

The Effect of Pursed-Lip Breathing on Functional Capacity of Stable Chronic Obstructive Pulmonary Disease Patient Assessed by Six Minutes Walk Test

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Abstract

Background. The number of people with Chronic Obstructive Pulmonary Disease (COPD) in Indonesia is estimated to continue grow and currently has reached 4.8 million sufferers resulting in a large socio-economic burden. Management of COPD requires a comprehensive approach involving rehabilitation activities such as Pursed Lip Breathing (PLB) in order to increase the functional capacity of sufferers. Assessment of physical functional capacity of COPD patients can be evaluated through the Six Minute Walk Test / 6-minutes walk test, which can also assess changes in post-intervention functional capacity such as pulmonary rehabilitation programs.

Aims. This study aimed to determine the effect of pulmonary rehabilitation with PLB technique for 4 weeks on the achievement of distance through a six-minute road test in COPD patients who received standard therapy.

Methods. An experimental, Randomized Controlled Trial (RCT) study was conducted on stable COPD patients with classification of Global Initiative for Chronic Obstructive Lung Disease stage II (GOLD 2) and GOLD 3 (Stage III). The study was conducted at the *Rumah Sakit Khusus Paru* (RSKP) Respira Bantul, Yogyakarta. Subjects were taken randomly as a treatment Pursed Lips Breathing (PLB) or control group. The treatment group consisted of 38 subjects, doing PLB 8 minutes for 28 days (4 weeks) in a row. The placebo group consisted of 37 subjects only continuing the previous standard therapy. Six-minute walking test measurements were carried out in both groups before and after treatment and compared between the PLB and control groups. The difference in average delta range between groups that received PLB and controls was tested by unpaired t-test.

Results. There was a difference increase in the average delta range of the six-minute walk test which was not significant between the two study groups. The increase delta mean range in the six-minute walk test treatment group was greater (22.19 ± 45.54 meters) compared to the control group (18.54 ± 42.57 m), with a $P = 0.720$.

Conclusion. There was an improvement in functional capacity in the form of increased performance distance in the six-minute walk test for COPD patients who received standard therapy and pulmonary rehabilitation by pursed-lip breathing (PLB) technique.

Keywords. COPD, Pursed-Lip Breathing, Six-minute walk test

Abstrak

Latar Belakang. Jumlah penderita PPOK di Indonesia diperkirakan terus bertambah dan saat ini telah mencapai 4,8 juta penderita yang mengakibatkan dampak beban sosio-ekonomi yang besar. Penilaian kapasitas fungsional fisik penderita PPOK dapat dievaluasi melalui Uji jalan Enam Menit/6-minutes walk test, yang dapat pula menilai perubahan kapasitas fungsional pasca intervensi seperti program rehabilitasi paru.

Tujuan. Penelitian ini bertujuan untuk mengetahui pengaruh rehabilitasi paru dengan teknik PLB selama 4 minggu terhadap capaian jarak tempuh melalui uji jalan enam menit pada penderita PPOK yang mendapatkan terapi standar.

Metode. Penelitian eksperimental, Randomized Controlled Trial (RCT), yang dilakukan pada pasien PPOK stabil GOLD 2 dan GOLD 3. Penelitian dilakukan di Rumah Sakit Khusus Paru (RSKP) Respira Bantul, Yogyakarta. Subjek diambil secara acak sebagai kelompok perlakuan (PLB) atau kontrol. Kelompok perlakuan terdiri dari 38 subyek, melakukan PLB 8 menit selama 28 hari (4 minggu) berturut-turut. Kelompok plasebo terdiri dari 37 subyek hanya meneruskan terapi standar sebelumnya. Pengukuran uji jalan enam menit dilakukan pada kedua kelompok sebelum dan sesudah perlakuan dan dibandingkan antara kelompok PLB dan kontrol. Beda rerata delta capaian jarak antara kelompok yang mendapat PLB dan kontrol diuji dengan uji-t tidak berpasangan.

