INSIGHTS-JOURNAL OF
HEALTH AND REHABILITATION

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

IMPACT OF DIAPHRAGMATIC BREATHING WITH PURSE LIP BREATHING VERSUS PURSED-LIP BREATHING ALONE ON DYSPNEA AND EXERCISE CAPACITY AMONG COPD PATIENTS

Original Research

Hifza Riaz[1]*, Amina Amjad[2], Nimra Mustafa[3], Amon[4], Ahmad Ammar Asif[5], Muhammad Ahsen Tahiri[6], Hafiz Ali Bin Asim[7]

[1]Riphah International University, Gulberg Campus, Lahore, Pakistan.
[2]Poonch Medical College, Rawalakot, Pakistan.
[3]Health Services Academy, Islamabad, Pakistan.
[4]Riphah International University, Pakistan.
[5]MBBS, Senior Medical Officer, THQ Hospital, Muridke, Pakistan.
[6]Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan.
[7]Lecturer, Foundation University, Islamabad, Pakistan.

Corresponding Author: Hifza Riaz, Riphah International University, Gulberg Campus, Lahore, Pakistan. hifzariaz118@gmail.com

Acknowledgement: The authors sincerely acknowledge the support and cooperation of the participating hospitals and patients in making this study possible.

Conflict of Interest: None

Grant Support & Financial Support: None

ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is a leading global health concern, affecting 13.6% of the population worldwide and ranking as the third most common cause of mortality. It is characterized by progressive respiratory dysfunction that significantly impacts quality of life. Integrating diaphragmatic breathing (DB) and pursed-lip breathing (PLB) into rehabilitation programs has shown potential in alleviating dyspnea and improving exercise capacity, offering a cost-effective and accessible non-pharmacological intervention for COPD patients.

Objective: To evaluate the effect of diaphragmatic breathing combined with pursed-lip breathing versus pursed-lip breathing alone on dyspnea and exercise capacity in COPD patients.

Methods: This experimental study included 32 clinically stable COPD patients, aged 45–75 years, categorized as GOLD II or III. Participants were recruited from Government Mozang Teaching Hospital, Sir Ganga Ram Hospital, and Lahore General Hospital using purposive sampling. Exclusion criteria included pleural effusion, liver or kidney disease, pulmonary tuberculosis, post-tuberculosis obstruction syndrome, unstable angina, and recent myocardial infarction. Participants were randomized into Group A, receiving diaphragmatic breathing combined with pursed-lip breathing, and Group B, receiving pursed-lip breathing alone. Both interventions were administered over eight weeks with four sessions per week. Dyspnea and exercise capacity were assessed using the modified Medical Research Council (mMRC) scale and the six-minute walk test (6MWT), respectively. Data were analyzed using SPSS version 24.

Results: Between-group analysis revealed that Group A demonstrated significantly greater improvements in dyspnea (mMRC: 3.2 ± 0.5 to 1.4 ± 0.6, $p = 0.033$) and exercise capacity (6MWT: 310.5 ± 45.3 to 365.9 ± 50.2 meters, $p = 0.020$) compared to Group B (mMRC: 3.1 ± 0.6 to 1.9 ± 0.7; 6MWT: 315.2 ± 50.1 to 350.3 ± 55.6 meters). Within-group analysis for both groups showed statistically significant improvements ($p < 0.001$).

Conclusion: Diaphragmatic breathing combined with pursed-lip breathing significantly outperformed pursed-lip breathing alone in reducing dyspnea and enhancing exercise capacity in COPD patients. This combined approach represents an effective and practical addition to pulmonary rehabilitation programs.

Keywords: Breathing exercises, Chronic obstructive pulmonary disease, Diaphragmatic breathing, Dyspnea, Exercise capacity, Pulmonary rehabilitation, Pursed-lip breathing.

