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Research

Differences in the Effect of the Combination of Home-Based Walking Exercise and Pursed Lip Breathing with Pranayama Exercise on Increasing Lung Capacity in COPD Conditions

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ABSTRACT

Background: Data from the pulmonary disease polyclinic at Bangil Hospital showed that there was an increase in Chronic Obstructive Pulmonary Disease (COPD) patient visits. In 2018 the number of COPD patients who visited the pulmonary disease clinic for the last 3 months was 219 COPD patients. COPD patients experience deficits in caring for themselves due to various symptoms that manifest as a manifestation of the development of COPD disease. The purpose of this study was to determine the differences in the effect of the combination of home based walking exercise and pursed lip breathing with pranayama exercise on increasing lung capacity in COPD conditions.
Subjects and Method: The design of this study is a two-group pre and post-test design. As many as 8 respondents to the pursed lip breathing intervention and home based walking exercise and 8 respondents to the pranayama exercise according to the inclusion and exclusion criteria This study compared the effect of Walking Exercises combined with Pursed Lip Breathing and Pranayama Exercise on increasing lung vital capacity in COPD patients. The independent variable is lung capacity. The dependent variable is home-based walking exercise and pursed lip breathing This research was conducted once a week for 12 weeks in May-August 2021 at Dungus Madiun Lung Hospital. All categories were analyzed using MannWhitney run on SPSS.
Results: The results before being given the combination of pursed lip breathing and home-based exercises (Mean= 95.39; SD=0.70) compared to after being given the combination of pursed lip breathing and home-based exercises (Mean= 98.08; SD= 1.23) and statistically significant p <0.001 increases lung capacity in COPD conditions. The results before being given pranayama exercises (Mean= 95.83; SD= 0.71), after being given pranayama exercises (Mean= 97.54; SD= 0.81) and statistically significant p<0.001 increased lung capacity in COPD conditions. score in the elderly was 32.57 (Mean=32.57; SD=4.49).
Conclusion: There is an effect of giving a combination of home-based walking exercises and pursed lip breathing in increasing the lung capacity of COPD patients. There is an effect of giving pranayama exercise in increasing the lung capacity of COPD patients.

Keywords: home-based walking exercise, pranayama exercise, pursed lip breathing, lung capacity

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BACKGROUND

Chronic obstructive pulmonary disease (COPD) is a preventable and treatable disease (GOLD, 2017). Chronic Obstructive Pulmonary Disease (COPD) is a chronic lung disease that causes airflow limitation in the

lungs resulting in impaired lung function. Decreased lung function occurs due to chronic inflammation of the proximal, peripheral, and pulmonary vascular airways. This condition results in decreased ventilation function in the lungs, and the patient will experience an increase in respiratory rate with prolonged expiration (Black and Hawks, 2014).

Chronic Obstructive Pulmonary Disease (COPD) is a disease that ranks fourth as the cause of death in Indonesia. COPD ranks first in the lung disease group in Indonesia with a morbidity rate (35%). The increase in the incidence of COPD is due to aging of the population and exposure to risk factors COPD. COPD is a common preventable and treatable disease with characteristic respiratory symptoms and consequent persistent airflow limitation by airway and alveolar abnormalities usually caused by particulate exposure hazardous or significant gas.

Characteristics of COPD patients as much as 80.6% are male, and as many as 66.7% are aged 51-70 years (Tarigan and Juliandi, 2018). The results of other studies showed concordance in as many as 60.96% of patients COPD is male (ROSHA, 2017). Most COPD patients (>53%) have a history of smoking (Huriah and Ningtias, 2017; Tarigan and Juliandi, 2018). Slightly different from the results of other studies that showed that 45.89% of COPD patients did not have smoking habits (ROSHA, 2017). The condition of insufficient oxygenation in COPD patients will have a negative impact on quality his life. The results of previous studies showed that 43.3% of COPD patients experienced a poor quality of life bad (Ritianingsih, 2017). The results of other studies show the difference that as much as 71.92%. COPD patients experience a good quality of life (ROSHA, 2017)

The report from the Global Initiative for Chronic Obstructive Lung Disease (GOLD, 2020) states that in 2010 as many as 384 million people or around 11.7% of the world's population were sufferers COPD has a death rate of up to three million people each year. In 2011, COPD was recorded as the third leading cause of death in the United States and by 2030, it is estimated that the death rate from COPD will increase to 4.5 million people each year (GOLD, 2020). The World Health Organization (WHO) in the 2015 Global Status of Non-communicable Diseases explained that COPD is the 4th largest non-communicable disease in the world which has a high mortality rate after ischemic heart disease, stroke, and lung cancer. Globally, it is estimated that around 3 million deaths were caused by this disease in 2015 i.e., 5% of all deaths worldwide in that year. More than 90% of COPD deaths occur in developing countries with weak economies.

