

# The effect of pursed-lips breathing and diaphragm exercises on the quality of life of COPD patient assessed by six-minutes walk test



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## ABSTRACT

**Introduction:** Chronic obstructive pulmonary disease (COPD) is a chronic inflammation that causes a variety of pulmonary and systemic disorders. Pursed-lip breathing and diaphragmatic breathing exercises are useful techniques for improving ventilation, reducing the degree of breathlessness, enhancing performance, and improving quality of life. The aim of this study was to determine the effect of pursed-lip breathing and diaphragmatic breathing exercise on the value of the 6-min walk test and to improve quality of life by SGRQ in stable COPD patients.

**Methods:** This study was an experimental study using group control before and after examining 60 stable COPD patients at Dr. RSUD Lung Center. Zainoel Abidin from November 2019 to February 2020. Samples were extracted by systematic random sampling and divided into two groups. The intervention group received indacaterol bronchodilator therapy in addition to four weeks of apron and diaphragmatic breathing exercises. The control group received only indacaterol therapy. A 6-minute walk test was administered and a quality of life questionnaire was completed using the SGRQ. A t-test and Wilcoxon test were performed to assess differences between groups, level of significance  $p < 0.05$ .

**Results:** There was a significant effect on the 6-minute walk test in the intervention group compared with the control group ( $p = 0.001$ ). There was a significant effect in improving quality of life using the SGRQ questionnaire in the intervention group compared with the control group ( $p = 0.001$ ).

**Conclusion:** There was a significant effect on the six-minute walking test in the intervention group compared to the control group. There was a significant effect on improving the quality of life using the SGRQ questionnaire in the intervention group compared to the control group.

**Keywords:** COPD, pursed-lips breathing, diaphragmatic breathing exercises, six-minute walk test, SGRQ.

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## INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a complex respiratory disorder characterized by limited airflow and increased response of chronic inflammation to the airway. The pathogenesis of COPD consists of an imbalance of inflammation-anti-inflammatory, protease-antiprotease, oxidant-antioxidant, and apoptosis as well. Those basic mechanisms not only occur independently but also interact with one another causing irreversible damage to the airway and lung leading to varied clinical symptoms of pulmonary and systemic events and also impacting many effects like decreased functional capacity and quality of life.<sup>1,2</sup>

The Global Initiative for Chronic

Obstructive Lung Disease (GOLD) guidelines have compiled standard therapy guidelines for COPD comprising pharmacological and non-pharmacological therapies. Pharmacological therapy includes the administration of bronchodilators, anti-inflammatory, antibiotics, antioxidants, and mucolytics. Moreover, non-pharmacological therapy consists of education, adequate nutrition, and pulmonary rehabilitation.<sup>3</sup>

Currently, non-pharmacological therapy in COPD patients is still not fully applied, although this therapy is effective enough to reduce the severity of breathlessness, to improve lung function and the quality of life among COPD patients so that they do not depend

on pharmacological therapy during mild breathlessness. The Indonesian Pulmonologist Association (PDPI) also recommends rehabilitation in COPD patients comprising of physical and breathing exercises. These exercises are effective in COPD like pursed lips breathing and diaphragmatic breathing exercises, which are useful for improving ventilation and synchronizing the thoraco-abdominal muscle for coughing and strengthening limb muscles.<sup>4,5</sup>

COPD patients experience weakness due to chronic hypoxia resulting in decreased cardiorespiratory function and functional capacity simply measured by a 6-minute walk test which is one of the tests to measure functional capacity impacting on clinical outcomes on the

further distance in accord with time, the greater the level of endurance reveals the better functional capacity. COPD patients experience reduced activity associated with reduced musculoskeletal work, respiratory, and cardiovascular impairment. Evaluation of the success and effectiveness of treatment in COPD is not only obtained through clinical parameters but also on the patient's subjective parameters like quality of life. Improved quality of life among COPD patients manifests with daily comfort, controlled psychological stress, and the impact of the disease. SGRQ (St George's Respiratory Questionnaire) is a questionnaire to determine the quality of life in patients with chronic diseases such as COPD.<sup>6,7,8</sup>

The effectiveness of pursed lips breathing and diaphragmatic breathing exercises in COPD has been widely reported. The results of Borge's 2014 study showed that there was a significant change in the quality of life among those with a 6-minute exercise test compared to the control group with bronchodilators alone. This study aimed to determine the effect of pursed lips breathing and diaphragmatic breathing exercises on the value of a 6-minute walk test as well as improvement of life quality assessed with SGRQ in stable COPD patients.<sup>9</sup>