INSIGHTS-JOURNAL OF
HEALTH AND REHABILITATION

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a persistent and progressively worsening lung parenchymal condition that poses a significant global health burden. According to data from the World Health Organization (WHO), approximately 80 million individuals worldwide were affected by COPD as of 2005, with projections indicating it would become the third leading cause of mortality and the fifth most prevalent disease globally by 2020. In the United States, COPD remains the primary cause of mortality among lung diseases, accounting for 53.8% of all related deaths, with hospital outpatient prevalence estimated at 76.3%. The condition's global impact is equally alarming, with an estimated 38.1 million individuals in China suffering from COPD as of 2006, alongside millions in Southeast Asia, including 2 million in Vietnam and 4.8 million in Indonesia. The high prevalence of smoking—affecting 90% of COPD sufferers—continues to drive these statistics, with Indonesia alone reporting 34.5% of its population as daily smokers in 2004 (1, 2, 3, 4).

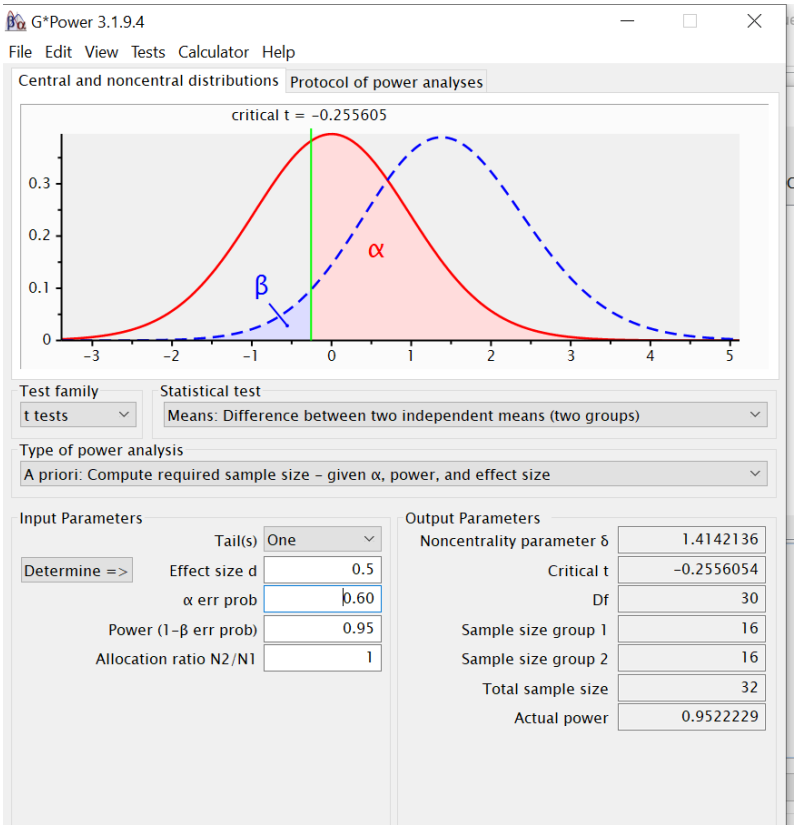
Characterized by chronic inflammation of the airways and lungs, COPD leads to impaired respiratory mechanics through pulmonary hyperinflation, air trapping, and increased airway resistance. This results in reduced lung ventilation, progressive dyspnea, and decreased physical functionality. Pulmonary rehabilitation has emerged as a cornerstone intervention to address these deficits, aiming to enhance the quality of life and physical capabilities of individuals with COPD (5, 6). Rehabilitation typically involves a triad of components—respiratory, psychological, and physical activities. Central to these interventions are breathing exercises, which aim to reduce dyspnea and optimize respiratory function. Among these techniques, pursed-lip breathing (PLB) and diaphragmatic breathing (DB) have been widely employed in isolation or combination to alleviate symptoms and improve outcomes in COPD (7, 8).

