

Original Article

Effectiveness of BBT Versus DBT on Physical Performance, Depression, and Health-Related Quality of Life Among Patients With COPD

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ABSTRACT

Background: Chronic Obstructive Pulmonary Disease (COPD) is a prevalent condition characterized by decreased respiratory function and reduced quality of life. Pulmonary rehabilitation techniques, specifically Buteyko Breathing Technique (BBT) and Diaphragmatic Breathing Technique (DBT), have been suggested to improve these aspects in COPD patients. However, comparative efficacy of these techniques remains uncertain.

Objective: This study aimed to compare the effectiveness of BBT and DBT on exercise capacity and quality of life in patients with COPD.

Methods: In a randomized clinical trial (WHO Registry of IRCTs: NCT05947227), 48 COPD patients (aged 40-65 years) were enrolled and randomly assigned to either BBT or DBT groups. Both groups underwent respective breathing technique training as part of pulmonary rehabilitation over a 10-month period at Jinnah Hospital, Lahore. Key measurements included the 6-minute walk test (6MWT) for exercise capacity and the St. George Respiratory Questionnaire (SGRQ) for quality of life assessment. The Modified Borg Dyspnea Scale was used to categorize dyspnea severity. Data were analyzed using SPSS software (Version 25), with parametric and non-parametric tests applied for comparative analysis.

Results: Both groups showed improvement post-intervention, but DBT demonstrated superior outcomes. Quality of life scores improved from an average of 85.33 (SD=1.110) to 76.06 (SD=4.503) in the DBT group, compared to 87.16 (SD=4.55) to 83.10 (SD=5.76) in the BBT group ($p=0.000$). Similarly, 6MWT distances showed significant improvement in the DBT group. The DBT group also exhibited a more considerable enhancement in activity scores and dyspnea reduction compared to the BBT group.

Conclusion: While both BBT and DBT are effective in improving exercise capacity and quality of life in COPD patients, DBT shows a more significant improvement. These findings suggest that DBT could be a more favorable technique in pulmonary rehabilitation for COPD patients.

Keywords: Chronic Obstructive Pulmonary Disease, Buteyko Breathing Technique, Diaphragmatic Breathing Technique, Pulmonary Rehabilitation, Exercise Capacity, Quality of Life.

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) presents as a significant global health concern (1), characterized by irreversible airflow restriction and encompassing emphysema and chronic bronchitis. Emphysema primarily affects the alveoli, leading to damaged air sacs and reduced gas exchange area, thus hindering exhalation. Chronic bronchitis involves inflammation of the bronchi and bronchioles, leading to excessive mucus production and clogged airways. The complexity of COPD, manifesting in

symptoms such as dyspnea, persistent cough, and frequent exacerbations, necessitates a multifaceted approach to treatment. This condition significantly impacts the global population; as reported by the World Health Organization, over 65 million people suffered from moderate to severe COPD in 2005, and it is projected to become the third leading cause of death by 2030 (2, 3).

A critical concern in COPD patients is the dysfunction of respiratory muscles, leading to increased work of breathing and hyperinflation, along with peripheral muscle deconditioning, which further impacts daily activities and exercise capacity (4).

Moreover, COPD patients often experience sarcopenia, characterized by a loss of muscle mass and strength, especially in the skeletal muscles. In addressing these challenges, physiotherapy, particularly through pulmonary rehabilitation programs (PRP), plays a crucial role (5). These interventions, encompassing airway clearance techniques, breathing exercises, and inspiratory muscle training, aim to improve mental and physical well-being, enhance health-related quality of life (HRQOL), and facilitate reduced hospital stays (6). The significance of PRP in enhancing exercise tolerance and HRQOL in COPD patients is underscored by the study conducted by

Vagedes (7). Similarly, Jones et al., 2021 article highlights the benefits of the Buteyko breathing retraining program, formulated by Konstantin Buteyko, in restoring normal breathing patterns and reducing COPD symptoms (7, 8). In contrast, studies by Hamasaki, and Marotta et al. in 2020, have compared the effectiveness of different pulmonary interventions such as Diaphragmatic Breathing (DB) and Buteyko Breathing Technique (BBT) in COPD management (9, 10). These studies have revealed the potential of these techniques in improving pulmonary function and quality of life. Furthermore, Anne E. Holland's 2012 systematic review and Santino 2022 study underscore the effectiveness of breathing exercises, particularly DB, in enhancing exercise capacity and alleviating breathlessness in COPD patients (11, 12).