Hasil. Terdapat perbedaan peningkatan delta rerata uji jalan enam menit yang tidak bermakna diantara kedua kelompok penelitian. Peningkatan delta mean capaian jarak pada uji jalan enam menit kelompok perlakuan lebih besar ($22,19 \pm 45,54$ meter) dibandingkan dengan kelompok kontrol ($18,54 \pm 42,57$ m), dengan nilai $P=0,720$.

Kesimpulan. Terdapat perbaikan kapasitas fungsional berupa peningkatan jarak capaian pada Uji jalan enam menit penderita PPOK yang mendapatkan terapi standar dan rehabilitasi paru dengan teknik pursed-lips breathing (PLB)

Kata Kunci. Penyakit Paru Obstruktif Kronik, Pursed-Lips Breathing, Uji Jalan enam menit.

Introduction

Chronic obstructive pulmonary disease (COPD) is a chronic progressive pulmonary parenchymal disease that is still a global health problem. Based on data from the World Health Organization (WHO) the number of people with COPD in 2005 reached 80 million people. It is estimated that in 2020 COPD is the 5th out of 12 diseases with the most frequent occurrences in the world, and is the 3rd highest cause of death in the world.

Incidence of COPD in the United States in outpatients in hospitals ranges from 76.3%, and is the highest cause of death which is 53.8% compared to other lung diseases. In China in 2006, it was estimated that COPD sufferers reached 38.1 million. Southeast Asian countries such as Vietnam have a COPD incidence of 2 million, and in Indonesia there

are an estimated 4.8 million. This incidence will increase with the increasing number of smokers, because 90% of COPD sufferers are smokers or former smokers. Smokers in Indonesia alone in 2004 estimated an estimated 34.5% and 28.4% smoked every day.

According to the results of Riskesdas in 2010, that the prevalence of smokers in the Special Region of Yogyakarta (DIY) was 31.6% and as much as 66.1% still smoked in the house, and the percentage of smoke-free households in DIY only reached 44.6%. Data from Yogyakarta Respira Hospital reported a significant increase in the number of outpatient COPD patients in 2015, which totaled 1598 patients and increased to 2495 patients until October 2016.

COPD is a pulmonary disease with the characteristics of limited breathing flow that is persistent, progressive and is associated with an increase in the chronic inflammatory

response of the airway and lungs. Chronic inflammation due to certain particles and gases found in cigarettes, further resulting in changes in the structure and narrowing of the airway in patients with COPD.

Patients with COPD will experience increased resistance to air flow, air trapping and pulmonary hyperinflation which results in decreased lung ventilation function. This situation requires an intervention in the form of medical rehabilitation to improve ventilation function.

Rehabilitation of people with COPD can increase physical functional capacity and improve quality of life. Rehabilitation of people with COPD consists of three components in the form of physical, psychosocial and breathing exercises. Good physical exercise and breathing can reduce and control shortness of breath. One breathing exercise technique is pursed-lip breathing (PLB), where the PLB training technique activates the abdominal muscles during expiration, and increases gas exchange and oxygen saturation in the arteries. Purse-lip breathing is expected to improve breathing patterns, increase tidal volume and reduce shortness of breath, thereby increasing the functional capacity of people with COPD. This study aims to determine the effect of pulmonary rehabilitation with PLB techniques for four weeks on the results of the six minute walk test in patients with COPD who get standard therapy.

Methods

This study used an experimental research design, Randomized Controlled Trial (RCT), an open label conducted at Respira Special Hospital (RSKP) Yogyakarta, Jl. Panembahan Senopati No.4 Yogyakarta between October

2016 - February 2017 and December 2017 - February 2018. The target population of this study was stable COPD patients. The affordable population of the study was COPD patients who were controls in the pulmonary outpatient clinic RSKP Respira.