Pursed-lip breathing, a method involving slow nasal inspiration followed by controlled expiration through pursed lips, serves to prevent airway collapse, reduce air trapping, and improve oxygen exchange. This technique has demonstrated efficacy in decreasing respiratory rate, enhancing tidal volume, and alleviating dyspnea, thus enabling individuals to engage in daily activities with less discomfort. It is a low-cost, practical method that requires minimal instruction and is readily integrated into home-based self-management strategies. In contrast, diaphragmatic breathing focuses on activating the diaphragm over accessory respiratory muscles, promoting deeper and slower breathing patterns. This method, often practiced supine with abdominal movements emphasized, enhances ventilation-perfusion matching, reduces thoracic excursion, and improves blood gas parameters by increasing oxygenation and decreasing carbon dioxide levels. The synergistic use of both techniques optimizes ventilatory mechanics and oxygenation, providing superior improvements in dyspnea, tidal volume, and exercise tolerance compared to either approach used alone (9-15).

The combined application of diaphragmatic breathing and pursed-lip breathing holds significant potential for addressing key pathological features of COPD, such as hyperinflation and diaphragmatic fatigue. By prolonging exhalation, this integrated approach facilitates the clearance of trapped air, reduces reliance on accessory respiratory muscles, and retrains the diaphragm for enhanced strength and endurance. The resultant improvements in oxygen delivery and work of breathing have been reflected in increased exercise capacity, including longer endurance during activities such as the six-minute walk test (6MWT). Despite substantial evidence supporting their individual and combined efficacy, there remains a need to delineate the relative benefits of these interventions to optimize pulmonary rehabilitation strategies for individuals with COPD. This study aims to evaluate the impact of diaphragmatic breathing combined with pursed-lip breathing versus pursed-lip breathing alone on dyspnea and exercise capacity, with the goal of informing evidence-based clinical practices for the management of COPD.

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

METHODS



This experimental study was conducted with a total sample size of 32 participants, calculated using G*Power software. Participants were recruited using a purposive sampling technique from Government Mozang Teaching Hospital, Sir Ganga Ram Hospital, and Lahore General Hospital. Clinically stable patients with COPD, classified as GOLD II or III, aged between 45 and 75 years, were included in the study. The exclusion criteria encompassed pleural effusion, liver disease, kidney disease, pulmonary tuberculosis, post-tuberculosis obstruction syndrome, lung cancer, bronchial asthma, unstable angina pectoris (Canadian Cardiovascular Society III), and a history of myocardial infarction within the preceding month. This ensured the selection of a homogenous population suitable for the intervention.

Participants were randomized into two groups: Group A, which received diaphragmatic breathing combined with pursed-lip breathing, and Group B, which received pursed-lip breathing alone. Randomization was achieved using a computer-generated allocation sequence to minimize selection bias and ensure equitable distribution of baseline characteristics. Both interventions were administered over a period of eight weeks, with participants attending four supervised sessions per week. Ethical considerations, including informed consent and approval from the institutional ethics committee, were strictly adhered to throughout the study, ensuring compliance with established guidelines.

Outcome measures included the six-minute walk test (6MWT) to assess exercise capacity and the modified Medical Research Council (mMRC) dyspnea scale to evaluate the severity of dyspnea. These tools were chosen for their validated use in COPD populations. Data collection spanned from February to September 2024. Statistical analysis was performed using SPSS version 24, employing appropriate statistical tests to compare pre- and post-intervention outcomes between the two groups.

RESULTS

The study evaluated the impact of diaphragmatic breathing combined with pursed-lip breathing versus pursed-lip breathing alone on dyspnea and exercise capacity in patients with COPD. The demographic and clinical characteristics indicated no statistically significant differences between the groups at baseline. The mean age of participants in Group A (diaphragmatic breathing combined with pursed-lip breathing) was 61.2 ± 9.0 years, while Group B (pursed-lip breathing alone) had a mean age of 59.9 ± 9.5 years ($p = 0.450$). Gender distribution showed that Group A consisted of 37.5% females and 62.5% males, while Group B comprised 50% females and 50% males ($p = 0.470$). These baseline similarities indicated comparable demographic and clinical profiles between the groups.

