Indonesian Journal of Global Health Research
Volume 6 Number S4, August 2024
e-ISSN 2715-1972; p-ISSN 2714-9749
http://jurnal.globalhealthsciencegroup.com/index.php/IJGHR

THE EFFECTIVENESS OF FORWARD LEANING POSITION AND PURSED LIP BREATHING ON DYSPNEA IN PATIENTS WITH LUNG DISEASE

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ABSTRACT

Dyspnoea is the most common and distressing symptom of lung disease, and it causes uncomfortable feelings. Dyspnoea occurs in patients with lung diseases such as lung cancer, COPD, asthma and tuberculosis. Positioning that can reduce shortness of breath in COPD patients is the tripod position and breathing exercises, namely lip breathing exercises, which can affect oxygen saturation. The aim of study is to determine the effectiveness of the application of forward leaning position and pursed lip breathing on dypsnea in patients with lung disease. Pursed lips breathing exercises and a tripod position significantly improved symptoms of shortness of breath and strengthened respiratory muscles. To determine the effectiveness of applying the forward leaning position and pursed lip breathing for dyspnea in patients with lung disease. This research is quantitative with a quasi-experimental design with a pretest-posttest design approach without a control group design. The inclusion criteria for adult patients ≥ 18 years, patients with lung disease: COPD, Asthma, Tuberculosis and Lung Cancer and moderate to severe dyspnea at rest as measured by the Modified Borg Dyspnea Scale (MBDS ≥3). The number of samples was 30 people. The results of the analysis using the Wilcoxon Test and the results obtained were that providing a forward leaning position (FLP) and Pursed Lips Breathing (PLB) breathing exercises in patients with lung disease could significantly reduce the degree of dyspnea. The application of a combination of forward-leaning positions and pursed lips breathing exercises can have an effect on reducing the degree of dyspnea in patients.

Keywords: dyspnea; pursed lips breathing; leaning forward position; lung disease

First Received	Revised	Accepted
28 Juni 2024	30 Juni 2024	20 July 2024
Final Proof Received		**Published**
22 August 2024		25 August 2024

How to cite (in APA style)
Astuti, W., Sitorus, R., Herawati, T., Aryani, D. F., Pratiwi, T. Z., & Maemun, S. (2024). The Effectiveness of Forward Leaning Position and Pursed Lip Breathing on Dyspnea in Patients with Lung Disease. *Indonesian Journal of Global Health Research*, *6*(S4), 181-190. https://doi.org/10.37287/ijghr.v6iS4.4148.

INTRODUCTION

Dyspnea is the most common and distressing symptom of lung disease. It is the sensation of inability to get enough air and causes discomfort. Dyspnea is a prevalent patient complaint caused by organic or psychogenic factors (Isnainy & Tias, 2019). Shortness of breath commonly occurs in lung cancer and often worsens as the disease progresses. Tumor growth, secondary infections, complications, or cancer treatments can cause breathing difficulties. Treatment options for shortness of breath with lung cancer depend on its cause but may include medications (such as morphine), oxygen therapy, breathing exercises, and surgery (Dahlan, 2011). Several studies have indicated abnormal lung function and chronic lung impairments in previously treated TB patients, which may contribute to increased mortality as well. Despite adequate treatment, pulmonary tuberculosis (TB) can lead to chronic structural changes in bronchial and parenchymal tissues, including bronchiectasis and emphysematous,

along with residual anatomical and physiological symptoms, such as dyspnea and chronic cough (Dezube R., 2023).

Dyspnea is a significant issue for individuals with COPD and is often the reason to seek help. Continuous and progressive dyspnea also results in the inability of individuals to engage in activities. The symptoms should be regularly assessed in every COPD patient. Dyspnea is assessed by measuring lung function with spirometry and can be evaluated using the Modified Borg Scale (MBS) questionnaire or the Modified Medical Research Council scale (MMRC scale) (Fletcher et al., 1959; Hareendran et al., 2012; Hsu et al., 2013). Breathing exercises such as Pursed Lips Breathing are recommended to alleviate dyspnea symptoms. This simple and easy breathing strategy can make breathing more effective and reduce the respiratory rate. Additional benefits of pursed lips breathing include improving breathing patterns, releasing trapped air in the lungs, promoting general relaxation, maintaining the airway open longer, and longer exhalation (Elbehairy et al., 2018).

