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Review Article

The Role of Yoga Therapy in Tuberculosis Recovery and Management: A Review

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ABSTRACT

Tuberculosis (TB) remains a global health burden, with prolonged treatment causing physical and psychological strain. Complementary therapies, such as yoga, may enhance recovery and management of tuberculosis; however, a synthesis of evidence is lacking. This review was conducted on clinical trials retrieved from PubMed, Scopus, and the Cochrane Library (2000–2024) using the following keywords: "yoga," "tuberculosis," "pulmonary rehabilitation," and "mind-body therapy." Clinical trials, observational studies, and mechanistic reports were included in the analysis. Yoga improves lung function, reduces stress and oxidative stress, and alleviates anxiety/ depression. Trials show adjunctive yoga accelerates sputum conversion and improves quality of life. Yoga therapy is a promising adjunct for TB recovery and management, but larger RCTs are needed to standardize protocols.

Keywords: Yoga therapy, Tuberculosis, Pulmonary rehabilitation, Immune modulation, Mind-body medicine

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INTRODUCTION

Tuberculosis (TB) remains one of the deadliest infectious diseases worldwide, with an estimated 10 million new cases and 1.3 million deaths annually, primarily in low- and middle-income countries.[1] The disease disproportionately affects vulnerable populations, where malnutrition, overcrowding, and limited healthcare access exacerbate its impact. While standard anti-TB therapy (ATT) is effective, its prolonged duration (6-9 months) and associated side effects-such as hepatotoxicity, fatigue, and gastrointestinal distress-often lead to poor adherence and treatment failure.[2] Moreover, TB extends beyond its microbiological pathology, inflicting significant psychological harm. Depression and anxiety affect 40-70% of TB patients, compounded by social stigma, isolation, and the financial burden of treatment.[3] These mental health challenges further weaken immune function, creating a vicious cycle that impedes recovery. Even after a successful microbiological cure, many patients experience persistent respiratory impairment, reduced exercise tolerance, and a diminished quality of life. TB continues to be a significant public health concern globally, particularly in low- and middle-income countries. While pharmacological treatment remains the cornerstone of TB management, the disease exerts a multidimensional burden that includes physical debilitation, respiratory dysfunction, and mental health challenges such as anxiety, depression, and fatigue. The chronic nature of TB and its social stigma can reduce adherence to medication and hinder recovery. The rise of multidrug-resistant-TB (MDR-TB) further complicates management, necessitating longer, more toxic regimens with lower success rates.[3-5]

Yoga, an ancient mind-body practice originating in India, has gained global recognition as a complementary therapy for various chronic conditions. Combining physical postures (*asanas*), controlled breathing techniques (*pranayama*), and meditation (*dhyana*), yoga promotes holistic well-being by enhancing physiological and psychological resilience.[6] Research demonstrates its efficacy in improving respiratory function, as evidenced by increased lung capacity and oxygenation in patients with Chronic Obstructive Pulmonary Disease (COPD) and asthma.[7,8] Beyond physical benefits, yoga modulates stress responses by reducing cortisol levels and regulating the Hypothalamic-Pituitary-Adrenal (HPA) axis, thereby alleviating anxiety and depression.[9] Additionally, its immunomodulatory effects, such as enhanced Natural Killer (NK) cell activity and reduced pro-inflammatory cytokines, suggest therapeutic potential for infectious diseases.[10] Given these multifaceted benefits, yoga presents a promising adjunctive intervention for TB, a disease that demands not only antimicrobial treatment but also holistic support for optimal recovery.

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Given these challenges, there is an urgent need for integrative therapies that address both the physical and psychological sequelae of TB. Yoga, with its dual focus on respiratory rehabilitation and mental well-being, offers a viable solution. Preliminary studies suggest that yoga can improve pulmonary function, accelerate sputum clearance, and alleviate treatment-related stress in TB patients.[11,12] For instance, a randomized controlled trial demonstrated that TB patients practicing *pranayama* and *asanas* alongside ATT showed a 12% improvement in forced expiratory volume (FEV1) and faster sputum clearance compared to the control group.[11] Similarly, an eight-week yoga intervention significantly reduced anxiety and depression while improving quality of life in TB patients.[12] Despite these promising findings, research on yoga as an adjunct to TB treatment remains limited, with studies often constrained by small sample sizes, heterogeneous methodologies, and a lack of mechanistic insights.[13]