Pursed Lips Breathing is used to achieve more controlled and efficient ventilation. This technique can stimulate relaxation and coordination of the respiratory muscles and help maximize the expulsion of air during expiration. Thus, the accumulation of air volume in the lungs can be reduced and ventilation becomes stable. This condition causes the respiration rate to decrease (Hartono, 2015). Supported by the results of research conducted by Surya P. Bhatt et al, (2013) showing that the use of Pursed Lips Breathing (PLB) in patients with stable COPD can increase exercise capacity and reduce respiration rate (RR) (Bhatt et al., 2013).

Walking exercises that are carried out independently at home can gradually increase tolerance in carrying out activities and improve the health status of COPD patients (Matos-Garcia et al., 2017). Home-based walking exercise is easy to implement at

home and does not require special costs and equipment. When compared to cycle training, walking exercise is more significant in increasing endurance walking time by 279 seconds (Leung et al., 2010).

Pranayama exercise is the expansion and control of breathing or controlling breathing consciously. Pranayama exercise creates an atmosphere of relaxation of the conscious mind in a deeply relaxed state. When the body begins to relax, breathing will become slow and deep so that the expansion of the thoracic cage can be maximized, the air that is inhaled and exhaled is maximal, the volume in the lungs increases so that there is an increase in vital capacity (Worby, 2007).

SUBJECTS AND METHOD

1. Study Design

The design of this study is a two-group pre and post-test design. The study compared the effect of Walking Exercises combined with Pursed Lip Breathing and Pranayama Exercise on increasing lung vital capacity in COPD patients. This research was conducted once a week for 12 weeks in April-June 2021 at Dungus Madiun Lung Hospital.

2. Population and Sample

Data collection for this study was carried out in outpatient and inpatient polyclinics for pursed lip breathing interventions, home based walking exercise and pranayama exercise. Respondents were mild COPD patients. The sampling technique is a total sampling of six-teen respondents. The researcher collected data from 8 respondents to the pursed lip breathing intervention and home-based walking exercise and 8 respondents to the pranayama exercise according to the inclusion and exclusion criteria

3. Study Variables

The independent variable is lung capacity. The dependent variable is home-based walking exercise and pursed lip breathing.

4. Operational definition of variables

Lung Capacity is the volume of air in the lungs upon the maximum effort of inspiration.

Home-based walking exercises are walking exercises performed at home independently.

Pursed lip breathing is a technique that allows people to control their oxygenation and ventilation.

5. Study Instruments

The measuring instrument used in this study was a spirometer which was used to measure vital capacity (VC). Spirometry is a pulmonary function test that is useful for differentiating between restrictive lung disease and for determining the degree (mild, moderate, or severe) of obstructive or restrictive lung disease. So far, it has been known that there is a relationship between vital lung capacity values with age, height, and gender.

6. Data analysis

This research is a quasi-experimental research with two group pre-test and post-test group design. Effect of Pursed Lip Breathing Combination with Home Based Walking Exercise and Pranayama Exercise on Lung Capacity using the Mann Whitney test, Different test post-test for the Pursed Lip Breathing group with Home Based Walking Exercise and the Pranayama Exercise group used an unpaired t test because the data was normally distributed. The data obtained processed and analyzed using the IBM SPSS 20.

7. Research Ethics

This proposal has been submitted and approved by the Research Ethics Committee of Faculty of Medicine, University of Muhammadiyah Surakarta with ethical clearance number 3570/B.2/KEPK-FKUMS/VI-/2021.

RESULTS

1. Sample Characteristics

Based on the characteristics of the sample in table 1, it shows that there are 5 female subjects with a percentage of 62.50%, 3 female subjects with a percentage of 37.50%. Age 31-40 amounted to 1 person with a percentage of 12.50%, aged 41-50 amounted to 5 people with a percentage of 62.50%, and aged 51-60 amounted to 2 people with a percentage of 25%.

