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# The Effect of Implementing Respiratory Muscle Training with Pursed Lips Breathing Technique on Pulmonary Ventilation Function in Patients with COPD at Advent Hospital Lampung

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**ABSTRACT**

Chronic Obstructive Pulmonary Disease (COPD) is a chronic respiratory disease that causes a decline in pulmonary ventilation function. This study aimed to determine the effect of Respiratory Muscle Training using the Pursed-Lips Breathing technique on pulmonary ventilation function in patients with COPD at Advent Hospital Bandar Lampung in 2025. This study used a quantitative approach with a pre-experimental method and a one-group pretest–posttest design. A total of 32 COPD patients were selected using purposive sampling. Pulmonary ventilation function was measured before and after the intervention using a peak flow meter and analyzed using the Wilcoxon test. The results showed a significant improvement in pulmonary ventilation function after the intervention ($p < 0.001$). It was concluded that the Pursed-Lips Breathing technique is effective in improving pulmonary ventilation function in patients with COPD. This method can be considered a non-pharmacological intervention to improve pulmonary ventilation function.

## INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a respiratory disorder characterized by persistent airflow obstruction due to chronic bronchitis and emphysema. COPD is a group of lung diseases characterized primarily by persistent airflow obstruction, leading to decreased lung function, respiratory muscle weakness, and ultimately a reduced quality of life (Prasana, 2024). Disorders of the respiratory system, including the lungs, can cause various diseases that impede inspiration and expiration (Suryana et al., 2025).

Patients with Chronic Obstructive Pulmonary Disease (COPD) experience impaired respiratory function due to decreased lung elasticity, chronic airway obstruction, and respiratory muscle weakness. This condition leads to hyperinflation, air trapping, and an imbalance between air intake and output. Due to these limitations, patients often have difficulty carrying out daily activities, which can lead to social withdrawal and feelings of low self-esteem (Handayani & Purba, 2021).

According to the World Health Organization (WHO, 2024), COPD is the third leading cause of death worldwide, with 3.23 million cases in 2024. The Global Initiative for Chronic Obstructive Lung Disease (GOLD, 2020) report also states that the incidence of COPD is expected to continue to increase until 2060, in line with the increasing number of smokers worldwide (Suryana et al., 2025a). In Southeast Asia, the prevalence of COPD reaches 6.3% in people aged 30 and over. In Indonesia, the number of COPD sufferers is estimated to reach 9.2 million people, or approximately 3.7% of the population. Based on the Indonesian Health Survey (Ministry of Health of the Republic of Indonesia SKI, 2023), the number of smokers in Lampung Province has increased to 4.2%, or approximately 3,954 people, and the prevalence of COPD in this province has reached 3.4%. COPD sufferers generally complain of shortness of breath, chronic cough, and fatigue during activities.

Based on data from the medical records of the Lampung Province Adventist Hospital, 163 COPD patients were registered during the 2023–2025 period, and approximately 70 patients underwent routine check-ups in the past three months. This figure indicates that the prevalence of COPD at the hospital remains quite high. A pre-survey conducted in October 2025 on two COPD patients undergoing treatment indicated that both patients frequently experienced shortness of breath and coughing. One patient regularly took medication but did not perform breathing exercises. This situation underscores the need for education and implementation of breathing exercises as a non-pharmacological approach to reducing symptoms and improving pulmonary ventilation function in COPD patients.

Treatment for COPD patients can be carried out through two main approaches: pharmacological and non-pharmacological therapy. Pharmacological treatment includes antibiotics to treat respiratory tract infections, bronchodilators to dilate the airways, and expectorants to help clear mucus secretions. Meanwhile, non-pharmacological approaches include oxygen therapy, chest physiotherapy, and various forms of breathing exercises. One breathing exercise widely used in COPD

patients is Respiratory Muscle Training, which aims to increase the strength and efficiency of the respiratory muscles, both with and without equipment. In non-equipped Respiratory Muscle Training, the Pursed-Lips Breathing technique is a frequently used method because it helps optimize respiratory muscle function, especially during the expiratory phase. Pursed-Lips Breathing has been shown to slow exhalation, reduce air trapping, stabilize small airways, and increase pulmonary ventilation efficiency (Ramli et al., 2023). Based on these principles, Pursed-Libs Breathing is a form of non-pharmacological Respiratory Muscle Training that focuses on controlling expiratory patterns to improve pulmonary ventilation function in COPD patients (Handayani & Purba, 2021b).