A randomized trial of 48 pulmonary TB patients showed that yoga adjunct to ATT significantly improved lung function (forced vital capacity [FVC], FEV1), weight gain, sputum conversion, and chest X-ray findings compared to breath awareness.[11] A case study of a TB patient demonstrated that yogic breathing techniques (YBT) alongside ATT improved weight, body mass index (BMI), pulmonary function, and quality of life, with sputum conversion to negative.[14] A randomized study of 44 TB patients found that yoga (*pranayama* and *asanas*) significantly improved lung function (FVC, FEV1, peak expiratory flow rate [PEFR]) and well-being scores compared to controls.[15] A quasi-experimental study of 74 TB patients showed that Yoga Breathing Exercises (YBE) and Effective Coughing (EC) reduced breathlessness, with YBE having a slightly greater effect.[16] A randomized controlled trial of 72 TB patients found that integrated yoga improved physical, psychological, and social quality of life domains.[12] An ongoing hospital-based RCT aims to evaluate yoga's impact on TB incidence among people living with HIV (PLHIV), with outcomes including CD4 count and ART adherence.[13] A pilot RCT of 43 chronic obstructive pulmonary disease (COPD) patients showed that *pranayama* improved 6-min walk distance (6MWD) and inspiratory capacity.[7] An RCT of 81 coal miners with COPD demonstrated that Integrated Approach of Yoga Therapy (IAYT) reduced dyspnea, fatigue, and pulse rate while improving peripheral oxygen saturation (SpO2) and 6MWD.[17] A meta-analysis of 11 RCTs (586 COPD patients) found that yoga improved exercise capacity (6MWT), lung function (FEV1 predicted), and quality of life (COPD Assessment Test [CAT] score).[9] A meta-analysis of 10 studies confirmed yoga's benefits for COPD patients, including improved 6MWD, dyspnea scores, FEV1, and quality of life.[18] An RCT of 150 COPD patients found that tele-yoga was as effective as tele-pulmonary rehabilitation in improving 6MWD, symptom scores, and mental health.[19] A study of lung cancer patients showed that preoperative yoga breathing improved short-term lung function.[2]

An RCT of 60 asthma patients found that a 30-min daily yoga routine improved pulmonary function, anxiety, depression, and quality of life.[8]

Reviews emphasized yoga's role in enhancing immunity, reducing stress, and improving respiratory health, particularly during the COVID-19 pandemic.[20] Explored the syndemic relationship between TB and mental health, advocating for integrated interventions like yoga. Highlighted the synergistic benefits of combining yoga with conventional TB therapy, including reduced side effects and improved holistic healing.[21] A narrative review found yoga reduced anxiety and depression in TB patients but called for more RCTs.[12]

Proposed integrating yoga into Pulmonary Rehabilitation (PR) for COPD to improve accessibility and outcomes.[22] A meta-analysis of 39 RCTs found that PR (including yoga) improved exercise capacity, quality of life, and dyspnea in COPD patients.[23] A pilot study showed laughter yoga improved psychological quality of life in COPD patients. Yoga therapy demonstrates significant potential as an adjunct to conventional TB treatment.[24]

This narrative review aims to synthesize existing evidence on the role of yoga in TB recovery, with three primary objectives: (1) to evaluate the impact of yoga on respiratory outcomes, including lung function and sputum conversion rates; (2) to assess its psychological benefits, particularly in reducing apprehension, depression, and improving quality of life; and (3) to explore potential mechanisms, such as immune modulation and stress reduction, underlying these clinical effects. By consolidating current knowledge, this review seeks to inform clinicians, researchers, and policymakers about the therapeutic potential of yoga in TB care and to guide the development of standardized, evidence-based protocols for integration into global TB management programs. Ultimately, this work highlights the importance of holistic approaches in combating TB; a disease that requires interventions for both the body and the mind. This review explores the multifaceted impact of TB and evaluates how yoga therapy can assist in physical and psychological recovery.

LITERATURE SEARCH

The literature search was conducted to identify relevant studies evaluating the effects of yoga as an adjunct therapy in the rehabilitation and management of tuberculosis. The electronic databases searched included PubMed, Scopus, and the Cochrane Library, chosen for their wide indexing of biomedical, clinical, and complementary medicine research. The search was conducted using a combination of controlled vocabulary and free-text terms, with the Boolean operators: ("yoga" OR "pranayama") AND ("tuberculosis" OR "TB") AND ("rehabilitation" OR "adjunct therapy"). This strategy was designed to capture both traditional and modern research perspectives addressing the role of yogic interventions in tuberculosis care.

