RESEARCH PAPER

Comparative Effects Of Breathing Control Technique Versus Diaphragmatic Breathing Exercise Combined With Positive Expiratory Pressure In Adults With Bronchial Asthma: A Randomized Comparative Trial

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ABSTRACT

Background: Bronchial asthma is a chronic inflammatory airway disease characterized by airflow limitation, reduced exercise tolerance, and impaired quality of life. Breathing-based physiotherapeutic interventions are commonly used as adjuncts to pharmacological management, yet comparative evidence between specific techniques remains limited.

Objective: To compare the effectiveness of breathing control technique with positive expiratory pressure (PEP) device versus diaphragmatic breathing exercise with PEP device on functional capacity, pulmonary function, and quality of life in adults with bronchial asthma.

Methods: Forty adults with clinically diagnosed moderate bronchial asthma were randomly allocated into two groups: Group A (breathing control technique with PEP device, n=20) and Group B (diaphragmatic breathing exercise with PEP device, n=20). Both groups underwent supervised intervention sessions three times per week for eight weeks. Outcome measures included Six-Minute Walk Test (6MWT), Peak Expiratory Flow Rate (PEFR), and Asthma Quality of Life Questionnaire (AQLQ), assessed pre- and post-intervention. Within-group comparisons were analyzed using paired t-tests, and between-group differences were analyzed using independent samples t-tests at a significance level of $p<0.05$.

Results: Both groups demonstrated statistically significant improvements in 6MWT, PEFR, and AQLQ scores following intervention ($p<0.001$). Group A showed significantly greater post-intervention improvements compared to Group B across all outcome measures ($p<0.05$). The mean difference in 6MWT and PEFR indicated a moderate-to-large effect size favoring breathing control technique with PEP.

Conclusion: Both breathing control and diaphragmatic breathing exercises combined with PEP device are effective adjunct interventions in bronchial asthma rehabilitation. However, breathing control technique with PEP demonstrated superior improvements in functional capacity, pulmonary function, and quality of life. These findings support its preferential inclusion in pulmonary rehabilitation programs for adults with bronchial asthma

Keywords: Bronchial asthma; Breathing control; Diaphragmatic breathing; Positive expiratory pressure; Pulmonary rehabilitation

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INTRODUCTION

Bronchial asthma is a chronic inflammatory disorder of the airways characterized by variable airflow obstruction, airway hyperresponsiveness, and recurrent respiratory symptoms such as wheezing, dyspnea, chest tightness, and cough. Despite advances in pharmacological management, many patients continue to experience functional limitations and reduced quality of life. Non-pharmacological strategies, particularly physiotherapeutic breathing interventions, have gained increasing attention as adjuncts to standard medical therapy.

Breathing retraining techniques aim to optimize ventilatory mechanics, reduce accessory muscle overactivity, improve diaphragmatic efficiency, and enhance ventilation distribution. Diaphragmatic breathing exercise has been shown to improve respiratory muscle function and reduce dyspnea, while breathing control techniques emphasize relaxation, controlled tidal breathing, and reduction of hyperventilation. The addition of positive expiratory

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pressure (PEP) devices further facilitates airway patency, mucus clearance, and improved expiratory flow.

Although individual benefits of diaphragmatic breathing, breathing control, and PEP therapy have been reported, direct comparative evidence between breathing control technique and diaphragmatic breathing exercise when combined with PEP remains scarce. Therefore, this study aimed to compare the effects of these two interventions on functional capacity, pulmonary function, and asthma-related quality of life in adults with bronchial asthma.

Materials and Methods

Study Design

This study was a randomized, experimental comparative trial conducted over an eight-week intervention period.

Participants

Forty adults aged 40–60 years with clinically diagnosed moderate bronchial asthma were recruited from the outpatient department of a physiotherapy college hospital. Diagnosis was confirmed by a physician prior to enrollment.