Several previous studies have shown that Respiratory Muscle Training is effective in improving pulmonary ventilation function in patients with Chronic Obstructive Pulmonary Disease (COPD). Handayani & Purba (2021) reported that regular respiratory muscle training can increase inspiratory muscle strength, improve pulmonary ventilation, and reduce shortness of breath in COPD patients. These findings are supported by Saka et al. (2021), who found that respiratory muscle training significantly increased lung functional capacity, as demonstrated by the results of the 6-Minute Walking Test (6MWT). Furthermore, a recent study by Karnianti & Kristinawati (2023) also confirmed that breathing exercise techniques, including Pursed Lips Breathing, are effective in reducing respiratory rate and improving breathing patterns in COPD patients.

Previous research has shown that Respiratory Muscle Training and Pursed Lips Breathing both provide benefits for COPD patients, but most studies have only assessed Respiratory Muscle Training or Pursed Lips Breathing separately. No studies have specifically assessed the effectiveness of Pursed Lips Breathing on pulmonary ventilation function as the primary outcome. Therefore, this study was conducted to determine whether there is an effect of Pursed Libs Breathing on pulmonary ventilation function in COPD patients.

## METHOD

Research participants

In this study, data from the last three months of 2025 collected from 70 COPD patients served as respondents. The sample size used in this study was 32 respondents. The sampling technique used in this study was purposive sampling, which is a sampling technique that uses specific considerations to select samples from within the population based on the research problem's objectives, ensuring that the sample represents previously identified population characteristics.

Research procedure

a. Researchers conducted a pre-test using a peak flow meter to assess pulmonary ventilation function. Respondents were asked to inhale as deeply as possible, then exhale as forcefully and quickly as possible using the peak flow meter. Measurements were taken three times, and the highest value was recorded as the initial peak expiratory flow (PEF) value.
b. Researchers provided a non-equipment-based Respiratory Muscle Training intervention in the form of pursed-lip breathing exercises in accordance with standard operating procedures (SOP). The intervention was conducted once

daily for 10 minutes, with each session consisting of six breathing cycles with a two-second pause between cycles, for 3–4 days. The intervention was administered by an enumerator.

c. After the intervention was completed, researchers conducted a post-test using a peak flow meter on the same group to assess changes in pulmonary ventilation function.
d. All measurement results were recorded on an observation sheet and summarized in a research data table for further analysis.

Instrument

Research instruments are tools used by researchers to collect the necessary data to achieve the research objectives. The instruments used in this study include an observation sheet for the implementation and SOP for Respiratory Muscle Training using the Pursed Lips Breathing technique and a Peak Flow Meter. The observation sheet was used to record the implementation process of respiratory muscle training, including frequency, duration, and patient compliance with the established training procedures. Meanwhile, a peak flow meter was used to measure the patient's pulmonary ventilation function through peak expiratory flow (PEF), which is the maximum speed of air flow during forceful expiration after maximum inhalation. Peak flow meter values were measured before and after the administration of the pursed lips breathing intervention.

Data Analysis

For bivariate analysis, if the data is normally distributed, a paired t-test is used to compare pulmonary ventilation function before and after the Respiratory Muscle Training intervention with the Pursed-Lips Breathing technique. If the data is not normally distributed, the Wilcoxon Signed Rank Test is used as a non-parametric alternative for paired data.

## RESULTS AND DISCUSSION

**Table 1.** Respondent Characteristics

| Sex | Frequensy (f) | Percentage (%) |
|---|---|---|
| Male | 24 | 75,0 % |
| Female | 8 | 25,0 % |
| **Ages** | | |
| 22-50 tahun | 7 | 21,9 % |
| 51-85 tahun | 25 | 78,1 % |
| **Occupation** | 5 | 15,6% |
| Housewife | 5 | 15,6% |
| Odd Job | 2 | 6,3% |
| Laborer | 2 | 6,3% |
| Driver | 1 | 3,1% |
| Workshop | 1 | 3,1% |
| Student | 4 | 12,5% |
| Trader | 12 | 37,5% |
| Unemployed | 5 | 15,6% |
| **Total** | **32** | **100,0 %** |