The inclusion criteria encompassed clinical trials, cohort studies, and mechanistic studies published between January 2000 and June 2024. Eligible studies were those published in English and reporting the therapeutic or rehabilitative effects of yoga or pranayama on individuals diagnosed with tuberculosis. These effects could include improvements in pulmonary function, symptom relief, immune modulation, psychological outcomes, or overall quality of life. Studies involving multi-arm interventions were included only if one group received yoga or pranayama as a defined component of the treatment protocol.

Exclusion criteria were applied to ensure methodological rigor. Studies that were non-English, as well as case reports, editorials, commentaries, and conference abstracts without full text, were excluded. Articles that did not specifically investigate TB or did not incorporate *yoga* or *pranayama* as part of the intervention were also excluded.

The key variables extracted included study design**,** sample size**,** participant characteristics (age, gender, and TB diagnosis details), intervention type (specific yoga or pranayama techniques used), duration and frequency of intervention**,** control group details**,** primary and secondary outcomes, and key findings**.** Key findings are denoted by an increase or decrease sign in the table. The extracted data is presented in Table 1.

The findings from the reviewed literature underscore the multifaceted impact of TB on both physical health and psychological well-being, while also demonstrating the promising role of yoga-based interventions in enhancing recovery outcomes. Some of the Key outcomes are mentioned in Table 1.

IMPACT OF TUBERCULOSIS ON HEALTH

Pulmonary tuberculosis predominantly compromises respiratory function, with clinical manifestations including chronic cough, dyspnea, chest discomfort, and general fatigue. Pathological changes, such as damage to alveolar structures and bronchial inflammation, contribute to restrictive pulmonary patterns and impaired gas exchange, resulting in diminished functional capacity. Even after completion of ATT, residual respiratory symptoms persist in a significant proportion of patients, indicating long-term pulmonary compromise.[3,5]

Moreover, TB exerts a substantial psychological toll. The protracted treatment regimen often lasting six to nine months; combined with drug-related side effects, social stigma, and isolation, frequently leads to elevated levels of emotional distress. Several studies reported high prevalence rates of anxiety and depression among TB patients. Psychological comorbidities such as chronic stress and insomnia were common and, in turn, contributed to poor adherence, weakened immune function, and delayed recovery.[4,5]

EFFICACY OF YOGA THERAPY

Yoga therapy emerged as a promising adjunct to standard TB care, targeting both physiological and psychological domains. Across studies, interventions centered on breath regulation (*pranayama*), postural exercises (*asanas*), and meditative or relaxation techniques.

Improvement in respiratory function: *Pranayama* practices such as *anulom vilom* and *bhramari* were found to enhance vagal tone, stabilize autonomic nervous system activity, and improve subjective symptoms of breathlessness and anxiety. Stimulating practices such as *kapalabhati* and *bhastrika* demonstrated improvements in pulmonary function when applied with clinical discretion during the convalescent phase. Controlled trials reported improvement in forced expiratory volume in one second (FEV1) following these practices.[11] Similarly, chest-opening *asanas* such as *mandukasana, ustrasana, Bhujangasana* and *Setu Bandhasana* contributed to increased lung capacity and enhanced respiratory mechanics of participants.[25]

Improvement in immunity: From an immunological perspective, yoga was associated with favorable shifts in inflammatory markers. Studies noted a reduction in serum IL-6 and TNF-α levels following structured yoga interventions, alongside improved natural killer (NK) cell activity in TB patients suggesting enhanced immune surveillance and potential for faster microbial clearance.[26,27]

Psychological upliftment: Psychologically, yoga has been shown to significantly alleviate stress-related symptoms. A 12-week intervention resulted in a reduction in salivary cortisol levels, indicating a decrease in physiological stress.[28]

Finally, the integration of yoga into TB care yielded tangible clinical benefits. Sputum conversion times were shorter in yoga-practicing groups, with a mean reduction from 21 days to 15 days.[27]

Yoga offers a uniquely holistic modality that aligns well with the multidimensional demands of TB rehabilitation. Yoga improves respiratory/immune metrics, as well as mental health, in individuals with TB. The included studies demonstrated that *pranayama* (yogic breathing techniques) significantly improved pulmonary function markers such as FEV1 and oxygen saturation, potentially through enhanced ventilatory mechanics and reduced airway resistance. These physiological improvements are complemented by psychophysiological effects such as improved autonomic regulation and stress reduction. Notably, *pranayama* practices such as *kapalbhati*, a*nulom vilom* and *bhramari* were particularly effective in balancing sympathetic and parasympathetic activity, which is crucial in maintaining homeostasis during chronic infections.

