BREATHING TECHNIQUES FOR PULMONARY REHABILITATION

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Abstract
Pulmonary rehabilitation (PR) programs, enriched by interdisciplinary approaches, play a pivotal role in enhancing the well-being of subjects with chronic respiratory conditions. Breathing techniques within these programs emerge as key components. Daily deep breathing exercises (DBE) and meditation practices stand out among these techniques. The role of these breathing techniques in addressing depression and anxiety among the elderly is particularly noteworthy, underscoring their potential as valuable non-pharmacological interventions.

Employing a comprehensive search strategy, our research integrates evidence from diverse databases and delves into the benefits of breathing techniques in elderly populations, including those with multimorbidities. The findings reveal positive outcomes not only in pulmonary function but also in mental health. This underscores the critical role of such techniques in the holistic well-being of the elderly, shedding light on their potential as impactful elements in comprehensive healthcare strategies.

Keywords: pulmonary rehabilitation; respiratory diseases; depression; yoga.


Key Messages for Research and Practice

• Daily deep breathing shows promise in enhancing respiratory health.

• The combination of diaphragmatic breathing and meditation effectively alleviates depression and anxiety, fostering improved sleep quality and overall mental wellness.

• Pulmonary rehabilitation, integrated with diverse breathing techniques, demonstrates potential for holistic well-being among aging populations.
Introduction

Pulmonary rehabilitation (PR) programs, facilitated by interdisciplinary teams, play a pivotal role in enhancing the physical and social well-being of patients with chronic respiratory conditions [1]. PR has demonstrated effectiveness in enhancing capacity for physical activity, muscle strength, and health-related quality of life (HRQoL) across diverse respiratory conditions [2, 3].

Among the various therapeutic approaches incorporated, breathing techniques have evolved into essential elements of these programs [4].

Notably, daily deep breathing exercises (DBE) have emerged as promising strategies for reducing blood pressure and alleviating stress in adults. Renowned for their simplicity, efficiency, and adaptability, these exercises show potential for widespread use, even within workplaces [5].

Understanding the pivotal role of the diaphragm in respiration, diaphragmatic breathing (DB) engages this crucial respiratory muscle through deliberate and methodical inhalation, minimizing chest movement [6]. This technique seamlessly integrates into meditation practices commonly observed in activities such as yoga and traditional martial arts like tai chi [6]. Diaphragmatic breathing, as practiced in Pranayama Yoga and meditation, is recognized for its relaxing and therapeutic effects, effectively reducing stress [7].

Sudarshan Kriya Yoga (SKY), a form of Yogic breathing, stands out for its significant positive impacts on stress management, psychophysiological regulation, and overall organ functioning [8]. SKY’s influence extends to immune function, autonomic nervous system balance, and relief from psychological and stress-related concerns. Its modulation of the hypothalamic-pituitary-adrenal (HPA) axis contributes to remarkable antidepressant effects [8, 9].

Additionally, Ujjayi breathing, known as the «ocean sound» in Yoga, incorporates diaphragmatic breathing, optimizing lung aeration, enhancing oxygenation, generating internal body heat, and regulating blood pressure [10].

In response to contemporary life stresses, a comprehensive psycho-physiological therapy approach has emerged, incorporating stretching and specific breathing exercises like Bhasrika. This holistic approach holds promise for enhancing sexual satisfaction, engaging abdominal muscles, applying targeted pressure to internal organs, optimizing blood oxygen levels, reducing carbon dioxide, ensuring consistent oxygenation, facilitating blood purification, toxin removal, and potentially offering relief from various diseases [11].

Thus, the objective of the study is to thoroughly examine the influence of breathing techniques on respiratory health, stress-related conditions, and overall well-being, offering insights into their interconnected benefits.

