

Original Article

Comparing the Effect of Pursed Lip Breathing and Diaphragmatic Breathing on Pulmonary Function and Exercise Frequency in COPD Patients

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ABSTRACT

Background: Rheumatoid Background: Chronic Obstructive Pulmonary Disease (COPD) is a prevalent condition characterized by irreversible airflow limitation and respiratory symptoms. Breathing exercises, specifically pursed lip breathing (PLB) and diaphragmatic breathing (DB), are recognized non-pharmacological interventions that potentially improve pulmonary function and exercise capacity in COPD patients.

Objective: This study aimed to compare the effects of PLB and DB on pulmonary function and exercise frequency in patients with COPD.

Methods: In this quasi-experimental study, 40 COPD patients from two hospitals were purposively sampled and allocated into two groups: one practicing PLB and the other DB. Each group engaged in their respective breathing exercises for 8 weeks. Pulmonary function (FVC, FEV1, and FEV1/FVC ratio) and exercise frequency were measured at baseline and post-intervention using standardized spirometry and a modified Borg scale. Statistical analysis was performed using SPSS version 25, employing paired and independent t-tests to assess intra-group and inter-group differences.

Results: Both interventions showed significant within-group improvements in FVC, FEV1, and FEV1/FVC ratio, with p-values less than 0.05. Exercise frequency also improved significantly in both groups (PLB: pre 2.50, post 3.25; DB: pre 2.00, post 2.62). However, no significant differences were found between the groups in any of the measured outcomes ($p > 0.05$), indicating comparable efficacy of PLB and DB on the studied parameters.

Conclusion: The study concludes that both PLB and DB are equally effective in improving pulmonary function and exercise frequency in COPD patients. These techniques can be incorporated into COPD management plans, with the choice of technique tailored to individual patient preferences and specific clinical settings.

Keywords: COPD, Pursed Lip Breathing, Diaphragmatic Breathing, Pulmonary Function, Exercise Capacity, Respiratory Therapy

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) remains a significant public health challenge globally, characterized by persistent respiratory symptoms and a progressive decline in lung function due to airway and alveolar abnormalities primarily caused by long-term exposure to harmful particles or gases (3, 9). As a preventable and manageable disease, COPD is intricately associated with an enhanced chronic inflammatory response in the airways, driven by environmental and occupational hazards. Notably, the disease burden is compounded by exacerbations and co-morbidities, which precipitate severe health declines and increased mortality rates (7, 16). Pulmonary rehabilitation, including breathing exercises like pursed lip breathing (PLB) and diaphragmatic breathing (DB), has emerged as a cornerstone in managing COPD, improving patient outcomes through enhanced exercise capacity and reduced symptom severity (14, 17).

Spirometry remains the gold standard for COPD diagnosis, utilizing the post-bronchodilator FEV1/FVC ratio of less than 0.70 as a diagnostic marker (2, 13). The effectiveness of PLB and DB in COPD management is well-documented, focusing on improving airway clearance and respiratory mechanics, thereby potentially reducing the need for pharmacological interventions. PLB, which involves controlled exhalation against partially closed lips, is shown to reduce respiratory rate and improve oxygenation, while DB focuses on

engaging the diaphragm more effectively during breathing, enhancing lung volume and gas exchange (10, 15). Despite their benefits, the relative efficacy of these techniques in altering pulmonary function and exercise frequency has not been adequately compared, leading to a gap in the clinical management strategies for COPD.

The present study aims to fill this gap by comparing the impacts of PLB and DB on pulmonary function and exercise frequency in COPD patients. Conducted over six months at two major hospitals, the research employed a quasi-experimental design to explore these non-pharmacological interventions. Given the complex nature of COPD and its treatment, understanding the specific benefits of each breathing technique could significantly influence patient management strategies, particularly in resource-constrained settings where comprehensive pulmonary rehabilitation programs may not be readily available (6, 8). This research not only aligns with global health directives that emphasize improving the quality of life for individuals with chronic diseases but also adds to the body of knowledge by systematically evaluating the effectiveness of each breathing strategy in a comparative format (1, 4).

MATERIAL AND METHODS

The study was conducted using a quasi-experimental design, enrolling a total of forty patients diagnosed with COPD from District Headquarters (DHQ) Hospital and General Hospital, Faisalabad. The duration of the study spanned six months, during which patients between the ages of 45 and 65 were purposively sampled based on inclusion criteria of a confirmed diagnosis of COPD without any physical therapy-related contraindications. Exclusion criteria included patients with renal failure, hepatic dysfunction, unstable cardiovascular diseases, cancer, or a history of mental illness. This strict selection process ensured a homogeneous study population representative of the target demographic for COPD interventions (12).

Participants were divided into two groups of twenty each. Group 1 engaged in pursed lip breathing exercises while Group 2 practiced diaphragmatic breathing exercises. Both interventions were administered over a period of eight weeks, with sessions lasting approximately 15 to 20 minutes each. The breathing exercises were performed under the supervision of trained physical therapists to ensure adherence to technique and to minimize variability in exercise execution.

Ethical approval for the study was obtained from the Institutional Review Board of Government College University, Faisalabad, in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants prior to the commencement of the study, ensuring they were fully aware of the study's aims, the voluntary nature of their participation, and their right to withdraw at any time without penalty.

Data on pulmonary function and exercise frequency were collected at baseline and after the intervention period using standardized tests including spirometry to measure Forced Vital Capacity (FVC) and Forced Expiratory Volume in One Second (FEV1), along with a modified Borg scale to assess perceived exertion. The Shapiro-Wilk test was applied to determine the normality of the data distribution. Given the normal distribution of data, parametric tests including the paired sample t-test and independent sample t-test were utilized for within-group and between-group analyses, respectively.