Regarding dyspnea, Group A showed a significant reduction in modified Medical Research Council (mMRC) scores from a pre-treatment mean of 3.2 ± 0.5 to a post-treatment mean of 1.4 ± 0.6 ($p = 0.033$). Group B also demonstrated an improvement, with mMRC scores decreasing from 3.1 ± 0.6 to 1.9 ± 0.7, but the extent of improvement was less pronounced compared to Group A. For exercise capacity, as measured by the six-minute walk distance (6MWD), Group A showed a significant increase from a mean of 310.5 ± 45.3 meters pre-treatment to 365.9 ± 50.2 meters post-treatment ($p = 0.020$). Group B demonstrated a smaller improvement, with 6MWD increasing from 315.2 ± 50.1 meters pre-treatment to 350.3 ± 55.6 meters post-treatment. These results underscore the enhanced effectiveness of the combined intervention.

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

Within-group comparisons further supported these findings. Group A exhibited a paired mean reduction in dyspnea (mMRC) of -1.8 ± 0.4 and an increase in 6MWD of +55.4 ± 12.8 meters (both $p < 0.001$). Group B, while showing statistically significant improvements, demonstrated smaller changes with a reduction in mMRC of -1.2 ± 0.5 and an increase in 6MWD of +35.1 ± 10.5 meters (both $p < 0.001$). These findings highlight the superior efficacy of combining diaphragmatic and pursed-lip breathing in improving dyspnea and exercise capacity in COPD patients.

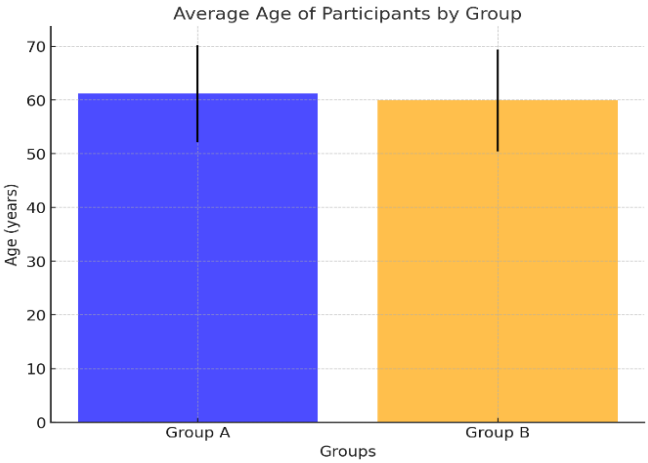


Figure 2 Average Age Of Participants By Group

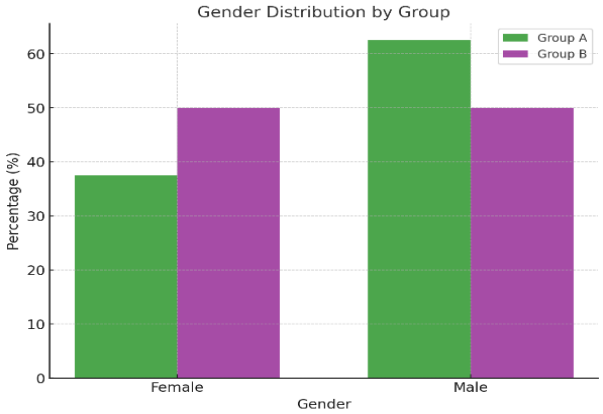


Figure 1 Gender Distribution By Group

Table 1: Demographics and Clinical Characteristics of the Study Subjects (Pursed-Lip Breathing Group)

Variables	Group A (Diaphragmatic + Pursed-Lip Breathing)	Group B (Pursed-Lip Breathing Alone)	P Value
N	16	16	
Age (years)	61.2 ± 9.0	59.9 ± 9.5	0.450
Gender			
Female (%)	6 (37.5%)	8 (50%)	0.470
Male (%)	10 (62.5%)	8 (50%)	

Table demonstrated average age in group A 61.2 ± 9.0 in group B was 59.9 ± 9.5. Group A had 6 (37.5%) female and 10 (62.5%) had male ratio. Group B had 8 (50%) female and 8 (50%) were male.