Inclusion criteria were stable COPD patients with age of GOLD II or III, had received routine therapy for at least 3 months and were willing to take part in the research as evidenced by filling out and signing informed consent. Exclusion criteria were COPD patients aged > 70 years, liver, kidney, pleural effusion, pulmonary tuberculosis, post-tuberculosis obstruction syndrome, lung malignancy, bronchial asthma, angina pectoris Canadian Cardiovascular Society (CCS) III, angina pectoris unstable, history myocardial infarction in the past 1 month, stroke with sequel, arthritis in acute conditions, joint injury of pelvis, genu and ankle. The drop out criteria in this study were subjects experiencing acute exacerbations (increased tightness, increased sputum production, sputum discoloration) during the study period or require an increase in drug dosage, do not meet the minimum compliance requirements to run a PLB and do not experience a 10-15% reduction in pulse after doing PLB. Subjects said to be compliant if within 4 weeks or 28 days, PLB is run at least 80% or 22 days.

The independent variable in this study was PLB and the dependent variable was the six-minute walk test. Researchers determine the groups that received treatment (PLB) and control. PLB groups given PLB exercises until the subjects done it correctly. Subjects were required to do PLB for 8 minutes every day for 4 weeks. Research data in the form of numerical data were presented in mean numbers and standard intersections. Statistical analyzes

performed by the unpaired T-test were used to assess differences in clinical characteristics between the PLB and control groups.

Results

The actual sample of the study were 75 people, consisting of 38 treatment groups and 37 control groups. The basic characteristics of the study subjects were the effect of pursed-lip breathing (PLB) on a six-minute walking test for 4 weeks in COPD patients including age, sex, weight (BB), height (TB), body mass index (BMI), routine therapy being undertaken and the results of spirometry examinations which include FEV₁/FVC for the diagnosis of COPD, FEV₁, FVC and predictive FEV₁ status to determine the severity of COPD severity.

The diagnosis and severity can be made by measuring FVC and FEV₁ with spirometry. This measurement serves to measure the speed of lung function in breathing air. The FEV₁ / FVC ratio can be used to determine the degree of airway obstruction. COPD sufferers have a FEV₁ / FVC ratio <0.7 (GOLD, 2015). The severity of COPD is then determined based on FEV₁ and FEV₁ predictions as in table 2 (GOLD, 2015).

Table 2. Classification of Severity of Airflow Obstacles in Patients with COPD

GOLD Category	Patients with FEV ₁ /FVC < 0.70	
	Severity level	FEV ₁ Measurement
GOLD 1	Mild	FEV ₁ ≥ 80% prediction
GOLD 2	Moderate	50% ≤ FEV ₁ < 80% prediction
GOLD 3	Severe	30% ≤ FEV ₁ < 50% prediction
GOLD 4	Very Severe	FEV ₁ < 30% prediction