Managing oxygen saturation to prevent hypoxemia, hypoxia, and cyanosis can be achieved through non-pharmacological therapies such as positional adjustments and breathing exercises. Positional adjustments which alleviate dyspnea in COPD patients include the tripod position and breathing exercises, such as pursed lips breathing, which can influence oxygen saturation. The administration of pursed lips breathing exercises and the tripod position show significant improvements in alleviating breathlessness symptoms and strengthening respiratory muscles. Based on these results, it is recommended to establish this program as routine care in clinical settings when providing COPD management (Hairunisa & Amalia, 2020). A study by Khandagale et al., found that the combination of Pursed Lips Breathing (PLB) and salbutamol resulted in sustained bronchodilation effects and better control of asthma symptoms compared to salbutamol alone (Khandagale et al., 2014). The forward-leaning or tripod position, is a seating position in which an individual leans slightly forward with their arms supported on a table over the bed or their knees. This position can be utilised by individuals experiencing breathlessness, especially orthopnea, a type of dyspnea that occurs when lying down. Moving the individual out of the supine position alleviates the condition causing orthopnea, thus reducing the effort required for breathing by allowing for more significant chest expansion and enhancing the ability to use accessory muscles. In patients with dyspnea due to lung cancer, administering the tripod position can aid in lung expansion and provide a sense of relief. Research conducted by Montes et al. in 2018 found that the tripod or forward-leaning position can increase the use of additional inspiratory muscles but also decrease the use of the transversus abdominis/internal oblique, thereby enhancing thoracoabdominal movement (Lalwani et al., 2020).

Positional adjustments and breathing exercises to decrease dyspnea in COPD patients include the forward-leaning position and Pursed Lips Breathing exercises. The forward-leaning position (FLP) can help improve respiratory conditions (Hairunisa & Amalia, 2020). Giving patients a seated position with their back leaning forward at a 135-degree angle, with the head and arms supported on a table or with the arms supported by the thighs, effectively reduces dyspnea in patients with COPD (M., 2022). The forward-leaning position elevates the diaphragm and external intercostal muscles at an angle of approximately 45 degrees. The diaphragm is the primary inspiratory muscle, while the external intercostal muscles are additional inspiratory muscles. The earth's gravitational force acting on the diaphragm facilitates its contraction, causing it to move downward and enlarging the volume of the thoracic cavity by increasing its vertical length. Similarly, the gravitational force acting on the

external intercostal muscles facilitates the ribs to lift outward, further enlarging the thoracic cavity in the anteroposterior dimension (M., 2022).

Pursed Lips Breathing is a breathing exercise that focuses on the breathing process, performed calmly, to facilitate the trapped air release in the airways (M., 2022). Pursed lips breathing exercise is a breathing technique aimed at regulating the frequency and pattern of breathing, thus reducing air trapping, improving alveolar ventilation to enhance gas exchange without increasing respiratory effort, and coordinating the breathing rate for more effective breathing and reduced dyspnea (Montes et al., 2018). Pursed lip breathing is used as a non-pharmacological treatment for COPD because it can relieve breathlessness, reduce respiratory rate, restore diaphragm function, and alleviate anxiety disturbances (Isnainy & Tias, 2019). The technique involves lips impeding the outward flow of air and increasing the pressure in the oral cavity. Excessed pressure spreads to the narrowed airways and keeps them open. When the airways are kept open, the air quickly exits and reduces the respiratory muscle effort to alleviate the symptoms (Mohamed, 2019). The aim of study is to determine the effectiveness of the application of forward leaning position and pursed lip breathing on dypsnea in patients with lung disease.