Inclusion Criteria

- Age between 40 and 60 years
- Both male and female participants
- Clinically diagnosed moderate bronchial asthma
- Dyspnea grade 3–5 on Modified Borg Scale
- Voluntary participation

Exclusion Criteria

- Unstable cardiac or neurological conditions
- Recent thoracic or abdominal surgery
- Other restrictive or chronic lung diseases
- Musculoskeletal or neuromuscular disorders affecting respiration
- Uncontrolled metabolic diseases

Randomization and Allocation

Participants were randomly allocated into two groups (Group A and Group B) using a computer-generated randomization sequence. Each group consisted of 20 participants.

Interventions

Both groups received supervised intervention sessions three times per week for eight weeks, with each session lasting approximately 40 minutes.

Group A: Breathing control technique combined with PEP device

Group B: Diaphragmatic breathing exercise combined with PEP device

The PEP device protocol was identical for both groups and consisted of slow inspiration followed by controlled expiration through the device with intermittent breath holds.

Outcome Measures

Assessments were conducted at baseline and after completion of the eight-week intervention: - Six-Minute Walk Test (6MWT) - Peak Expiratory Flow Rate (PEFR) - Asthma Quality of Life Questionnaire (AQLQ)

Statistical Analysis

Data were analyzed using descriptive and inferential statistics. Within-group pre–post differences were analyzed using paired samples t-tests. Between-group comparisons of mean change scores were analyzed using independent samples t-tests. Effect sizes were calculated using Cohen's d. Statistical significance was set at $p<0.05$.

Results

Participant Characteristics

A total of 40 participants with bronchial asthma were randomized equally into Group A (Breathing Control Technique with PEP device, n = 20) and Group B (Diaphragmatic Breathing Exercise with PEP device, n = 20). The allocation ratio was 1:1. Sex distribution was comparable between groups (Group A: 50% male, 50% female; Group B: 45% male, 55% female).

Table 1. Baseline characteristics of participants

Variable	Group A (n=20)	Group B (n=20)
Age (years), mean ± SD	43.15 ± 10.28	43.85 ± 11.96
Male/Female, n	10 / 10	9 / 11

Within-group Comparisons

Group A: Breathing Control Technique with PEP Device

Significant improvements were observed in all outcome measures following intervention.

Table 2. Within-group comparison for Group A (Paired t-test)

Outcome	Pre-test mean ± SD	Post-test mean ± SD	Mean difference	t (df=19)	p value	95% CI
SMWT (m)	556.66 ± 48.05	652.29 ± 55.56	95.64	27.99	<0.001	88.48 to 102.79
PEFR (L/min)	318.00 ± 44.30	346.75 ± 39.54	28.75	6.85	<0.001	19.96 to 37.54

Outcome	Pre-test mean ± SD	Post-test mean ± SD	Mean difference	t (df=19)	p value	95% CI
AQLQ (score)	74.30 ± 5.69	128.80 ± 9.36	54.50	34.60	<0.001	51.20 to 57.80

Group B: Diaphragmatic Breathing Exercise with PEP Device

Group B also demonstrated statistically significant post-intervention improvements.

Table 3. Within-group comparison for Group B (Paired t-test)

Outcome	Pre-test mean ± SD	Post-test mean ± SD	Mean difference	t (df=19)	p value	95% CI
SMWT (m)	540.17 ± 52.74	610.88 ± 51.85	70.72	8.26	<0.001	52.80 to 88.63
PEFR (L/min)	324.35 ± 40.51	341.45 ± 42.24	17.10	10.47	<0.001	13.68 to 20.52
AQLQ (score)	75.15 ± 6.49	120.70 ± 11.24	45.55	28.38	<0.001	42.19 to 48.91

Between-group Comparisons

The mean change scores were significantly greater in Group A compared with Group B for all outcome measures.

Table 4. Between-group comparison of mean change scores (Independent t-test)

Outcome	Group A mean ± SD	Group B mean ± SD	Mean difference	t (df=38)	p value	95% CI
SMWT change (m)	95.64 ± 15.28	70.72 ± 38.28	24.92	2.70	0.010	6.26 to 43.58
PEFR change (L/min)	28.75 ± 18.78	17.10 ± 7.30	11.65	2.59	0.014	2.53 to 20.77
AQLQ change (score)	54.50 ± 7.04	45.55 ± 7.18	8.95	3.98	<0.001	4.40 to 13.50

These findings indicate that breathing control technique combined with PEP produced significantly superior improvements in functional exercise capacity, expiratory flow, and asthma-related quality of life compared with diaphragmatic breathing combined with PEP.