It was found that the respondents with chronic obstructive pulmonary disease (COPD) were mostly aged 51-85 (25 respondents (78.1%), while 7 respondents

were aged 22-50 (21.9%). The gender of the respondents with chronic obstructive pulmonary disease (COPD) was found to be predominantly male (24 respondents (75.0%), while 8 respondents (25.0%) were female. It was found that the majority of respondents were unemployed (12 people) (37.5%). Furthermore, respondents who worked as housewives and odd-job workers (5 people each) (15.6%), respondents who worked as traders (4 people each) (12.5%), and respondents who worked as laborers and drivers (2 people each) (6.3%). Respondents who worked in workshops and students (1 person each) (3.1%).

**Table 2.** Pulmonary Ventilation Function N Minimum Maximum Mean SD

| Pulmonary Ventilation Function | N | Minimum | maximum | Mean | SD |
|---|---|---|---|---|---|
| Before Intervention (Pretest) | 32 | 240 | 300 | 269.69 | 17.130 |

Based on Table the pulmonary ventilation function of the 32 respondents before receiving the Respiratory Muscle Training intervention using the Pursed Libs Breathing technique had a mean value of 269.69 with a standard deviation of 17.130, with a minimum value of 240 and a maximum of 300. These results indicate the respondents' pulmonary ventilation function at baseline before the intervention.

**Table 3.** Pulmonary Ventilation Function N Minimum Maximum Mean SD

| Pulmonary Ventilation Function | N | Minimum | Maximum | Mean | SD |
|---|---|---|---|---|---|
| After intervention (Posttest) | 32 | 280 | 320 | 296.56 | 12.078 |

Based on Table it is known that the pulmonary ventilation function of the 32 respondents after the intervention had a mean value of 296.56 with a standard deviation of 12.078, with a minimum value of 280 and a maximum value of 320. This mean value is higher than the pulmonary ventilation function before the intervention, indicating an improvement in the respondents' pulmonary ventilation function after the intervention.

**Table 4.** The Effect of Implementing Respiratory Muscle Training with the Pursed Libs Breathing Technique on Patients with Chronic Obstructive Pulmonary Disease (COPD) at Advend Hospital Bandar Lampung in 2025.

| Wilcoxon Signed Rank Test Results | |
|---|---|
| Z | -4,943 |
| Asymp. Sig. (2-tailed) | 0,001 |

Based on Table 4, the analysis results using the Wilcoxon Signed Ranks Test yielded a Z value of -4.943 with a significance value (Asymp. Sig. 2-tailed) of p=<0.001. This value is less than p=0.05, thus concluding that there is a significant effect of the implementation of the Respiratory Muscle Training intervention with the Pursed Libs Breathing Technique on pulmonary ventilation function in patients with Chronic Obstructive Pulmonary Disease (COPD) at Advend Hospital Bandar Lampung in 2025.

This research has passed the ethical feasibility test from the Adventist Hospital ethics team with the number: 157/KEP-RSABL/XII/2025

Based on the analysis, a p-value of <0.001 was obtained, indicating an effect of the Pursed-Lip Breathing technique on pulmonary ventilation function before and

after the intervention in 32 respondents. The mean posttest score was 296.56, a standard deviation of 12.078, and a minimum score of 280 and a maximum score of 320. This average score was higher than before the intervention. The Wilcoxon Signed Rank Test results showed that most respondents experienced an increase in pulmonary ventilation function after the intervention, as indicated by a greater number of positive ranks than negative ranks. The Wilcoxon test statistic obtained was Z = -4.943 with a significance value of p-value <0.001, less than p-value = 0.05. Therefore, it can be concluded that there was a statistically significant effect on pulmonary ventilation function before and after the intervention, and the research hypothesis was accepted.