Despite the extensive research in this domain, there remains a notable gap in the literature regarding the direct comparison of the impact of BBT and DB on the quality of life and exercise capacity in COPD patients. The aim of this research is to bridge this gap by comparing the effects of DB and BBT, thereby providing critical insights into optimizing the care of COPD patients. This endeavor not only contributes to the existing body of knowledge but also aids in the development of more effective, patient-centric treatment strategies for COPD, a disease with a growing global prevalence and significant health impacts.

MATERIAL AND METHODS

In a randomized clinical trial registered with the WHO Registry of IRCTs (NCT05947227), researchers embarked on a study to investigate the effects of different breathing techniques on exercise capacity and quality of life in patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD). This trial, spanning a period of 10 months, was conducted post-approval by the ethical committee of RCS & AHS and was set in the clinical environment of Jinnah Hospital, Lahore.

To establish the required sample size for this study, the G*Power Analysis Software (Version 3.1.9.2) was employed. This analysis considered a statistical power of 0.80, a type I error probability (α) of 0.05, and a confidence interval of 95%. Additionally, a 10% attrition rate was anticipated, leading to the determination of a total sample size of 48 patients. These participants were equally divided into two groups of 24 each. The inclusion criteria specified participants aged between 40 and 65 years, all clinically diagnosed with mild to moderate COPD. A practical sample technique was utilized for the selection process. Exclusion criteria were rigorous, eliminating candidates with restrictive lung disease, risk of pneumothorax, recent cardiac events, intubation, low resting oxygen saturation, recent surgery, exacerbations, unstable conditions, active infections, or specific orthopedic, urogenital, or neurological conditions.

The assignment of patients to either Group A or Group B was executed through the use of sealed, opaque envelopes in a singleblinded manner. Group A was subjected to conventional pulmonary rehabilitation supplemented with Buteyko breathing exercises, whereas Group B received conventional rehabilitation paired with Diaphragmatic breathing exercises. To ensure clarity and comprehension, the participants were briefed about the interventions in a formal session led by a qualified physiotherapist. The primary tools for data collection in this study were the 6-minute walk test (6MWT) and the St. George Respiratory Questionnaire (SGRQ). The 6MWT, a method endorsed by the American Thoracic Society, was utilized to evaluate the functional exercise capacity of the participants, with measurements of arterial saturation and heart rate serving as secondary outcomes. The SGRQ was instrumental in assessing the quality of life, scoring the health state of the participants on a scale ranging from 0, indicating no impairment, to 100, reflecting the worst possible health state. Additionally, the Modified Borg Dyspnea Scale was employed to categorize the severity of dyspnea experienced by the patients.

For the analysis of the collected data, SPSS software (Version 25) was used. The level of statistical significance was predetermined at 0.05. The presentation of descriptive statistics was facilitated through frequency tables and bar charts. The normality of the data distribution was evaluated using the Shapiro-Wilk test. To compare the two population sets over the duration of the study, both

parametric and non-parametric tests were applied. For data that followed a normal distribution, the independent sample t-test was utilized, while the Mann-Whitney test was employed for data that did not exhibit normal distribution. Comparisons within each group were conducted using the paired sample t-test and the Wilcoxon rank test.

RESULTS

The demographic characteristics of the participants in the study were evenly distributed across both Group A and Group B. In both groups, the majority of participants were male (87.5%), and all participants were smokers, reflecting the high prevalence of smoking among COPD patients. The socioeconomic status varied, with a higher percentage of participants from the lower class in Group B (33.3%) compared to Group A (20.8%). All participants in Group A had a history of respiratory illness, whereas in Group B, this was slightly lower at 66.7%.