Table 2: Between-Group Comparison of Dyspnea and Exercise Capacity

Outcome	Treatment Groups	N	Pre-Treatment	Post-Treatment	T	p-value
Dyspnea (mMRC)	Group A (Diaphragmatic + Pursed-Lip Breathing)	16	3.2 ± 0.5	1.4 ± 0.6	-2.210	0.033
	Group B (Pursed-Lip Breathing Alone)	16	3.1 ± 0.6	1.9 ± 0.7		
Exercise Capacity (6MWD)	Group A (Diaphragmatic + Pursed-Lip Breathing)	16	310.5 ± 45.3	365.9 ± 50.2	+2.381	0.020
	Group B (Pursed-Lip Breathing Alone)	16	315.2 ± 50.1	350.3 ± 55.6		

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

Group A 3.2 ± 0.5 had pre treatment 1.4 ± 0.6 were post treatment readings with 0.033 p value on Mmrc scale and 3.1 ± 0.6 pre , 1.9 ± 0.7post values of group B. Group A had pre 310.5 ± 45.3 to post 365.9 ± 50.2 values with significant p value 0.020 on 6MWD scale. Group B demonstrated 315.2 ± 50.1 pre to 350.3 ± 55.6 post treatment reading on 6MWD scale .

Table 3: Within Group Comparison of Dyspnea and Exercise Capacity

Outcome	Groups	Pre-Treatment	Post-Treatment	Paired Difference	p-value
		Mean (SD)	Mean (SD)		
Dyspnea (mMRC)	Group A (Diaphragmatic + Pursed-Lip Breathing)	3.2 ± 0.5	1.4 ± 0.6	-1.8 ± 0.4	<0.001
	Group B (Pursed-Lip Breathing Alone)	3.1 ± 0.6	1.9 ± 0.7	-1.2 ± 0.5	<0.001
Exercise Capacity (6MWD)	Group A (Diaphragmatic + Pursed-Lip Breathing)	310.5 ± 45.3	365.9 ± 50.2	+55.4 ± 12.8	<0.001
	Group B (Pursed-Lip Breathing Alone)	315.2 ± 50.1	350.3 ± 55.6	+35.1 ± 10.5	<0.001

Group A and group B revealed significant p<0.001 values within group comparison on both scales.

DISCUSSION

The findings of this study align with previous research, demonstrating the significant impact of diaphragmatic and pursed-lip breathing exercises on improving exercise capacity and reducing dyspnea among COPD patients. Javaid et al. conducted an experimental study involving 40 COPD patients over an eight-week period, reporting that both diaphragmatic and pursed-lip breathing exercises substantially improved exercise frequency and pulmonary function, corroborating the results of the present investigation, which observed significant improvements in dyspnea scores and six-minute walk distance following similar interventions (16). These findings further emphasize the therapeutic value of these simple and cost-effective breathing techniques for enhancing respiratory mechanics in COPD management.

Yang et al. performed a systematic investigation and identified notable improvements in forced expiratory volume in one second (FEV1), forced vital capacity (FVC), FEV1/FVC ratio, and six-minute walk test performance following the implementation of combined diaphragmatic and pursed-lip breathing exercises. The findings highlighted the combined interventions as effective tools for improving exercise capacity and lung function in COPD patients, a conclusion consistent with the outcomes of the current study. The simplicity, accessibility, and low cost of these interventions make them suitable for widespread implementation in COPD care (17). Conversely, De Araujo et al.'s randomized controlled trial reported that pursed-lip breathing did not enhance six-minute walk test performance, despite reducing dynamic hyperinflation during the test. This finding contrasts with the improvements observed in the present study, suggesting variability in outcomes that may stem from differences in study design, sample size, or intervention protocols (18).