Furthermore, postural *asanas* such as *bhujangasana* and *tadasana* contributed to improved chest wall mobility, better

Table 1: Literature Review Table: Yoga Therapy in Tuberculosis and Respiratory Conditions.

First Author (Year)	Population (Intervention vs. Control)	Intervention Group Practice (Duration)	Control Group Practice (Duration)	Parameters Studied	Results
Visweswaraiah & Telles (2004)[11]	48 PTB patients (Yoga vs. Breath Awareness)	Yoga + ATT (2 months)	Breath Awareness + ATT (2 months)	Symptoms, weight, FVC, FEV1, sputum conversion, CXR	Yoga group: ↑Weight, ↑FVC/FEV1, faster sputum conversion, better CXR clearance
Srinivas *et al.* (2023)[12]	72 PTB patients (Yoga vs. Control)	Yoga + ATT (8 weeks)	ATT only (8 weeks)	Quality of Life (QoL) domains	Yoga group: ↑Physical, psychological, and social QoL
Chauhan *et al.* (2023)[13]	1800 PLHIV (Yoga vs. Usual Care)	Yoga + ART (3 years)	Usual Care (3 years)	TB incidence, CD4 count, ART adherence	Preliminary data pending
Singh *et al.* (2019)[15]	44 PTB patients (Yoga vs. Control)	Pranayama + Asanas (8 weeks)	Standard care (8 weeks)	FVC, FEV1, PEFR, well-being scores	Yoga group: ↑FVC, ↑FEV1, ↑PEFR, better well-being
Dadang *et al.* (2021)[16]	74 PTB patients (Yoga Breathing vs. Effective Coughing)	Yoga Breathing Exercises (YBE)	Effective Coughing (EC)	Breathlessness reduction	YBE: Mean reduction 2.84; EC: 2.30 (both significant, YBE slightly better)
Mooventhan *et al.* (2013)[14]	1 PTB patient (Case Study)	Yogic Breathing Techniques (YBT) + ATT (8 weeks, 3x/week)	N/A	Weight, BMI, sputum conversion, QoL	↑Weight, ↑BMI, sputum negative, ↑QoL
Ranjita *et al.* (2016)[17]	81 COPD patients (Yoga vs. Control)	IAYT (90 mins/day, 6x/week for 12 weeks)	Standard care (12 weeks)	Dyspnea, fatigue, SpO_2, 6MWD	Yoga group: ↓Dyspnea, ↓fatigue, ↑SpO_2, ↑6MWT
Kaminsky *et al.* (2017)[7]	43 COPD patients (Pranayama + Education vs. Education alone)	Pranayama + Education (12 weeks)	Education alone (12 weeks)	6MWD, inspiratory capacity	Pranayama group: ↑6MWD ↓air trapping
Dua *et al.* (2023)[19]	150 COPD patients (Tele-Yoga vs. Tele-Pulmonary Rehab)	Tele-Yoga (45 mins/day, 5x/week for 3 months)	Tele-Pulmonary Rehab (same duration)	6MWD, HrQoL, FEV1%	Both groups improved 6MWD and HrQoL (no intergroup difference); FEV unchanged
Cramer *et al.* (2019)[9]	586 COPD patients (Meta-analysis of 11 RCTs)	Yoga (varied protocols)	Standard care/no yoga	6MWT, FEV1 predicted, CAT score	Yoga: ↑6MWT ↑FEV1 ↓CAT score

PTB: Pulmonary tuberculosis; ATT: Anti-tuberculosis therapy; ART: Anti-retrovial therapy; PLHIV: People living with human immunodeficiency virus; CD4: Cluster of differentiation 4; FVC: Forced vital capacity; FEV1: Forced expiratory volume in one second; PEFR: Peak expiratory flow rate; BMI: Body mass index; SPO2: Oxygen saturation; 6MWD: 6-min walk distance; HrQol: Health related quality of life; COPD: Chronic obstructive pulmonary disease, C AT: COPD assessment test; RCT: Randomized controlled trial.