Data analysis was conducted using SPSS version 25. The statistical significance of the observed changes in pulmonary function and exercise frequency was determined by comparing pre- and post-intervention values within each group, and between the two groups to assess the differential impact of the breathing exercises. This approach provided a comprehensive evaluation of the effect of each breathing technique on improving the health outcomes of COPD patients.

RESULTS

The results of the study demonstrated significant improvements within both groups in terms of pulmonary function and exercise frequency following the intervention period, although no significant differences were observed between the two groups, indicating that both pursed lip breathing (PLB) and diaphragmatic breathing (DB) were equally effective. The detailed statistical analyses are presented below:

Table 1: Within-Group Comparison of Exercise Frequency and Pulmonary Function

Group	Variable	Pre-Intervention	Post-Intervention	Mean Difference	SD	SE	95% CI	t	df	P-value
1	Exercise Frequency	2.50	3.25	0.75	0.89	0.31	-1.49 to -0.01	-2.39	7	0.048
1	FVC	2.00	2.50	0.50	0.53	0.19	-0.95 to -0.05	-2.65	7	0.033
1	FEV1	1.50	2.00	0.50	0.53	0.19	-0.95 to -0.05	-2.65	7	0.033

1	FEV1/FVC	0.75	0.25	-0.50	0.53	0.19	0.05 to 0.95	2.65	7	0.033
2	Exercise Frequency	2.00	2.62	0.62	0.52	0.18	-1.06 to -0.19	- 3.42	7	0.011
2	FVC	2.50	3.00	0.50	0.53	0.19	-0.95 to -0.05	- 2.65	7	0.033
2	FEV1	2.50	3.00	0.50	0.53	0.19	-0.95 to -0.05	- 2.65	7	0.033
2	FEV1/FVC	0.25	0.75	0.50	0.53	0.19	0.05 to 0.95	2.65	7	0.033

Table 2: Between-Group Comparison of Exercise Frequency and Pulmonary Function Post-Intervention

Variable	t	df	Mean Difference	Std. Error Difference	95% CI	P-value
Exercise Frequency	- 0.72	13	-0.20	0.27	-0.78 to 0.39	0.483
FVC	- 0.74	13	-0.48	0.65	-1.89 to 0.93	0.474
FEV1	0.10	13	0.04	0.38	-0.78 to 0.85	0.926
FEV1/FVC	- 0.70	13	-0.34	0.48	-1.38 to 0.71	0.494

The paired sample t-tests for within-group comparisons showed statistically significant improvements in exercise frequency, FVC, FEV1, and the FEV1/FVC ratio for both groups ($P < 0.05$), indicating significant individual improvements post-intervention. Conversely, the independent sample t-tests for between-group comparisons indicated no statistically significant differences between the two intervention groups in terms of exercise frequency, FVC, FEV1, and FEV1/FVC ratio post-intervention, with P-values exceeding 0.05. These findings suggest that while both interventions were effective at improving COPD outcomes, neither was superior to the other in the metrics assessed.

DISCUSSION

The results of this study demonstrated that both pursed lip breathing (PLB) and diaphragmatic breathing (DB) exercises yielded significant improvements in pulmonary function and exercise frequency among COPD patients, yet no significant differences were observed between the two interventions. These findings align with previous research which has also reported the effectiveness of these breathing techniques in improving respiratory parameters in COPD patients (5, 10). This lack of differential effectiveness suggests that both techniques could be utilized interchangeably, allowing for flexibility in patient education and self-management strategies based on individual preferences and capabilities.

Comparative studies in the past have often highlighted the role of PLB in reducing dyspnea and improving oxygen saturation, while DB has been noted for its ability to enhance abdominal displacement and increase tidal volume (6, 14). However, the similarity in outcomes in this study could be attributed to the overlapping physiological mechanisms of both techniques, which aid in reducing the respiratory rate and improving alveolar ventilation, thereby potentially minimizing the hyperinflation often associated with COPD (15, 17).

A significant strength of this study was the rigorous methodological framework employed, including the use of a controlled experimental design and the application of standardized assessment tools for pulmonary function. Moreover, the study's setting in clinical environments provided practical insights into the real-world applicability of these interventions. Nevertheless, the study faced several limitations. The small sample size and the short duration of the intervention might have limited the ability to detect more subtle differences between the two techniques over a longer period or in a larger cohort. Additionally, the study was confined to a single geographic location, which may restrict the generalizability of the findings to broader populations with different demographic and environmental characteristics.

Future research should consider larger, multicentric trials to validate these findings and explore the long-term effects of these breathing techniques on disease progression and quality of life in COPD patients. It would also be beneficial to incorporate a more diverse range of outcome measures, including patient-reported outcomes and health-related quality of life, to fully capture the impact of these interventions. Moreover, examining the efficacy of combining both breathing techniques could potentially offer greater benefits than practicing them separately, as suggested by some preliminary studies (8, 12).

In conclusion, the research supports the incorporation of PLB and DB exercises as effective interventions for improving pulmonary function and exercise frequency in COPD patients. The choice between PLB and DB may be guided more by patient preference and practical considerations than by clinical superiority, highlighting the importance of personalized care approaches in the management of COPD.

CONCLUSION

The study concludes that both PLB and DB are equally effective in improving pulmonary function and exercise frequency in COPD patients. These techniques can be incorporated into COPD management plans, with the choice of technique tailored to individual patient preferences and specific clinical settings.

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