El-Saidy et al. further demonstrated that combining diaphragmatic and pursed-lip breathing exercises led to significant improvements in clinical outcomes among elderly COPD patients. Their study observed reductions in respiratory rate, pulse, dyspnea scores, and CAT scale scores, alongside increased oxygen saturation levels, outcomes that align with the improvements reported in the current investigation. These findings reinforce the synergistic effects of combining diaphragmatic and pursed-lip breathing exercises to optimize respiratory function and quality of life in COPD patients (19). Similarly, Antony et al. and Riasat et al. demonstrated that these breathing techniques enhance lung function and exercise tolerance, supporting the effectiveness of these interventions as observed in the present study (20, 21).

The strength of the current study lies in its rigorous design, including randomization and the use of validated outcome measures, which strengthen the reliability and clinical relevance of the findings. However, the study is limited by its relatively small sample size and the lack of blinding, which could introduce bias in the assessment of subjective outcomes like dyspnea. Additionally, participant adherence

to the breathing exercises was not explicitly tracked, which could influence the results. Future research with larger samples, longer follow-up periods, and adherence monitoring is needed to further substantiate these findings and refine COPD rehabilitation strategies.

This study contributes to the growing evidence supporting the integration of diaphragmatic and pursed-lip breathing exercises into COPD management. These techniques represent a valuable, non-pharmacological approach to enhancing functional outcomes and improving the quality of life in this population. By addressing both dyspnea and exercise capacity, the combined intervention offers a holistic approach to managing the multifaceted challenges faced by individuals with COPD.

CONCLUSION

Diaphragmatic breathing combined with pursed-lip breathing demonstrated greater effectiveness in improving dyspnea and exercise capacity compared to pursed-lip breathing alone in patients with COPD. This combined approach addresses key respiratory challenges by enhancing ventilation efficiency, reducing air trapping, and improving functional capacity, making it a valuable addition to pulmonary rehabilitation strategies. These findings highlight the importance of integrating such synergistic breathing techniques into the management plans for individuals with COPD to improve their overall quality of life and physical functionality.

AUTHOR CONTRIBUTIONS

Author	Contribution
Hifza Riaz*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Amina Amjad	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Nimra Mustafa	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Amon	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Ahmad Ammar Asif	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Ahsen Tahiri	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Hafiz Ali Bin Asim	Contributed to study concept and Data collection Has given Final Approval of the version to be published

REFERENCES

1. Mei F, Dalmartello M, Bonifazi M, Bertuccio P, Levi F, Boffetta P, et al. Chronic obstructive pulmonary disease (COPD) mortality trends worldwide: An update to 2019. Respirology. 2022;27(11):941-50.

2. Adeloye D, Chua S, Lee C, Basquill C, Papana A, Theodoratou E, et al. Global and regional estimates of COPD prevalence: Systematic review and meta–analysis. Journal of Global Health. 2015;5(2).

3. Quaderi SA, Hurst JR. The unmet global burden of COPD. Global Health, Epidemiology and Genomics. 2018;3:e4.

4. Agustí A, Vogelmeier C, Faner R. COPD 2020: changes and challenges. American Journal of Physiology-Lung Cellular and Molecular Physiology. 2020;319(5):L879-L83.

5. Singh A, Prakash N, Jain A. A review on prevalence of worldwide COPD situation. In: Proceedings of Data Analytics and Management: ICDAM 2022. Springer; 2023. p. 391-405.

6. Cahalin LP, Braga M, Matsuo Y, Hernandez ED. Efficacy of diaphragmatic breathing in persons with chronic obstructive pulmonary disease: a review of the literature. Journal of Cardiopulmonary Rehabilitation and Prevention. 2002;22(1):7-21.