Sources: GOLD, 2015

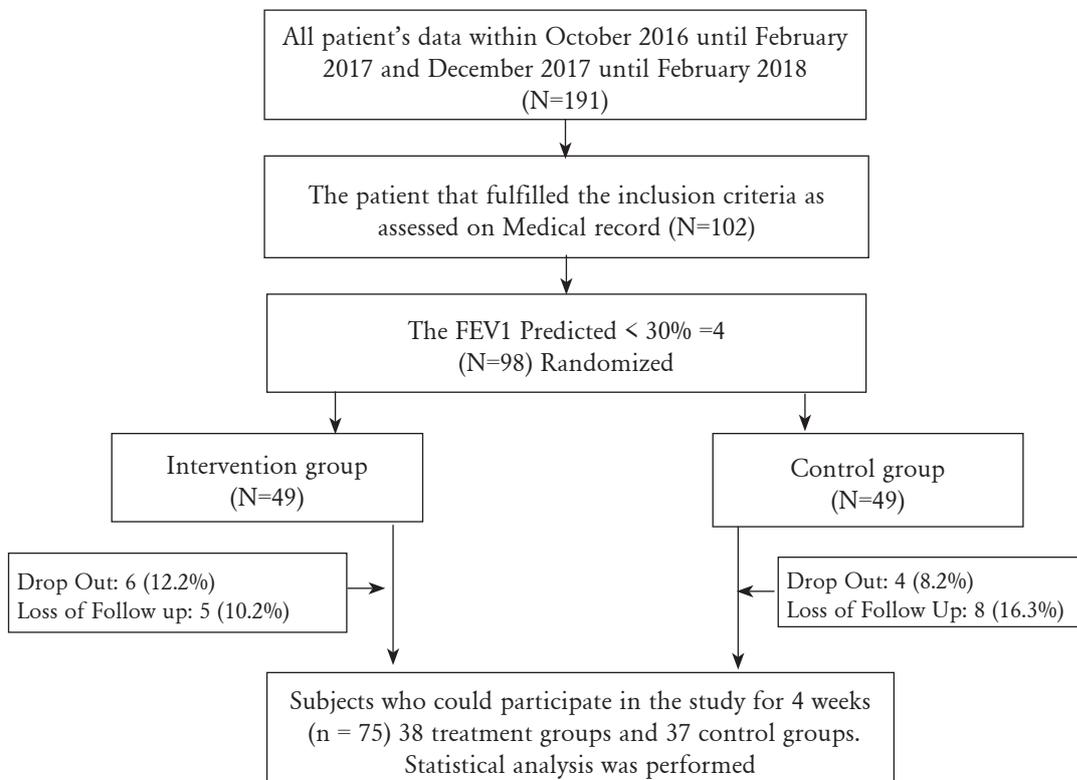


Figure 1. Study procedure

Table 1. Baseline Characteristic

Variable	Group		P Value
	Control (n = 37)	Intervention (n = 38)	
Sex			
Men, n (%)	24 (64.9 %)	30 (78.9 %)	0.427 ^c
Age, Years (mean ± SD)	64.78 ± 8.11	62.73 ± 7.88	0.307 ^b
Weight, Kilograms (mean ± SD)	53.18 ± 9.69	54.86 ± 10.58	0.468 ^a
Height, Metre (mean ± SD)	1.59 ± 0.06	1.6 ± 0.07	0.357 ^b
Body Mass Index (BMI) Kg/m ² , (mean ± SD)	21.06 ± 3.67	21.24 ± 3.41	0.822 ^a
Routine Medication, n (%)			
Bronchodilator	8 (21.6%)	10 (26.4%)	0.593 ^c
Bronchodilator and Steroid	29 (78.4%)	28 (73.6%)	
Spirometry			
FEV ₁ , Litre (mean ± SD)	0.96±0.34	0.97±0.32	0.912 ^b
FVC, Litre (mean ± SD)	1.64±0.49	1.63±0.47	0.96 ^b
FEV ₁ /FVC (mean ± SD)	60.69 ± 6.99	57.17 ± 9.48	0.130 ^b
FEV ₁ prediction (mean ± SD)	52.93 ± 14.6	54.27 ± 13.55	0.83 ^b
Smoking Status			
Smokers	26 (70.30%)	26 (68.42%)	0.506 ^c
Non-smokers	11 (29.70%)	12 (31.58%)	

The treatment group consisted of 30 men (78.9%) and 8 women (21.1%) while the control group consisted of 24 men (64.9%) and 13 women (35, 1%). The mean age of the treatment group was 62.73 ± 7.88 years, while the control group was 64.78 ± 8.11 years. The mean weight of the treatment group was 54.86 ± 10.58 kg and the control group was 53.18 ± 9.69 kg, the average height of the treatment group was 1.6 ± 0.07 m and the control group was 1.59 ± 0.06 m, and the mean body mass index (BMI) of the treatment group 21.24 ± 3.41 kg / m² and the control group 21.06 ± 3.67 kg/m².

After obtaining the mean value of each variable before and after treatment, to assess the significance of the changes between the two study groups, an unpaired T-test was performed on the variable mean variable between the two groups. Researchers measure the achievement of the distance that can be

traveled by subjects by conducting a six minute walk test. The value of the six-minute walk test variable obtained from the measurement results in each study subject both the treatment and control groups are presented in the form of a mean and standard deviation both before treatment and after treatment.