The increase in pulmonary ventilation function after the application of the Pursed-Lip Breathing technique can be explained by the physiological mechanisms of respiration. This technique works by prolonging the expiratory phase, allowing air to exit the lungs more optimally. Slower, more controlled expiration helps maintain positive pressure within the airways, preventing narrowing or collapse of the small airways that often occur in COPD patients. By maintaining airway openness during expiration, air accumulation in the lungs (air trapping) can be reduced. Reduced air trapping reduces residual air volume, making the alveolar space more ready to receive fresh air during the next inspiratory phase. This condition increases the efficiency of alveolar ventilation and improves the exchange of oxygen and carbon dioxide in the lungs. Furthermore, the Pursed-Lips Breathing technique helps improve breathing patterns, making them more regular and efficient. Controlled breathing decreases respiratory frequency, increases depth, and reduces the use of accessory muscles. This reduces the work of breathing and the respiratory muscle load that is previously increased due to airflow obstruction in COPD patients. This improvement in respiratory efficiency results in reduced shortness of breath and increased tolerance to physical activity. Patients become better able to perform daily activities with less fatigue. Overall, these mechanisms contribute to improved pulmonary ventilation function and the prevention of respiratory deterioration in COPD patients (Aida et al., 2025).

The results of this study align with those of Agisyha et al. (2025), who reported that applying the Pursed Lip Breathing technique to COPD patients reduced shortness of breath, decreased respiratory rate, and increased oxygen saturation, reflecting improved pulmonary ventilation. Another study by Ramadhani et al. (2022) also showed that applying Pursed Lip Breathing for three days had a positive impact, reducing respiratory rate from 28 breaths per minute to 20 breaths per minute and reducing the need for supplemental oxygen in COPD patients. The similarity in these research findings reinforces the findings in this study that the Pursed Lip Breathing technique is effective in improving pulmonary ventilation function and reducing shortness of breath in COPD patients.

According to the researchers' analysis, age significantly influences pulmonary ventilation function. As patients age, especially in the elderly, lung function declines. This decline occurs due to reduced lung elasticity, weakened respiratory muscles, and increased chest wall stiffness, resulting in less effective breathing and worsening pulmonary ventilation. Elderly patients with COPD already experience more severe respiratory impairment than younger patients. Therefore, administering the Pursed-Lips Breathing technique provides more tangible benefits by helping improve breathing patterns and increasing pulmonary ventilation efficiency. Conversely, in younger patients, lung function is still relatively good, so the improvement in pulmonary ventilation after

intervention is not as significant as in older patients.

## CONCLUSIONS AND RECOMMENDATIONS

Conclusion

1. The majority of respondents were in the 51–85 age group (25 respondents (78.1%), 24 respondents (75.0%), and 12 respondents (37.5%) were unemployed. These results indicate that COPD patients in this study were predominantly elderly, male, and mostly unemployed.
2. The average value of pulmonary ventilation function in COPD patients before Respiratory Muscle Training with the Pursed-Lips Breathing technique was 269.69.
3. The average value of pulmonary ventilation function in COPD patients after Respiratory Muscle Training with the Pursed-Lips Breathing technique increased to 296.56, indicating improved pulmonary ventilation function after the intervention.
4. There is a significant effect of the application of Respiratory Muscle Training with the Pursed-Lips Breathing technique on improving pulmonary ventilation function in COPD patients at Adventist Hospital Bandar Lampung in 2025, based on the results of the Wilcoxon Signed Rank Test with a p-value of <0.001.

Recommendations

1. Based on the results of this study on the effect of the application of Respiratory Muscle Training with the Pursed-Lips Breathing Technique on Pulmonary Ventilation Function in Chronic Obstructive Pulmonary Disease (COPD) patients at Adventist Hospital Bandar Lampung in 2025, the researcher provides the following recommendations:
2. For Healthcare Workers at Adventist Hospital Bandar Lampung: Nurses and healthcare workers are expected to use the results of this study as a basis for routinely implementing breathing exercises in COPD patients, thereby improving pulmonary ventilation function and patient comfort in daily activities.
3. For Patients: The application of these breathing exercises is expected to provide tangible benefits, including increasing respiratory muscle strength, improving lung function, reducing shortness of breath, and helping patients become more independent in performing daily activities.
4. For Future Researchers: This research can serve as a reference for further studies with broader designs, larger sample sizes, or longer intervention durations, so that the results can be more generalized and provide stronger evidence regarding the effectiveness of breathing exercises in COPD patients.

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