This proved that pursed lips breathing and diaphragmatic breathing exercises are very simple measures. However, it is effective in improving lung function, reducing the severity of breathlessness, and improving the quality of life in COPD patients.<sup>10</sup>

## METHODS

### General Background of Research

In this study, we used an experimental study design with a control group before and after testing by systematic random sampling. Zainoel Abidin General Hospital (RSUDZA), Banda Aceh, Indonesia from November 2019 to February 2020. The population of this study were COPD patients who were controls at the RSUDZA respiratory clinic. stable COPD patients.

### Sample of Research

The selection criteria were stable COPD patients of GOLD II or III (40-75 years) who were willing to participate in the study,

as indicated by filling out and signing an informed consent form. Exclusion criteria were COPD patients with other lung dysfunctions (tuberculosis, asthma, lung cancer) and patients with limited physical activity caused by other disorders such as heart and musculoskeletal disorders. The independent variable for this study was intervention (PLB-DB) and the dependent variable was a 6-minute gait test. The investigator will determine the group treated (PLB-DB) and the control group. The interview was conducted to obtain personal and relevant data by completing St. George's Respiratory Quality (SGRQ). A 6-minute trial run was carried out on a 15 m x 60 cm track. Subject was asked to walk along the path as quickly as possible.

### Study Procedures

Subjects were given indacaterol bronchodilator in both control and intervention groups. In the intervention group of whom were taught to perform pursed lips breathing exercises and diaphragmatic breathing exercises. These exercises were accomplished 8 times for 20 minutes per training session and for 2 times a week for 4 weeks. The exercises were

carried out at the RSUDZA Pulmonary Polyclinic. The control group only received indacaterol-type bronchodilator therapy for 4 weeks. Four weeks later, the 6-minute walking exercise examination was carried out and a quality of life questionnaire measurement was carried out using SGRQ in both groups.

### Data Analysis

Statistical analysis was carried out by assessing the difference between the pre and post-results of the two groups as well as the difference in the mean value between the two groups using the Statistic Package for Social Sciences 20 (SPSS 20) with p value <0.05 statistically significant.

## RESULTS

The actual sample of the study was 60 people, consisting of 30 treatment groups and 30 control groups. Characteristics of respondents in Pulmonary Polyclinic at RSUDZA, all of respondents aged between 41-45 years as inclusion criteria. Based on the smoking history of all respondents in the intervention had a smoking history of 35 people (84%), and nutritional status in the intervention group was obtained 21