METHOD

This quantitative study included a quasi-experimental design using a pretest-posttest without a control group design. We recruited 30 respondents and measured dyspnea level, respiratory rate, and oxygen saturation. Subsequently, the subjects will receive interventions involving the forward-leaning position and pursed lips breathing. After the intervention, dyspnea level, respiratory rate, and oxygen saturation measurements will be retaken. The instrument used is the Modified Borg Scale (MBS) to classify level of dyspnea. This instrument has undergone validity testing (0.972) and reliability testing (0.934) (El sayed, 2019). Inclusion criteria included adult patients (≥18 years old) diagnosed with lung diseases (COPD, Asthma, Tuberculosis, and Lung Cancer), experiencing moderate to severe dyspnea at rest, measured by the Modified Borg Dyspnea Scale (MBDS ≥3).

RESULTS

Characteristics of Respondents

Univariate analysis of respondent characteristics included age, gender, duration of illness, comorbidities, smoking history, primary disease, and use of bronchodilator medication. The analysis results indicate that the average age of the respondents is 50.7±15.01 (19-79) years old. Most respondents are male, comprising 19 individuals (63.3%). Most of the participants were diagnosed with Pulmonary Tuberculosis (TB), totalling 15 individuals (50%). Confounding variables of the respondents include smoking history, duration of illness, comorbidities, and bronchodilator medication use.Most respondents did not smoke (n=13 individuals;4 3.3%) and had suffered from the disease for 1 to 2 years (n=17 individuals; 56.7%). Furthermore, most respondents also experienced comorbid disease (n=17 respondents; 56.7%) and did not receive bronchodilators as medication (n=22 individuals; 77.3%) (Table 1).

Table 1.
Characteristics of Respondents (n = 30)

Characteristic	f	%
Age (mean±SD)	50.7 ±15.01	
Gender		
Male	19	63,3
Female	11	36,7
Underlying Disease		
Lung cancer	10	33,3
COPD	4	13,3
Asthma	1	3,3
Lung tuberculosis	15	50
History of smoking		
No	13	43,3
Mild	3	10
Moderate	6	20
Severe	8	26,7
Onset of disease		
1-2 year(s)	17	56,7
3-4 years	3	10
>5 years	10	33
Comorbid disease		
Yes	17	56,7
No	13	43,3
Bronchodilator medication		
Yes	8	26,7
No	22	77,3

Normality Test

A normality Test with Shapiro-Wilk for numerical data was conducted for the application of evidence-based nursing (EBN). The data included MBS Score, respiratory rate, and peripheral oxygen saturation, all of which are numerical types. The data analysis found that the variables MBS score, respiratory rate, and peripheral oxygen saturation have p-values < 0.005, indicating that the data is not normally distributed. Therefore, analysis was conducted using the Wilcoxon test.

Bivariate Analysis

Bivariate analysis was conducted to determine the effectiveness of administering the forward-leaning position and Pursed Lips Breathing exercises on dyspnea in patients with lung disease, with the assessment parameters being the Modified Borg Scale (MBS), Respiratory Rate (RR), and Peripheral Oxygen Saturation (SpO2).

Table 2.
The difference in MBS scores before and after Forward-Leaning Position (FLP) and Pursed Lips Breathing (PLB) exercise (n = 30)

Variable	Median (min-max)		P
	Pre-intervention	Post-intervention	
Score MBS	3-6 (4)	2-5 (3)	0.000
RR	22-44 (26)	18-40 (22)	0.000
SpO_2	95-99 (97)	96-100 (99)	0.000

There was a change in MBS scores, with 20 subjects experiencing a decrease, ten subjects remaining the same, and no subjects experiencing an increase. There was a significant difference in MBS score values before and after the application of Forward-Leaning Position (FLP) and Pursed Lips Breathing (PLB) exercises in reducing dyspnea ($p < 0.05$). There was also a significant change in RR values, with 28 subjects experiencing a decrease, two subjects remaining the same, and no subjects experiencing an increase ($p < 0.05$). Similarly, there was a significant improvement in SpO2 values, with 28 subjects experiencing a decrease, two subjects remaining the same, and no subjects experiencing an increase.

The MBS scores after the intervention, with the forward-leaning position and pursed lips breathing exercises, had a lower mean value than before (Figure 1).