diaphragmatic movement, and posture correction-all of which are vital for optimizing respiratory mechanics. The incorporation of meditative techniques such as *Yoga Nidra* and *Om* chanting addressed the psychological distress observed in TB patients, with demonstrable reductions in anxiety, depression, and insomnia.[28-30]

One of the most clinically relevant findings from the included studies was the observed acceleration in sputum conversion among TB patients practicing yoga, which may reflect improved host immunity and adherence to treatment protocols. Heterogeneity in yoga protocols (session duration, style) limits comparability. Reduced dropout rates in yoga intervention groups suggest improved patient engagement, possibly due to enhanced symptom control and better perceived quality of life. These outcomes resonate with the broader public health goal of reducing TB burden and preventing relapses or drug resistance through comprehensive care strategies.[11,31]

In summary, the reviewed evidence demonstrates that yoga, particularly when used as a structured, supervised adjunct to ATT, can lead to substantial improvements in pulmonary function, psychological resilience, quality of life and treatment adherence. These findings support the incorporation of yoga-based rehabilitation modules in the holistic care of TB patients. Yoga therapy, when used judiciously, aligns well with the recovery goals of TB patients. It addresses the dual burden of respiratory limitation and psychological distress. Moreover, its cost-effectiveness and adaptability make it suitable for low-resource settings. Despite growing evidence, there is a need for well-designed clinical trials to assess its long-term efficacy in TB rehabilitation.

This review synthesizes the growing evidence supporting the integration of yoga therapy as a complementary approach in the management of TB. The findings highlight that TB is not solely a respiratory disease but a bio-psycho-social challenge, marked by lasting pulmonary dysfunction and profound emotional stress. Conventional ATT, while essential, does not adequately address the residual physical limitations or mental health burden experienced by many patients during and after treatment. This highlights the importance of integrative approaches that promote physical recovery while enhancing emotional well-being and overall quality of life.

However, certain limitations in most studies, including relatively small sample sizes, variations in yoga protocols, instructor qualifications, and adherence tracking, could affect reproducibility. There are few large-scale randomized controlled trials available. Most studies lack long-term follow-up. Additionally, more mechanistic studies are needed to elucidate the immune-modulatory pathways by which yoga may influence disease progression or recovery in TB. Future research should also explore long-term outcomes, scalability of interventions, and feasibility in community-based or resource-limited settings. Standardized yoga protocols for TB (45-min daily sessions with emphasis on pranayama), biomarker studies (oxidative stress, microbiome changes).

CONCLUSION

The current body of evidence suggests that yoga implemented as an adjunctive therapy to standard ATT offers considerable physiological and psychological benefits to patients with pulmonary TB. Improvements in lung function, immune modulation, emotional well-being, and treatment adherence underscore yoga's value as a low-cost, accessible, and culturally adaptable rehabilitation tool. As TB continues to pose a major global health challenge, especially in high-burden regions, integrating yoga into national TB control programs could be a transformative step toward holistic and sustainable patient care. Well-designed, large-scale trials are warranted to standardize yoga modules and validate their long-term effectiveness in TB rehabilitation.

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CONFLICT OF INTEREST

Authors declared that they have no conflict of interest.

ABBREVIATIONS

ART: Antiretroviral Therapy; **ATT:** Anti-Tuberculosis Therapy; **BMI:** Body Mass Index; **CAT:** COPD Assessment Test; **CD4:** Cluster of Differentiation 4; **COPD:** Chronic Obstructive Pulmonary Disease; **EC:** Effective Coughing; **FEV1:** Forced Expiratory Volume in One Second; **FVC:** Forced Vital Capacity; **HPA axis:** Hypothalamic-Pituitary-Adrenal Axis; **IAYT:** Integrated Approach of Yoga Therapy; **IL-6:** Interleukin-6; **DR-TB:** Multidrug-Resistant Tuberculosis; **NK cells:** Natural Killer Cells; **PEFR:** Peak Expiratory Flow Rate; **PLHIV:** People Living with Human Immunodeficiency Virus; **PR:** Pulmonary Rehabilitation; **RCT:** Randomized Controlled Trial; **SpO_2:** Peripheral Oxygen Saturation; **TB:** Tuberculosis; **TNF-α:** Tumor Necrosis Factor-alpha; **WHO:** World Health Organization; **YBE:** Yoga Breathing Exercises; **YBT:** Yogic Breathing Techniques; **6MWD:** Six-Minute Walk Distance; **6MWT:** Six-Minute Walk Test.

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