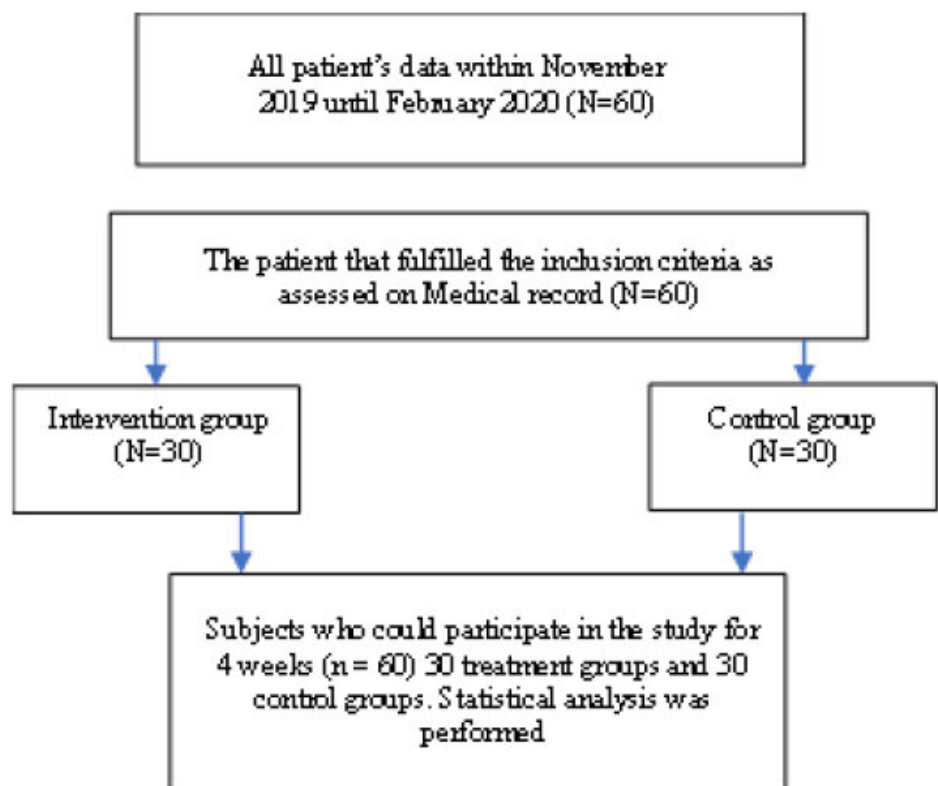


Figure 1. Study procedure.

(70%) people with normal, 3 (10%) people with malnutrition status, and 6 (20%) people with overweight status.

After undergoing both pursed lips breathing and diaphragmatic breathing exercises for four weeks, all subjects experienced an increase in the 6-minute walking test value from 361.20 meters to 408.07 meters and from 350.50 meters to 350.50 meters among the intervention group and the control group respectively. The results of the different test on the value of 6 minutes walking test with

paired sample T-test were significant differences ( $p < 0.001$  and  $p < 0.001$ ) among the control group and intervention group respectively. Although both groups showed improvement, the value of the 6-minute walk test tended to be greater in the intervention group than in the control group with a significant difference of 18.96 meters ( $p < 0.001$ ). This concluded that both exercises might increase the value of a 6-minute walk test among stable COPD patients.

## DISCUSSION

All subjects were male of whom the majority of COPD prevalence occurs mostly among men than women due to smoking as vulnerable factors for COPD disease. It often occurs in elderly people since impaired pulmonary function and individual immunity. Risk factors for COPD increase with age, as the cardiorespiratory system decreases physiologically found in lung, heart and blood vessels, leading to reduced elasticity of the lung parenchyma and chest wall

**Table 1. Baseline Characteristic.**

Variables		Group			
		Intervention		Control	
		N	%	n	%
Sex	Male	30	100	30	100
	Female	0	0	0	0
Age (years)	41-50	3	10	0	0
	Mean		59,8	62,57	
Smoking history	Ex-smoker	25	84	29	97
	Smoker	1	3	1	3
	Non-Smoker	4	13	0	0
Brinkman	NA	3	10	0	0
	Brinkman Index				
	Mild	6	20	2	6
	Moderate	17	57	14	47
	Severe	4	13	14	47
	Mean	362,00		523,47	
Nutritional status	Malnutrition	3	10	3	10
	Normal	21	70	20	67
	Overweight	6	20	7	23
Race	Acehnese Aceh	28	93	28	93
	Javanese Jawa	2	7	2	7

**Table 2. The effect of pursed lips breathing and diaphragmatic breathing exercises on the results of the six-minute walking test.**

Group	Treatment			p-value
	Pre Mean±SD	Post Mean±SD	Differences Mean±SD	
Intervention	361,20±45,55	408,07±47,09	46,86±15,15	0,000
Control	350,50±46,34	378,40±56,56	27,90±29,95	0,000
The difference between groups	10,70	29,67	18,96	0.001

**Table 3. Effect of pursed lips breathing and diaphragmatic breathing exercises on quality of life.**

Group	Life Quality			
	Pre Mean±SD	Post Mean±SD	Mean Difference ±SD	p-value
Intervention	58,71±6,76	51,35±6,20	7,36±1,86	0,000
Control	61,35±8,24	54,60±11,48	6,75±12,12	0,000
Difference between groups	2,64	3,25	0,61	0,001

resulting in difficulty in breathing. Lastly, it obstructed small airway manifested in expiratory flow. The prior studies revealed that the average of COPD patient was aged 60-70 years.<sup>10,11</sup>

Regarding smoking habits, most of the subjects were ex-smokers, namely 90%. Several systematic review studies and observational meta-analyses showed close relationship between COPD and smoking. Smoking is the main etiology of COPD containing 10 free radicals and noxious chemicals and other substances known as oxidants inducing inflammation and reducing lung function as well. Finally, smokers have higher risk for decreased pulmonary function.<sup>5,12</sup>