In terms of baseline characteristics, there were no significant differences between the two groups in age, height, weight, and Body Mass Index (BMI). Group A participants had an average age of 53.63 years with a standard deviation (SD) of 6.730, and Group B participants had an average age of 55.21 years with an SD of 4.26, showing no significant age difference ($p=0.335$). The height of participants in Group A was on average 1.67 meters ($SD=0.115$) and in Group B, it was 1.61 meters ($SD=0.15$), which was not a significant difference ($p=0.121$). The average weight in Group A was 53.63 kg ($SD=7.365$) compared to 50.08 kg in Group B ($SD=7.08$), again showing no significant difference ($p=0.096$). The BMI comparison between the groups also indicated no significant difference, with Group A having an average BMI of 19.45 ($SD=3.245$) and Group B 20.89 ($SD=5.09$), $p=0.246$.

Table 1 Demographics and Characteristics

Demographics	Group A	Group B
Gender		
- Male	21 (87.5%)	21 (87.5%)
- Female	3 (12.5%)	3 (12.5%)
Smoking History		
- Smokers	24 (100%)	24 (100%)
Socioeconomic Status		
- Lower Class	5 (20.8%)	8 (33.3%)
- Middle Class	14 (58.3%)	16 (66.7%)
- Upper Class	5 (20.8%)	Not applicable
History of Respiratory Illness		
- Yes	24 (100%)	16 (66.7%)
- No	Not applicable	8 (33.3%)

Regarding the quality of life (QOL) scores, there was a significant difference noted post-intervention. At baseline, the average QOL score in Group A was 85.33 ($SD=1.110$) compared to 87.16 in Group B ($SD=4.55$), which was not significantly different ($p=0.063$). However, post-intervention, Group A showed a significant improvement, with QOL scores reducing to 76.06 ($SD=4.503$), indicating better quality of life, compared to a lesser improvement in Group B, with scores reducing to 83.10 ($SD=5.76$), $p=0.000$. The symptom score at baseline was similar between the groups, but at post-intervention, Group A showed a more significant improvement with a reduction in symptom scores from 80.47 ($SD=5.933$) to 69.56 ($SD=10.924$), $p=0.009$, compared to Group B. The analysis of the activity scores and the Six-Minute Walk Distance (6MWD) revealed interesting findings. At baseline, the activity scores were similar between both groups, with no significant difference ($p=0.853$). However, post-intervention, Group A showed a more considerable improvement in activity scores compared to Group B, with the Mann-Whitney test indicating a significant difference ($p=0.002$). Similarly, for the 6MWD, there was no significant difference at baseline ($p=0.285$), but post-intervention, Group A showed a significant increase in walk distance compared to Group B, $p=0.000$.

Table 2 Mean Comparison in Group A and B by Ind. Samples t-Test

Variable	Group A Mean (SD)	Group B Mean (SD)	t	Mean Difference	P Value
Participant Age	53.63 (6.730)	55.21 (4.26)	-0.974	-1.583	0.335
Participant Height	1.67 (0.115)	1.61 (0.15)	1.579	0.061	0.121
Participant Weight	53.63 (7.365)	50.08 (7.08)	1.698	3.542	0.096
Participant BMI	19.45 (3.245)	20.89 (5.09)	-1.176	-1.448	0.246
QOL Score at Baseline	85.33 (1.110)	87.16 (4.55)	-1.904	-1.820	0.063
QOL Score at Post Intervention	76.06 (4.503)	83.10 (5.76)	-4.721	-7.042	0.000
Variable	Group A Mean (SD)	Group B Mean (SD)	t	Mean Difference	P Value
Symptom Score at Baseline	80.47 (5.933)	81.91 (12.88)	-0.495	-1.432	0.623
Symptom Score at Post-Intervention	69.56 (10.924)	79.14 (13.16)	-2.744	-9.581	0.009

Table 3 Mann Whitney Based Comparative Difference

Variable	Group A Mean Rank	Group B Mean Rank	Mann-Whitney U	Wilcoxon W	Z	Asymptotic Significance (2-tailed)
Activity Score at Baseline	24.13	24.88	279.0	579.0	-0.18	0.853
Activity Score at Post-Intervention	18.23	30.77	137.5	437.5	-3.10	0.002
Six-Minute Walk Distance at Baseline	26.63	22.38	237.0	537.0	-1.06	0.285
Six-Minute Walk Distance at Post-Intervention	34.77	14.23	41.50	341.5	-5.25	0.000

These results indicate that both Buteyko and Diaphragmatic breathing techniques are effective in improving the quality of life and exercise capacity in patients with COPD. However, Buteyko breathing technique, as represented by Group A, showed a more significant improvement in these parameters.