Discussion

The present study demonstrated that both breathing control technique and diaphragmatic breathing exercise combined with PEP device significantly improved functional capacity, pulmonary function, and quality of life in adults with bronchial asthma. However, participants who received breathing control technique with PEP device showed superior outcomes compared to those who received diaphragmatic breathing exercise with PEP.

The greater effectiveness of breathing control technique may be attributed to its emphasis on reducing hyperventilation, promoting relaxation of accessory respiratory muscles, and improving ventilatory efficiency. When combined with PEP, breathing control may enhance expiratory flow stability and reduce airway collapse, leading to improved exercise tolerance and symptom control.

These findings are consistent with previous studies reporting improvements in asthma-related quality of life and pulmonary outcomes following breathing retraining interventions. The present study adds to existing literature by providing direct comparative evidence favoring breathing control technique over diaphragmatic breathing exercise when combined with PEP therapy.

Clinically, these results support the inclusion of structured breathing control programs within pulmonary rehabilitation for asthma, particularly for patients with persistent dyspnea and reduced exercise tolerance.

Conclusion

Breathing control technique combined with positive expiratory pressure demonstrated superior improvements in functional exercise capacity, expiratory flow, and asthma-related quality of life compared with diaphragmatic breathing combined with positive expiratory pressure. These findings support the incorporation of structured

breathing control techniques into pulmonary rehabilitation programs for patients with moderate bronchial asthma.

REFERENCE

1. Global Initiative for Asthma (GINA). Global strategy for asthma management and prevention. 2023 update.
2. Shaw BS, Shaw I. Pulmonary function and posture in asthma. J Bodyw Mov Ther. 2011;15(4):422–429.
3. Hoshino M, Nakamura Y, Sim JJ. Expression of TGF-β1 in asthmatic airway remodeling. Am J Respir Crit Care Med. 1997;155(1):188–194.
4. D'Amato G, Liccardi G, D'Amato M, Holgate S. Environmental risk factors and allergic bronchial asthma. Clin Exp Allergy. 2005;35(9):1113–1124.
5. Shine G, Saad S, Nusaibath S, Shaik AR, Padmakumar S. Effect of breathing exercises on pulmonary function in asthma. Int J Physiother Res. 2016;4(2):1420–1426.
6. Cowie RL, Conley DP, Underwood MF, Reader PG. A randomized controlled trial of the Buteyko technique as an adjunct to asthma management. Respir Med. 2008;102(5):726–732.
7. Valenza MC, Valenza-Peña G, Torres-Sánchez I, González-Jiménez E, Conde-Valero A, Valenza-Demet G. Controlled breathing and quality of life in respiratory disease. Respir Care. 2014;59(9):1331–1338.
8. Thomas M, Bruton A, Little P, Holgate S. Breathing exercises for asthma. Thorax. 2014;69(1):82–83.
9. Bhatawadekar SA, Dixon AE, Peters U, et al. Positive expiratory pressure mitigates airway narrowing in asthma. J Appl Physiol. 2021;130(4):1070–1080.
10. Hassan AM, Abo El-Magd MH. Effect of positive expiratory pressure on mucus clearance in asthma. Egypt J Chest Dis Tuberc. 2005;54(3):223–230.
11. Thorat YT, Salvi SS, Kodgule RR. Peak expiratory flow monitoring in obstructive airway disease. Lung India. 2017;34(1):1–6.
12. Enright PL. The six-minute walk test. Respir Care. 2003;48(8):783–785.
13. Lombardi C, Berti A, Cottini M, et al. Six-minute walk test in severe asthma. J Asthma. 2023;60(3):489–497.
14. Juniper EF, Buist AS, Cox FM, Ferrie PJ, King DR. Validation of the Asthma Quality of Life Questionnaire. Am Rev Respir Dis. 1992;145(3):S32–S38.
15. Juniper EF, Svensson K, Mörk AC, Ståhl E. Measurement properties of the standardized Asthma Quality of Life Questionnaire. Respir Med. 2005;99(5):553–558

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