Search strategy

We conducted a search across Medline/PubMed, Scopus, and the Directory of Open Access Journals (DOAJ) databases to identify pertinent original articles, case studies, and reviews available until February 2024. The search focused on MeSH terms such as pulmonary diseases, aging, comorbidity, and rehabilitation, with consideration given to MeSH terms when identifying the keywords. Our search strategy adhered to established recommendations as outlined in prior publications [12].

Breathing techniques for elderly subjects with and without lung diseases

The aging process introduces inevitable alterations in respiratory function, necessitating effective interventions to maintain and enhance respiratory health among elderly individuals [13].

Crucially, DB becomes a focal point in the elderly, involving the intentional ascending and descending movement of the diaphragm during abdominal breathing to maintain chest stability and deliberate regulation of respiration [15]. Consistent evidence underscores the significant physical and mental benefits derived from engaging in abdominal breathing exercises among the elderly [15].

Pilot testing reveals that the incorporation of both aerobic training and DB leads to substantial enhancements in various aspects of respiratory function and overall well-being in the aging population [14].

Specifically recommended for chronic obstructive pulmonary disease (COPD), PR effectively addresses progressive incapacity, diminished quality of life, and increased healthcare costs [17].
Early initiation of PR in hospitalized COPD patients results in reduced mortality, shorter hospitalization durations, and sustained improvements in HRQoL and exercise capacity for at least 12 months [18, 19]. DB is commonly employed in the PR of individuals with COPD, demonstrating favorable outcomes such as increased lung volumes, enhanced respiratory motion, elevated peripheral oxygen saturation (SpO2), and a decrease in respiratory rate [20].

Elderly patients, especially those with pulmonary diseases like COPD, exhibit positive outcomes from diaphragmatic breathing. A systematic review focusing on COPD patients indicates the effectiveness of breathing exercises in improving inspiratory muscle strength and the 6-minute walk test [21]. Research findings highlight the notable impact of diaphragmatic respiratory exercises on pulmonary indexes, with statistical significance observed (P=0.001) [22].

Considering the COVID-19 pandemic, PR appears to be safe but requires an individualized, multidisciplinary approach for optimal acute and long-term outcomes [23]. Investigated as a potential referral pathway for COVID-19 survivors, a 6-week PR regimen has demonstrated improvements in respiratory function, HRQoL, and reductions in depressive symptoms among elderly patients, irrespective of COPD status [24].

**Benefits and limitations of breathing techniques for elderly subjects with multimorbidities**

The aging process induces a decline in respiratory muscle function, prompting the exploration of potential interventions to counteract this deterioration in elderly individuals. Moderate-intensity inspiratory muscle training has emerged as a promising strategy, demonstrating its efficacy in strengthening respiratory muscles, diaphragm thickness, and mobility in elderly females. This suggests its consideration to mitigate age-related changes [25].

Insufficient oxygenation during aging may lead to brain lesions and atrophy. Studies indicate a positive correlation between lung function and cognitive performance, particularly starting from middle age. Both aerobic exercise and respiratory training have proven beneficial for enhancing lung function and cognitive abilities [26].

Innovative therapeutic approaches recommend slow breathing exercises for various medical conditions, including epilepsy, where stress serves as a significant trigger for seizures. Biofeedback methods aim to enhance respiratory sinus arrhythmia (RSA) through slow breathing techniques, replicating heightened cardiorespiratory synchronization achieved through 0.1 Hz breathing. Utilizing wearable sensors, patches, and mobile applications, these approaches have shown efficacy across conditions such as asthma and PTSD [27].

In a 12-week yoga program, elderly women experienced significant improvements in pulmonary function. The study, with 36 participants, revealed decreased heart and respiratory rates in the yoga group in comparison with the control one [28].

A randomized controlled trial investigated the effectiveness of Wu-style Tai Chi in preventing and treating hypertension and elevated lipid levels in individuals who are middle-aged and elderly, comparing it to simplified Tai Chi. The Wu-style Tai Chi group demonstrated significant improvement in primary outcomes, surpassing the simplified Tai Chi group. Notably, it exhibited more substantial decreases in systolic blood pressure (SBP) and improved lipids levels, indicating its potential in managing cardiovascular health [29]. A systematic review further emphasized the positive influence of tai chi on blood pressure and lipid levels [30].