2. Bivariate Analysis

Table 2 shows the results before being given the combination of pursed lip breathing and home-based exercises (Mean= 95.39; SD= 0.70) compared to after being given the combination of pursed lip breathing and home-based exercises (Mean= 98.08; SD= 1.23) and statistically significant p <0.001 increases lung capacity in COPD conditions. The results before being given pranayama exercises (Mean= 95.83; SD= 0.71), after being given pranayama exercises (Mean= 97.54; SD= 0.81) and statistically significant p<0.001 increased lung capacity in COPD conditions. score in the elderly was 32.57 (Mean=32.57; SD=4.49).

Then, to find out which group is better seen from the different means before and after the treatment of each group. The group that had a higher mean difference before and after treatment than the other groups was better at increasing lung capacity. In this study, the group that had a higher mean differential was Group 1 or the home-based walking exercise and pursed lip breathing group with a result of 7.225 and statistically significant p<0.001.

Table 1. Sample characteristics

Characteristics	Category	Frequency	Percentage
Gender	Male	5	62.50%
	Female	3	37.50%
Age	31-40 years	1	12.50%
	41-50 years	5	62.50%
	51-60 years	2	25%

Table 2. Changes In Lung Capacity Pre and Post the Combination of Pursed Lip Breathing and Home-Based Exercises with Pranayama Exercises

	Combination Of Pursed Lip Breathing and Home-Based Exercises			Pranayama Exercises		
	Mean	SD	p	Mean	SD	p
Pre	95.39	0.70	0.001	95.83	0.71	0.001
Post	98.08	1.23		97.54	0.81	

Table 3. Difference In Lung Capacity Pre and Post the Combination of Pursed Lip Breathing and Home-Based Exercises with Pranayama Exercises

Variable	n	Mean Rank	p
Pursed lip breathing and home-based walking exercises	8	7.22	< 0.001
Pranayama exercises	8	2.94	

DISCUSSION

1. Effect of Pursed Lip Breathing and Home-Based Walking Exercise on Lung Capacity

From the research that the researchers have done, the results show that there is an effect of pursed lip breathing and home-based walking exercise on lung capacity values. The results of the Mann Whitney pursed lip breathing test and home-based walking exercise on the level of the lung capacity of 8 respondents showed p<0.000, so from the Mann-Whitney test results it can be interpreted that there is an influence between pursed lip breathing and home-based actions walking exercise on increasing lung capacity values in mild COPD patients.

COPD is motivated by several pathological conditions such as chronic bronchitis, emphysema, and asthma chronic In chronic bronchitis there is enlargement of the bronchial mucous glands, goblet cell metaplasia, inflammation, hypertrophy of respiratory smooth muscle and distortion due to fibrosis. Bronchial epithelium long term inflammation with mucous gland hypertrophy and increase goblet cell count. There is also damage to cilia and mucociliary movement, mucus viscosity, and secretion increases, which will then cause obstacles to expel it (expectoration disorder). Enlargement of the mucous glands can be caused by infection, and Recurrent inflammation can cause irreversible structural damage to the wall airway. This damage will cause injury and make the peripheral airway experience narrowing and inhibition. This condition can develop into a duct obstruction severe breathing, which is then called COPD.

The results of this study are supported by Budiono and Mustayah (2017) which states that there is a significant effect of pursed lip breathing on increasing lung capacity values. This is also in line with Sri et al. (2018), which stated that pursed lip breathing is effective in increasing the respiration rate value in COPD patients. Pursed lip breathing is a breathing exercise by compressing the lips which aims to slow expiration, prevent the collapse of the lung units, and help the patient to control the respiratory rate and depth of breathing so that the patient can achieve control of dyspnea. Pursing the breathing lips helps COPD sufferers to empty the lungs and slow down the breathing rate. Pursed Lip Breathing helps to restore the position of the diaphragm which is the breathing muscle that is located under the lungs. Pursed Lip Breathing also causes the stomach muscles to contract during expiration, this forces the diaphragm upwards, and helps to empty the lungs, as a result, COPD sufferers will breathe more slowly and more efficiently (Smeltzer and Bare, 2013).

