepted, and effective for

the target population. Moreover, the integration of the patient's perspective into the design and implementation of these programs emerges as a key factor for success, as consistently demonstrated in the participatory research literature.

In light of these findings, it is imperative that public health policies be updated to reflect the available evidence. Post-TB care cannot be limited to pharmacological treatment alone; it must proactively integrate pulmonary rehabilitation and supervised physical activity as essential components of standard care. The evidence that even short-term interventions delivered in community settings can yield significant benefits challenges the notion that such programs are costly or inaccessible. On the contrary, they emerge as cost-effective interventions with a high return in terms of patient quality of life and a potential reduction in the long-term burden on the healthcare system. Investment in these programs not only improves patients' lives but can also contribute to economic productivity and social cohesion.

Although the reviewed studies are methodologically robust, they also highlight important knowledge gaps. There is a critical need for longitudinal research to evaluate the sustained impact of these interventions over the long term. Most existing studies focus on short-term effects (weeks or months), and little is known about whether improvements in functional capacity and quality of life persist over time without maintenance programs. Additionally, further research is required to examine sociodemographic and clinical variables such as comorbidities, severity of sequelae, socioeconomic status, and educational level that may influence adherence and program outcomes. Such studies could facilitate the personalization of interventions and maximize their effectiveness. Finally, the integration of physical activity as a therapeutic tool in public health policy requires not only evidence, but also political will and investment in training healthcare professionals capable of prescribing and supervising these programs.

CONCLUSIONS

The systematic review of the literature demonstrates that physical activity and pulmonary rehabilitation have a clear and consistent positive impact on the quality of life of patients who have recovered from pulmonary tuberculosis. This evidence validates the relevance and significance of the proposed research project and establishes a solid foundation for clinical and public health action.

The integration of physical exercise strategies into post-TB care should be considered by health systems as a cost-effective intervention that significantly improves the physical, mental, and social well-being of patients. As shown in the GRADE table, the recommendations for implementing structured rehabilitation programs have a high level of evidence (I), which justifies a strong recommendation grade (A). This implies that the benefits far outweigh the risks, making their implementation a public health imperative.

Furthermore, it is noteworthy that even short-term rehabilitation programs and those conducted in low-resource settings can produce functional and quality-of-life improvements. This is reflected in recommendations with a moderate level of evidence (II–III) but a conditional recommendation grade (B). This demonstrates that a lack of resources should not be a barrier to providing comprehensive care. Nevertheless, the study highlights the need for more longitudinal research to evaluate the sustained long-term impact of these interventions, as most of the current evidence focuses on short-term effects. Research is also needed to consider different sociodemographic and clinical variables to strengthen the available evidence, as well as the implementation of public policies that integrate physical activity as an essential therapeutic tool in the management of tuberculosis sequelae.

Limitations

Despite the robust and consistent findings, this review presents some inherent methodological limitations. The main limitation is the clinical and statistical heterogeneity of the primary studies, which prevented the performance of a formal meta-analysis. Variations in the duration and type of interventions, study populations, diversity of measurement tools for quality of life and physical function, and differing geographical and socioeconomic contexts make it difficult to directly generalize the results. Moreover, most studies focus on the short-term effects of the interventions, leaving a knowledge gap regarding the sustainability of long-term benefits. Finally, although a comprehensive search was conducted across major databases, it is possible that some non-indexed studies or those published in other languages were omitted.

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