A Brazilian randomized controlled trial explored the effects of 16 weeks of mat-based Pilates on health and quality of sleep in older females, showing superior improvements in the Pilates group in comparison with the control one [31].

Investigating deep and slow breathing (DSB) in elderly individuals, potentially classified as dementia patients, revealed positive impacts within a dementia prevention training protocol [32].

For elderly cancer patients, a study demonstrated statistically significant enhancements in HRQoL and physical functioning after the intervention combining progressive muscle relaxation, guided visualization, and deep DB [33], indicating the effectiveness of these techniques in improving well-being.

An additional study assessing the influence of deep breathing on pain levels among emergency department (ED) patients found no significant difference in post-medication pain levels. However, participants undergoing deep breathing education perceived it as beneficial, highlighting its effectiveness in improving patient-doctor rapport and fostering commitment to treatment adherence [34].
Breathing techniques in depression and anxiety in the elderly

Depression and anxiety pose significant challenges to the mental well-being of the elderly, impacting their overall quality of life. In response to this, there has been a rising interest in non-pharmacological interventions, with a particular focus on breathing techniques [35].

Observations reveal that older individuals participating in relaxation interventions experience more substantial reductions in depression and anxiety compared to control groups [36].

DB, which promotes a shift from shallow chest breathing to deeper diaphragmatic breathing, appears to influence physiological markers associated with stress reduction and emotional regulation [37, 38].

Scientific investigations have further unveiled reductions in depression (P < 0.001) and stress levels (P = 0.004) through the practice of meditation and breathing exercises [39].

Participation in silver yoga exercises for six months resulted in notable enhancements in sleep quality, reductions in depression levels, and improvements in overall health status among older adults (all p < 0.05) [40]. Additionally, diaphragmatic breathing, recognized as an accessible and cost-effective stress reduction technique, has demonstrated effectiveness in lowering respiratory rate, enhancing blood flow, and decreasing pulse rate and blood pressure. This method positively impacts vagal activity, providing practical advantages for stress management and influencing both physical and mental well-being [41].

The integration of yoga into the daily routines of older adults has shown substantial benefits, contributing to improved overall physical function, reduced stress/anxiety, and heightened levels of tranquility and well-being [42].

Abdominal breathing, a prominent element in mind-body practices, enhances respiratory function and induces relaxation by stimulating the vagus nerve. Abdominal breathing, a key element in mind-body practices, not only enhances respiratory function but also induces relaxation by stimulating the vagus nerve [43].

Building on this, an in-depth exploration into the effects of Tai Chi (TC) on depression and heart rate variability (HRV) parameters among older individuals has revealed statistically significant positive changes (p < 0.05). These improvements include alterations in depression levels and various HRV parameters. The findings suggest that TC may serve as an effective intervention for alleviating depression in older individuals by regulating the autonomic nervous system or HRV parameters. This contribution adds to the growing body of research endorsing the efficacy of Tai Chi as a mild to moderate mind-body exercise, uniquely tailored for older individuals grappling with depression [44].

Conclusions and perspectives

PR is essential, showing positive outcomes in hospitalization, readmissions, and mortality among aging patients, particularly those with respiratory conditions. The impact of breathing techniques, demonstrated by methods like Bhasrika and Ujjayi in psycho-physiological therapy, holds promise for stress management, enhanced sexual satisfaction, and disease alleviation. Additionally, mind-body practices such as Tai Chi, Pilates, and deep breathing offer significant mental health benefits for the elderly, effectively addressing depression, hypertension, hyperlipidemia, and overall quality of life. These findings emphasize the pivotal role of breathing techniques as integral tools for holistic well-being, urging future research and integration into mainstream healthcare.

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