In line with Wootton et al., (2014) Q1 quality and a PEDro score of 8/10 shows the conclusion that Ground-based walking training can improve the quality of life of patients with moderate to severe COPD. This is shown in the decrease in the Saint George Respiratory Questionnaire (SGRQ) score. Domain symptoms at baseline (Mean= 56; SD= 22) and at study completion (Mean= 41; SD= 14). Domain activity limitations at baseline (Mean= 63; SD= 19) and at study completion (Mean= 59; SD= 18). Domain impact on baseline (Mean= 33; SD= 18) and on study completion (Mean= 27; SD= 14). SGRQ total score at baseline (Mean= 47; SD= 17) and at study completion (Mean= 41; SD= 14). Also shown in the increase in Chronic Respiratory Questionnaire (CRQ) scores. Domain dyspnoea at baseline (Mean= 16; SD= 5) and at study completion (Mean= 19; SD= 5). The fatigue domain at baseline (Mean= 17; SD= 6) and at study completion (Mean= 19; SD= 5). Domain emotional function at baseline (Mean= 35; SD= 8) and at study completion

(Mean= 37; SD= 7). Domain mastery at baseline (Mean= 21; SD= 5) and at study completion (Mean= 22; SD= 5). Total CRQ score at baseline (Mean= 89; SD= 19) and at study completion (Mean= 97; SD= 18). Limitations in this study were patients with mild COPD category not included, therefore, researchers cannot easily expand study findings to this group. In addition, this study did not have any gaps from all objects that were given therapy.

Bhatt et al., (2013) shows that Pursed lips breathing can reduce dyspnea in a subjective sense, and can reduce RR during the recovery period after doing Pursed lips breathing. In addition, PLB increases functional exercise tolerance thereby reducing the work of breathing for the same effective level of effort in reducing shortness of breath. However, it may present with increased diaphragmatic activity leading to markedly increased muscle activity, compensating for reduced subjective perception of dyspnea. The advantage of this study is measuring diaphragm movement during PLB in real time using ultrasonography. The limitation of this study is that it was not intention-to-treat.

2. Effect of Pranayama Exercise on Lung Capacity

From the research that the researchers have done, the results show that there is an effect of Pranayama Exercise on lung capacity. The results of the Pranayama Exercise test on the oxygen saturation level of 8 respondents showed $p<0.001$, so from the Mann-Whitney test results, it can be interpreted that there is an influence between the pranayama exercise action on increasing the value of lung capacity in COPD patients.

The results of this study are supported by Sinambela et al. (2015), based on this study a significant effect was found between pranayama exercise on increasing lung capacity in the group of respondents with mild degrees of COPD. According to the Minister of Health of the Republic of Indonesia in 2009, pulmonary rehabilitation can be in the form of physical exercise and breathing exercises.

The pranayama breathing technique controls the breath and the mind. This exercise can strengthen the respiratory system, calm the nervous system, and can strengthen the immune system. The real benefits that can be felt from this exercise are reduced fatigue, and calm thoughts and emotions (Worby, 2007).

Pranayama is done by regulating and controlling the breath. Breath control consists of setting the length and duration of inhalation (inhalation) length and the duration of exhalation (exhalation), as well as breathing stops. The average respiratory frequency reaches 16-18 times per minute in normal people, by doing yoga breathing exercises the breath speed will become slower and each breath in and out will be longer and fuller. This condition is called deep breathing and will enable existing energy to move to reach the cells. This exercise uses deep breathing relaxation exercises, slow deep breathing, and pursed lip breathing. But this pranayama practice uses another form of practice, namely breathing using one nostril and incorporating elements of spirituality at the end of the exercise (Worby, 2007).

The mechanism of yoga breathing exercises (pranayama) for the physical changes that occur in the body begins with the creation of an atmosphere of conscious relaxation which systematically leads to a deeply relaxed state. The creation of an atmosphere of relaxation will eliminate the voices in the mind so that the body will be able to release muscle tension. When the body begins to relax, the breath becomes slow and deep, so that the respiratory system can rest. Slowing the rhythm of brea-

thing will make the heart beat slower and have a positive effect on the entire circulatory system. The sympathetic nervous system will react to relaxation while the parasympathetic nervous system will respond to relaxation. In addition to the sympathetic nerves, messages for relaxation are also received by the endocrine glands which are responsible for most of the emotional and physical states (Worby, 2007).

During forced respiration exercises, the chest and lungs are maximally contracted and relaxed and the muscles work to their maximum capacity. It is supported that forced respiration exercises without holding phases can also strengthen the respiratory muscles and increase the elasticity of the chest and lungs by increasing some of the ventilation functions of the lungs (Grover et al, 1998).

