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The Effectiveness of Ballon Blowing Exercise on Increasing Expiratory Forced Volume Value in 1 Second (FEV1) and Oxygen Saturation among COPD patients

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Abstract. Balloon-blowing exercise is a breathing technique that is used to reduce breathlessness and improve lung expansion. This study explains the difference in effectiveness balloon blowing exercise to the increase in value FEV1 and *oxygen saturation in COPD patients.* This study used a quasi-experimental design with a pre-test post-test study; the study population was patients with COPD in Taman Husada Bontang hospitals. Consecutive sampling techniques do sampling following the inclusion criteria, with a total of 20 patients. Intervention balloon blowing exercise performed three times per week within four weeks. The results showed that there are positive effects on FEV1 (p-value= 0.001) and oxygen saturation (p-value 0.02). Balloon-blowing exercise could increase in value FEV1 and oxygen saturation in patients with COPD.

Keyword: balloon blowing exercise, forced expiratory volume, oxygen saturation, COPD

INTRODUCTION

Obstructive Chronic Disease (COPD) is a disease on progressive airflow, which associated with a chronic inflammatory response with parenchymal breathing due to gas or harmful substances. Exacerbations and comorbidities contribute to serious illness. Characteristics of flow transfer in COPD is caused by a combination of airway obstruction

and varying parenchymal damage of each individual due to chronic inflammation which causes a decrease in the relationship of alveoli and airways and pulmonary recoil elasticity (1)

The inflammation and luminal exudate were associated with decreasing the expiratory volume in 1 second (FEV1) and FEV1 / FVC ratio. Decreased FEV1 is a typical sign of COPD. Airway obstruction causes hyperinflation. Hyperinflation increased the functional residual capacity, specifically during exercise (dynamic hyperinflation). The hyperinflation that develops at the onset of the disease is the leading cause of dyspnea's onset during exercise (2).

The impact was compounded by the habit of COPD sufferers who were forced to lean their shoulders forward and involuntarily bend their shoulders. Therefore, one of the efforts that can be made to increase FEV1 values starts from enhancing the ability of inspiration by using breathing exercises that are wrong using balloon exercises that increase the amount of FEV1 and oxygen saturation in COPD patients (3). There has been no research on the effectiveness of balloon blowing against forced expiratory volume in 1 second (FEV1) and oxygen saturation in COPD patients.

COPD patients will overcome fatigue, productive cough, improve walking, and do daily activities (WHO, 2017). The typical effect of COPD patients is narrow complaints with various characteristics. People with COPD are aware of the difficulty of walking while doing sports. This has increased over the years, getting worse. Longer runs in lighter activities, daily activities such as housework (1).

Clinical effects in COPD patients due to changes in lung function, alveolar damage, inflammation of the bronchi, and damage to the terminal bronchiole walls can obstruct the terminal bronchioles. At the time of inspiration, air can enter the alveoli. When the wind is trapped, and there is an accumulation of air, it causes expiration and changes in other lung functions such as gas, gas distribution, gas diffusion, and perfusion of blood to be moved (4)

The emergence of difficulties that occur in patients with COPD causes a decrease in individuals' ability to carry out daily activities, thereby increasing the quality of life of a person. The higher the degree of COPD suffered by the patient, the better the quality obtained will be. A stimulus is needed to help patients adjust their physical condition and improve the expected quality (2)

OBJECTIVE

The study aimed is to examine the effectiveness of balloon blowing exercise to the increase in value FEV1dan *oxygen saturation* in COPD patients.

METHOD

A quasi-experimental study with one group pre and post-test design was applied in this study. The study population was patients with COPD in Taman Husada Bontang hospitals. Twenty samples were selected by using the consecutive sampling technique. This study protocol has been passed the test of conduct, with "Ethical Approval" No. 1366- KEPK. The intervention balloon blowing exercise performed three times per week, for four weeks. Before the exercise, respondents were first given video training modules and served as guides in fulfilling exercise. Patient measurements value FEV1dan *oxygen saturation* and after four weeks of administration of the intervention (post-test). Measuring of FEV1 with a spirometry and oxygen saturation by a pulse oximeter. Data were analyzed using paired t-test.

RESULTS

Characteristic of respondents

Table 1 showed the characteristics of respondents. Most respondents have age 56-65 years, amounting to 10 respondents (50%) who are elderly. Gender characteristics, all of which are 20 respondents (100%) male. Characteristics of education, the highest number of respondents, was elementary school, amounting to 19 respondents (47.5%). Job characteristics, mostly eight respondents (40%), are private and self-employed. Based on GOLD criteria, 8 (40%) of respondents classified as moderate COPD. Body mass index (BMI) is mostly a total of 14 respondents (70%) in the normal category. While smoking history demographic data, all 20 respondents, 100%, have a history of smoking.