The nutritional status of the subjects of this study was generally good with average of body mass index (BMI) was 21. This is the simplest way to monitor nutritional status among adults in order to assess the excess and underweight. Regarding COPD, malnutrition increases mortality as it is correlated with worsened lung function and impaired blood gas analysis. Malnutrition has a detrimental effect on the structure, elasticity and function of the lungs, strength as well as resilience of the respiratory muscles.<sup>12,13</sup>

Pursed lips breathing and diaphragmatic breathing exercises are very effective methods for reconditioning the muscles of patients with COPD experiencing weakness due to chronic hypoxia. Both exercises may improve cardiorespiratory fitness and functional capacity assessed by 6-minutes walking test objectively measuring functional capacity. The clinical implication of 6-minute walk test is the longer the path referred to time basis. The greater the level of endurance and functional capacity of a person the lower activity associated with reduced musculoskeletal work, respiratory and cardiovascular disorders among COPD. They experience daily decreased functional capacity. The 6-minute walk test is simply analogue to daily physical activity, easy to do and simple method for assessing lung function as well as prediction of mortality and morbidity among COPD.<sup>14,15,16</sup>

This is accord with studies conducted by Casanova and Wiyono which found the effect of pursed lips breathing and

diaphragmatic breathing exercises were associated with combined changes in tidal volume and FEV1 and impact on functional capacity thereby increasing the ability to perform daily activities with increased lung function, heart, muscle strength, and cognitive function among COPD patients manifested with increase in the value of the 6-minute walk test predicting a simple method for assessing lung function, mortality and morbidity.<sup>17,18,19</sup>

The outcome of COPD is not only obtained through clinical parameters, but also on subjective parameters like quality of life assessing the comfort on controlling psychological stress and daily impact of disease. SGRQ is a questionnaire used to determine the quality of life in patients with chronic diseases such as COPD considered valid and reliable. The SGRQ consists of 50 questions divided into three domains of symptoms, activity, and impact. The overall scores are divided by the total score of 50 question items and multiplied by 100. The range of values on this scale is 1 to 100, the lower value obtained the better results achieved.<sup>8</sup>

The mechanism of shortness of breath in COPD patients is due to increased need for ventilation as hypoxia, hypercapnia, lactic acidosis, and airway obstruction occur leading to advanced phase in which systemic hyperinflammation happens manifested in respiratory muscle weakness and limb muscle weakness. These affect the quality of life among COPD patients worsening symptoms, psychological stress, or the cognitive impact. Maneuvers from pursed lips breathing and diaphragmatic breathing exercises are known to be able to reduce shortness of breath at rest by changing breathing patterns and increasing alveolar ventilation so that impact on improving the quality of life in COPD patients regarding symptoms, daily activities or ultimate impact of disease.<sup>8,20</sup>

Studies conducted by Shaji and Durado found that there was an effect of pursed lips breathing exercise for 4 weeks and diaphragmatic breathing exercise on reducing severity of shortness of breath, increasing FEV1, and improving quality of life in COPD. Pursed lips breathing exercises may help the patient to achieve more controlled and efficient ventilation

and to reduce the work of breathing, to increase maximal alveolar inflation and muscle relaxation, to relieve anxiety, and to eliminate uncoordinated patterns of activity of respiratory muscles. If the techniques are performed routinely and correctly, they optimize the mechanical function of the lung, limit the increase in the end-expiratory lung volume and prevent the effect of hyperinflation and ultimately will have a relaxing effect on the patient's breathing pattern.<sup>21,22</sup>

## CONCLUSION

All subjects had a significant increase in functional performance and quality of life after 4 weeks of exercise, as indicated by an increase in 6-minute gait test scores and a decrease in SGRQ with and without lip and diaphragmatic respiratory movements. The improvement in quality of life 6-minute gait test scores was greater in the intervention group with apron and diaphragmatic breathing exercises than in the control group ( $p < 0.001$ ). Also, both exercises to improve quality of life and a 6-minute gait test were effective and can be considered as additional COPD therapy. Further research is needed with larger sample sizes and more comprehensive designs.

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## CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

## AUTHOR CONTRIBUTION

All authors similarly contribute to the think about from the investigate concepts, information acquisitions, information investigation, factual investigations, changing the paper, until detailing the consider comes about through publication.

## ETHICAL CONSIDERATION

The investigators agreed to conduct this study in full agreement with the principles of the Declaration of Helsinki' and its subsequent related amendments.



This study was approved by the Ethics Committee of the Surabaya Islamic Hospital. Letter of exemption Ref. No. 1223/EC.KEPK/UMS/2020.

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