The position in pranayama is done in padmasana, which is a sitting asana position with legs crossed by placing one foot or two feet on the opposite thigh. Padmasana provides a natural position for the spine and upper body and provides a strong and stable position. In the upright position, the diameter of the main airways increases gradually and the diaphragm is maximally expanded, the anteroposterior dimension of the thorax is greatest and the pressure on the heart and lungs is lowest. In this position, the diaphragm is neutralized by increasing breathing (Unnati et al, 2014).

3. Differences in Oxygen Saturation Values Between Pursed Lip Breathing and Home-Based Walking Exercise with Pranayama Exercise

From the research that the researchers have done, the results show that there are differrences in oxygen saturation values between respondents who have done pursed lip breathing and home-based walking exercises and respondents who have done pranayama exercises. The results of the Mann-Whitney test of post-pursed lip breathing and home-based walking exercise lung capacity on pranayama exercise in 8 respondents showed $p<0.001$, this means that there is a difference in lung capacity values between pursed lip breathing and home-based walking exercise and pranayama exercise. Both interventions had the same effect on increasing oxygen saturation values but there were differences in the range of increase in lung capacity before and after the intervention. In the pursed-lip breathing and home-based walking exercise intervention group, the average lung capacity before the intervention was 95.39% and after the intervention, the average oxygen saturation value was 98.08%, which means there was an increase of 2.69%. Whereas in the pranayama exercise intervention group the average lung capacity value before the intervention was 95.83% and after the intervention, the average lung capacity value became 97.54% which means there was an increase of 1.71%.

The results of this study are supported by Suryantoro et al., (2017), that pursed lips breathing and home-based walking exercise with Pranayama Exercise are equally able to increase FEV1 values with results showing that the average FEV1 post-test in the pursed lips breathing group was greater than in the pranayama exercise group. This is because pursed lips breathing is more able to train the respiratory muscles to extend expiration and increase airway resistance during expiration, thereby reducing airway resistance and trapped air, as well as shortness of breath. This is because pranayama exercise does not directly train to breathe such as pursed lips breathing which helps COPD sufferers to exhale more efficiently as shown by prolonged expiration. Pranayama exercise to be able to increase FEV1 must go through several processes, starting from increasing O2 intake obtained from physical

activity to the formation of ATP as a material for respiratory muscle contractions to produce forced expiration (Sherwood, 2012). From the theory above, it can be concluded that both pursed lip breathing, home-based walking exercise, and pranayama exercise can increase lung capacity values in mild COPD patients, although the results are not the same. So both pursed lip breathing and home-based walking exercises or pranayama exercises can be applied to patients suffering from mild degrees of COPD to increase lung capacity values.

Pursed lip breathing (PLB) is a treatment that can reduce dynamic hyperinflation as according to Ferracini Cabral et al., (2015) Q1 quality and PEDro5/10 score said that PLB can help reduce dynamic hyperinflation, increase SPO2, exercise tolerance in COPD patients by reducing peak expiratory flow (PEF) when doing PLB. Several studies have also reported that PLB can affect the breathing patterns of COPD patients at rest. In addition to the reduction in respiratory rate (RR) and increase in tidal volume (TV), there is also a decrease in the inspiratory duty cycle (Ti/Tot) during PLB, indicating that the inspiratory muscles experience a longer rest period between muscle contractions during PLB. PLB works on the breathing pattern by prolonging expiration, reducing functional residual capacity, and increasing ventilation efficiency. The limitations of this study are that there is no explanation regarding the criteria for COPD patients according to GOLD, and in this study no intention-to-treat was carried out.

This study concluded that there is an effect of giving a combination of home-based walking exercise and pursed lip breathing in increasing lung capacity COPD patients with a value of $p<0.001$, There is an effect of giving pranayama exercise in increasing the lung capacity of COPD patients with $p <0.001$.

The combination of home-based walking exercise and pursed lip breathing has more effect on increasing lung capacity than pranayama exercise with the mean difference in group I 7.22 and group II 2.94 (7.22 > 2.94).

AUTHOR CONTRIBUTION

Nurul Fithriati Haritsah as the main character of the research who chooses the topic, conducts searches and collects data in this study, compiles research articles. Farid Rahman played a role in conducting, data analysis and reviewing research documents, and Noerdjannah as the author of the research report.

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CONFLICT OF INTEREST

There is no conflict of interest.

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