7. Kant S, Singh G. Breathing exercises as adjuvant in the management of COPD: an overview. Lung India. 2006;23(4):165-9.

8. Priego-Jiménez S, Torres-Costoso A, Guzmán-Pavón MJ, Lorenzo-García P, Lucerón-Lucas-Torres MI, Álvarez-Bueno C. Efficacy of different types of physical activity interventions on exercise capacity in patients with chronic obstructive pulmonary disease (COPD): a network meta-analysis. International Journal of Environmental Research and Public Health. 2022;19(21):14539.

9. Yamaguti WP, Claudino RC, Neto AP, Chammas MC, Gomes AC, Salge JM, et al. Diaphragmatic breathing training program improves abdominal motion during natural breathing in patients with chronic obstructive pulmonary disease: a randomized controlled trial. Archives of Physical Medicine and Rehabilitation. 2012;93(4):571-7.

10. Mendes LP, Moraes KS, Hoffman M, Vieira DS, Ribeiro-Samora GA, Lage SM, et al. Effects of diaphragmatic breathing with and without pursed-lips breathing in subjects with COPD. Respiratory Care. 2019;64(2):136-44.

11. Fernandes M, Cukier A, Feltrim MIZ. Efficacy of diaphragmatic breathing in patients with chronic obstructive pulmonary disease. Chronic Respiratory Disease. 2011;8(4):237-44.

12. Ma X, Yue Z-Q, Gong Z-Q, Zhang H, Duan N-Y, Shi Y-T, et al. The effect of diaphragmatic breathing on attention, negative affect and stress in healthy adults. Frontiers in Psychology. 2017;8:874.

13. Mohamed SA. The effects of positioning and pursed-lip breathing exercise on dyspnea and anxiety status in patients with chronic obstructive pulmonary disease. Journal of Nursing Education and Practice. 2019;9(6):41-51.

14. Ealias J, Babu B. Effectiveness of pursed lip breathing exercise on selected physiological parameters among COPD patients. International Journal of Science and Research. 2016;5(5):19-22.

15. Ningsih AD, Amin M, Bakar A. The effect of walking exercise and pursed lips breathing on signs and symptoms of COPD patients: a systematic review. In: Proceedings from the 9th International Nursing Conference; 2018.

16. Javaid A, Riasat K, Khalid A. Comparing the effect of pursed lip breathing and diaphragmatic breathing on pulmonary function and exercise frequency in COPD patients. Journal of Health and Rehabilitation Research. 2024;4:1807-10.

17. Yang Y, Wei L, Wang S, Ke L, Zhao H, Mao J, et al. The effects of pursed lip breathing combined with diaphragmatic breathing on pulmonary function and exercise capacity in patients with COPD: a systematic review and meta-analysis. Physiotherapy Theory and Practice. 2022;38(7):847-57.

18. de Araujo CL, Karloh M, Dos Reis CM, Palú M, Mayer AF. Pursed-lips breathing reduces dynamic hyperinflation induced by activities of daily living test in patients with chronic obstructive pulmonary disease: a randomized cross-over study. Journal of Rehabilitation Medicine. 2015;47(10):957-62.

19. El-Saidy TMK, Alagamy ZGA, Sayed MA. Effect of combining diaphragmatic and pursed lips breathing exercises on clinical outcomes of elderly patients with chronic obstructive pulmonary disease. Egyptian Journal of Health Care. 2021;12(3):1-14.

20. Antony A. Comparative study to evaluate the efficacy of pursed lip breathing and pranayama (Kumbhaka) on pulmonary function in chronic obstructive pulmonary disease (COPD) patients. Rajiv Gandhi University of Health Sciences; 2012.

21. Riasat K, Javaid A, Nasir K, Shahid R, Sehar J. Comparing the effect of pursed lip breathing and diaphragmatic breathing on pulmonary function and exercise frequency in COPD patients. Journal of Health and Rehabilitation Research. 2024;4(2):1807-10.