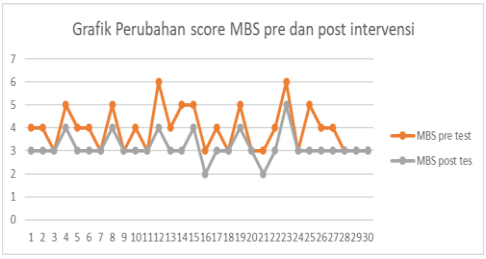

Figure 1. Graph of MBS Score Changes (n = 30)

The respiratory rate (RR) after the forward-leaning position and pursed lips breathing exercises have a lower mean value than before (Figure 2).

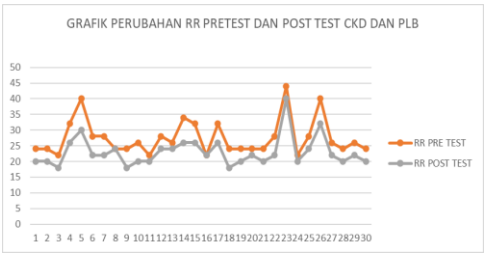

Figure 2. Graph of RR Value Changes (n = 30)

The oxygen saturation (SpO2) values after the forward-leaning position and pursed lips breathing exercises have a higher mean value than before (Figure 3).

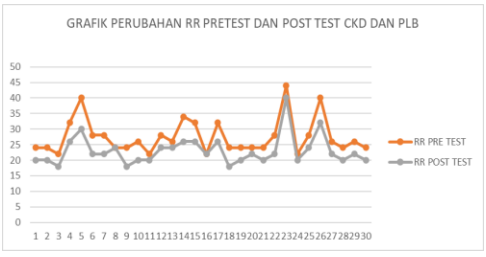

Figure 3. Graph of SpO2 Value Changes (n = 30)

DISCUSSION

With the demographic data, the average age of the patients is 50.7 years, this result same is the other study (Liu et al., 2023; Sundblad et al., 2013). This result aligns with the previous study (Isnainy & Tias, 2019). Most of the COPD study group in the control group receiving the intervention of the FLP and PLB are between 45 and 56 years old. This indicates that lung

function gradually declines with age, which leads to structural and physiological changes. The effects of ageing on the respiratory system are similar to those in other organs: maximum function gradually decreases. Age-related changes in the lungs include decreased peak airflow, reduced lung function parameters such as vital capacity, weakening of respiratory muscles, and reduced effectiveness of lung defence mechanisms (Ramadhani et al., 2021).

The respondents in this study are primarily male, comprising 19 individuals (63.3%). This result is consistent with Mohammed's study (Isnainy & Tias, 2019) that reported that most of their research participants were male (63.3%). Differences in gender in the prevalence, severity, and vulnerability to various lung diseases have been reported. While the causes of these differences have not been fully explained, they are related to biological factors (gender) such as the anatomy and physiology of the respiratory tract, chromosome contributions, genetics and epigenetics, and sex hormones with the onset and outcomes of lung diseases in men and women. This also suggests that sociocultural and environmental factors also influence different outcomes in lung diseases (Riteau et al., 2023; Ritianingsih, 2017).

The primary diseases among the respondents were pulmonary tuberculosis (TB), with 15 individuals (50%), and Lung Cancer, with 10 individuals (33.3%). This aligns with the high prevalence of Pulmonary TB in Indonesia, which is one of the countries with the highest TB burden in the world, with an estimated 845,000 cases and 98,000 deaths, or equivalent to 11 deaths per hour (Silveyra et al., 2021). Similarly, the prevalence of lung cancer remains relatively high. Based on WHO, lung cancer ranks third highest after breast cancer and cervical cancer (Singh et al., 2018). The majority of respondents are passive smokers, with 13 respondents (43.3%) having no history of smoking, while eight respondents (26.7%) have a history of heavy smoking. Pollutants, especially cigarette smoke, can cause lung damage, chronic inflammation, and mucus hypersecretion, leading to bronchial obstruction, alveolar wall disorder, and significantly impairing lung function (Siregar et al., 2021). Chronic exposure to cigarette smoke induces inflammatory substances causing increased contraction and proliferation of smooth muscle cells in the pulmonary blood vessels, increased pulmonary artery pressure, and remodelling of the pulmonary blood vessels. Thus, vasoconstriction of pulmonary blood vessels and inflammation contribute to the development of cardiovascular diseases. It is clear that cigarette smoke causes damage and dysfunction of the pulmonary blood vessels and airways (Sulistiyawati & Cahyati, 2019; WHO, 2020).