DISCUSSION

The study conducted aimed to assess the impact of Buteyko breathing technique (BBT) and Diaphragmatic breathing technique (DBT) on the exercise capacity and quality of life in patients with Chronic Obstructive Pulmonary Disease (COPD). The findings of this research contribute significantly to the understanding of pulmonary rehabilitation methods in the management of COPD, revealing that both BBT and DBT substantially enhance exercise capacity and quality of life. However, it was observed that DBT yielded superior outcomes in these domains during COPD rehabilitation.

In contrast to these results, a study by Arora and Subramanian in 2019 posited that BBT was particularly effective for patients with obstructive disorders, noting improvements in breath holding time, six-minute walk distance (6MWD), respiratory rate, and heart rate (13). This divergence from the current study, especially regarding the significant reduction in heart rate and increase in 6MWD observed in the experimental group, suggests variability in the response to BBT across different cohorts. Similarly, Saeed 's (2022) research concluded that both BBT and Pursed Lip Breathing are effective for COPD management, with BBT proving more efficacious (14). This aligns with the current study's findings on dyspnea reduction, underscoring the potential of BBT in improving ADL scale grades.

Marotta et. al. highlighted the effectiveness of DBT in managing COPD, showcasing substantial improvements in respiratory rate, oxygen saturation, and arterial blood gases (9). The comparison between different breathing exercises suggested a preference for DBT, resonating with the current study's findings. Furthermore, Neşe and Bağlama's study in 2022 Anne E. Holland's recent study corroborated these results, emphasizing the positive effects of DBT on health-related quality of life and exercise tolerance (15). On the other hand, Yun's study in 2021 presented a slightly different perspective, observing enhanced diaphragmatic activity and improved functional capacity following a DBT program in COPD patients (16). This finding, while in partial agreement with the present study regarding quality-of-life enhancement, differed in the emphasis on functional capacity improvement, particularly as measured by the 6MWT (17).

The strength of this study lies in its methodological rigor and the comparative analysis of two prevalent breathing techniques in COPD rehabilitation (18). However, limitations are present, including the sample size and the short duration of the intervention. A larger sample and a longer intervention period could provide more comprehensive insights (19). Additionally, the study did not account for potential confounding factors such as environmental variables and patients' adherence to the breathing techniques outside the clinical setting (20).

In terms of recommendations, future research should consider these limitations and possibly include a more diverse patient population to validate the findings across different demographics (21). Studies exploring the long-term effects of these breathing techniques and their impact on various stages of COPD would also be valuable. Moreover, incorporating objective measures like lung function tests could enhance the understanding of the physiological changes accompanying these breathing exercises (22).

While this study indicates the effectiveness of both BBT and DBT in improving quality of life and exercise capacity in COPD patients, it particularly highlights the potential superiority of DBT in these areas. However, the variability in findings across different studies suggests a nuanced approach to COPD management, where individual patient characteristics and preferences might influence the choice and effectiveness of breathing techniques.

CONCLUSION

In conclusion, this study elucidates the efficacy of both Buteyko Breathing Technique (BBT) and Diaphragmatic Breathing Technique (DBT) in enhancing exercise capacity and quality of life in COPD patients, with a slight superiority observed in the outcomes of DBT. These findings have significant implications for clinical practice in pulmonary rehabilitation, suggesting that while both techniques are beneficial, DBT may offer a more pronounced improvement in managing COPD symptoms and improving patients' quality of life. This insight can guide clinicians in tailoring more effective, patient-specific respiratory rehabilitation strategies, potentially leading to better management of COPD and its associated challenges.

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