Table 2. The Changes of Test Variable for the Six-Minute Walk Before and After Treatment

Group	Control	Treatment	p
Δ mean IMT	-0.2 ± 0.6	-0.09 ± 0.54	0.464
Δ mean FEV ₁	-1.34 ± 8.05	2.78 ± 11.29	0.012
Δ mean six-minute walk	18.54 ± 42.57	22.19 ± 45.54	0.720

The unpaired T test, p value <0.05 was considered statistically significant difference

An assessment of the change in mileage achieved using the Six Minute Road Test showed that there was a change in the mean

mileage that greater in the treatment group compared to the control, which was obtained Δ (delta) the average mileage in the treatment group was 22.19 ± 45.54 meters compared to the control group of 18.54 ± 42.57 meters. The difference in mileage obtained used this six-minute walk test was not statistically significant, $p = 0.720$.

The final evaluation of the distance achieved after treatment in the Six Minute Walk Test showed a significant difference ($P = 0.009$) between the Control group (224.86 ± 37.60) against the treatment group (255.43 ± 58.04).

Discussion

The Global Initiative for Chronic Obstructive Lung Disease (GOLD) in 2015 showed a higher prevalence of COPD in men compared to women. This is consistent with the findings obtained in this study, where as many as 54 people (72%) of the research subjects were male and the remaining 21 people (28%) were female with an average age of the study subjects aged over 60 years.

Smoking is still a major cause of COPD, both active smoking and passive smoking. According to the results of Riskesdas in 2010, that the prevalence of smokers in the Special Region of Yogyakarta (DIY) was 31.6% and as much as 66.1% still smoked in the house, and the percentage of smoke-free households in DIY only reached 44.6%. In this study, 26 control subjects (70.30%) and 26 treatment subjects (68.42%) were smokers.

This study shows the results of differences in distance between the control group and the treatment group who received PLB breathing exercises for 4 weeks. It can be seen (Table 2)

that the change in the mean distance of the control group is smaller than the treatment group (Δ the average distance of the control group is 18.54 ± 42.57 meters and the treatment group is 22.19 ± 45.54 meters), but the difference is statistically not significant ($p = 0.720$). The results of a comparison analysis of the average post-PLB distance achievement in the control group (224.86 ± 37.60 meters) to the treatment group (255.43 ± 58.04 meters) in this study showed a significant increase of $P = 0.009$.

The results of this study are in accordance with research conducted by Bhat *et al.* (2012) involving 14 patients with stable COPD with moderate to severe degrees, found a significant increase in the results of distance on the six-minute walk test on study subjects who received PLB with a mean of 34.9 ± 26.4 m ($p = 0.002$).

Based on the factors that affect the examination of the six-minute walk test described by Papathanasiou *et al.* (2013), according to the researchers' observations motivational factors become one of the factors that influence the achievement of the distance generated by research subjects. Researchers see a lack of motivation in research subjects to undergo a six-minute walking test in earnest, because research subjects immediately want to complete the routine control process done every month. A systematic review study by Roberts *et al.* (2009) on the use of PLB in stable COPD, showed the benefits of a four-week PLB program as evidenced by the decrease in the index of congestion of research subjects when undergoing a six-minute Road test, and an increase in the quality of life index in the PLB program for 12 weeks. Randomized-Controlled Trial (RCT) Research by Nield *et al.* (2007) also showed that the PLB group had a

significant development after 12 weeks of PLB intervention on the symptoms of spasms and function performance through a six-minute walk test and SF-36.

The PLB technique is proven a simple method that can be done in conjunction with all activities, without any restrictions related to medication and instrumentation. The benefits of the PLB program appear to be significant after being given for 12 weeks when compared to the PLB program for 4 weeks, this shows that the benefits of PLB therapy are highly dependent on the continuous training process.

Conclusion

There was a significant increase in distance in the Six Minute Road Test for COPD patients who received standard therapy and pulmonary rehabilitation with pursed lips breathing technique (PLB) compared to those who only received standard therapy before and after treatment. However, there was no significant difference in the difference in the distance of the achievement of the Six Minute Walk Test between before and after treatment in groups of COPD patients who received standard therapy and pulmonary rehabilitation with pursed-lips breathing technique (PLB), compared to patients who only received standard therapy before and after treatment.

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