More than half of respondents (n=17; 56.7%) had experienced symptoms of their lung disease in the past 1-2 years. Most of them stated that they sought treatment after experiencing severe dyspnea, and upon examination, they were found to have chronic lung disease. Ten respondents have been suffering from the disease for more than five years. The duration of illness affects the quality of life and severity of the disease, especially in patients with COPD. In COPD, there is bronchiolar obstruction, which increases airway resistance and respiratory effort. Inspiration involves respiratory muscles actively, allowing air to pass through obstacles and enter the alveoli. However, expiration is a passive process based on lung elasticity. Because of the obstruction in COPD, air from inspiration can't be fully expelled, leading to residual air in the alveoli. The alveoli become overstretched, causing alveolar distension (air trapping) and resulting in breathlessness. Without treatment, the obstruction worsens over time and the symptom limits the patient's social and daily functions (Vatwani, 2019; Wahidati et al., 2019). Therefore, pharmacological and non-pharmacological treatments are needed to improve lung function and reduce symptoms in patients, thus improving the quality of life for patients with lung diseases.

Most respondents (n=19 individuals) have comorbidities, including hypertension, diabetes mellitus, HIV, nasopharyngeal cancer, and other cardiovascular diseases. Comorbidity refers to additional diseases that coexist with a primary diagnosed disease (Sarfati et al., 2016; Smith & Wrobel, 2014). Comorbidities commonly associated with COPD include cardiovascular diseases (hypertension, atrial fibrillation, ischemic heart disease, and heart failure), pulmonary pathology (pulmonary hypertension, lung cancer, pulmonary fibrosis, and pulmonary embolism), mental health conditions (depression and anxiety), metabolic syndrome diseases (diabetes mellitus, hyperlipidemia, osteoporosis, and obesity), and chronic kidney disease. Cardiovascular disease is the most common comorbidity in COPD patients, accounting for 64.4% (Widya, 2016; Zhang & Xu, 2020). The severity of lung disease tends to increase in the elderly and patients with comorbidities such as heart disease, diabetes mellitus, chronic lung disease, hypertension, and cancer (Häder et al., 2023; Joshi, 2024). Several studies have indicated that short-acting bronchodilator medications reduce dyspnea and lower dynamic hyperinflation due to expiratory flow limitation. Increasing the concentration of oxygen during inspiration enhances lung capacity by reducing dynamic hyperinflation due to decreased ventilation required and improving systemic oxygen delivery (Sikora et al., 2024). Twenty-two respondents did not receive bronchodilator therapy during treatment. Most were given nasal cannula oxygen. This condition makes it easier for researchers to assess the effectiveness of forward-leaning positions and Pursed Lips Breathing exercises in reducing dyspnea in patients with lung disease.

CONCLUSION

Dyspnea is the most common and distressing symptom of lung disease. It is the sensation of inability to get enough air to breathe and causes discomfort. Dyspnea is a very common complaint among patients, and it can be caused by organic or psychogenic factors. Shortness of breath commonly occurs in lung diseases and often worsens with advanced disease. Difficulty in breathing can be caused by tumor growth, secondary infections, disease complications, or specific cancer treatments. Treatment options for dyspnea depend on its cause but may include medications (such as morphine), oxygen therapy, breathing exercises, and surgery.The application of a combination of forward-leaning positions and pursed lips breathing exercises can have an effect on reducing the degree of dyspnea in patients. Patients can easily perform these exercises either in the hospital or at home, and they can be motivated to do so because they produce effects that can be felt immediately by the patient.

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