Variables	*F*	*%*
Age		
Age 46-55 years	4	20
Age 56-65 years	10	50
Age ≥ 65 years	6	30
Gender		
Man	20	100
woman	0	0
Education		
No school	0	0
Elementary school	10	50
Junior high school	2	10
High School	8	40
Work		
Does not work	1	5
Retired	3	15
Private	8	40
entrepreneur	8	40
GOLD criteria		
FEV1≥80% predicted	0	0
50% ≤FEV1 <80% predicted	8	40
30% ≤FEV1 <50% predicted	6	30
FEV1 <30% predicted	6	30
Body mass index (BMI)		
≤ 18.5 (kg / m2)	3	15
18.4 to 24.9 (kg / m2)	14	70
25 to 29.9 (kg / m2)	3	15
> 30 (kg / m2)	0	0
Smoking history		
Smoke	20	100
Do not smoke	0	0

The mean difference of the value of forced expiratory volume in 1 Second (FEV1) before and after receiving the balloon blowing exercise

Table 2 shows the mean difference in the value of forced expiratory volume in 1 Second (FEV1) before and after receiving the balloon blowing exercise**.** The BBE group, the FEV1 value tends to increase by 1.248 liters. The BBE group showed that after testing the data analysis using paired t-test in the BBE, groups obtained p 0.001, which showed a significant difference in the increase in FEV1 after BBE training with a value of p <0.05.

Table 2. The mean difference of the value of forced expiratory volume in 1 Second (FEV1) before and after receiving the balloon blowing exercise

Variables	Group	Pre-Test	Post-Test		
		Mean ± standard deviation	Mean ± standard deviation	Δ	*p-value*
FEV1(% Prediction)	BBE	± 40.9505 15.3708	41.7020 ± 13.547	1.248	0,001

The mean difference of oxygen saturation values before and after administration of intervention balloon blowing exercise

Table 3 shows that in the BBE group, the value of oxygen saturation increased by 0.800 percent. The BBE Group showed that after testing the data analysis using paired t-test in the BBE, the group obtained p 0.002 which showed a significant difference in the increase in oxygen saturation after BBE training with a value of p <0,05

Table 3. Oxygen saturation values before and after administration of intervention balloon blowing exercise

Variables	Group	Pre-Test	Post-Test		
		Mean ± standard deviation	Mean ± standard deviation	Δ	*p-value*
Oxygen saturation	BBE	96.8000 ± 0.89443	97.3500 ± 1.13671	0.8000	0,002

DISCUSSION

Forced expiratory volume in 1 second (FEV1) in COPD patients

The results showed a difference in effectiveness between balloons blowing exercise and the increase in value FEV1 in COPD patients. The treatment group experienced a mean increase in FEV1 after administration exercise balloon blowing based on the average value of the pre-test and post-test. The increase in FEV1 was marked by an increase in FEV1 scores on pulmonary function tests by using spirometry.

The results are consistent with other research showing that breathing exercises affect the increased forced expiratory volume in 1 second (FEV1) (5). Balloon blowing is a simple exercise that creates lung capacity by blowing several balloons every day. Blowing a balloon moves the intercostal muscles responsible for spreading and lifting the diaphragm and rib cage. This allows the lungs to exchange gas as the gusts begin. The blowing balloon, while effectively exercising the lungs' ability to expand and take in the air, does not affect the size or number of alveoli in the lungs (5).

The effectiveness of balloons blowing for 10 or 15 could increase lung capacity and improve the lungs' ability to maintain adequate oxygen supply. Thus, the airways become open, with back pressure airway and evacuation process expiratory air volume for the better (6). Spending more CO2 due to an increase in end-expiratory volume increasing in tidal volume (7). A decrease in respiratory rate also occurs due to time adjustment and ventilation-perfusion (8). Changes in physiological effects on the use of breathing techniques in balloon-blowing exercise cause an increase in intra-abdominal pressure during expiration, thereby increasing the bronchial diameter, thus increasing the flow of inspiration and expiration (9).

Intraabdominal positive influence can prevent the collapse of the bronchi during the expiratory phase (10).

The research results have shown that the majority of respondents are 55-65 years of age (11) at that age included in the elderly category. The age factor is estimated to affect lung function in a person. This is due at the time of the elderly as a process of aging of the mark with the declining stages of various structures and functions of cells, tissues, and organ systems (12). Pulmonary organs in the elderly are also a decline in service, so that the examination of lung function using spirometry showed a decrease in FEV1.

The results showed the patients' total male sex, and most have a history of smoking. Respondents with male gender and had a history of smoking are estimated to result in a decrease in lung function (13). This is in line with the statement of the Global Initiative for Chronic Obstructive Lung Disease that gender and smoking history is a risk factor in a person's COPD (1). This statement is in line with research conducted (14). The research showed that a history of smoking and male gender affects the ratio of FEV1 / FVC (15).

In this research exercise balloon blowing, performed regularly with regular frequency and mentoring one workout per week, while the second and third practice patients performed independently by assisting the family. The final result of the research showed an increase in FEV1 in the intervention group. The rise in FEV1 showed success in the treatment of patients themselves.

Based on the data tabulation FEV1 in the group balloon blowing exercise workout, 14 respondents also experienced an increase in FEV1. This is because doctors and nurses in Taman Husada Bontang hospitals provide pharmacological therapy and health education in COPD patients undergoing outpatient treatment. The education was provided by advising patients on medication adherence based on recipes from a doctor. Prompts for quitting smoking, eating a balanced diet, not too strenuous activity, and doing light activities according to the patient's ability.

The increase in FEV1 in COPD patients showed the patients have a good prognosis (11,16–18). This is due to the improvement in lung function. Improvement in lung function demonstrated achievement of one come out in the implementation of nursing care. In this case, the patient can perform self-care by doing a balloon-blowing exercise independently of an increase in FEV1.

Oxygen Saturation among COPD patients

The results showed that there was a difference in effectiveness between balloons blowing exercise to the increase in value oxygen saturation in *COPD patients. The results of this study indicate that before* balloon blowing exercise workout, the lowest oxygen is 95% and the highest 99%, where the majority of respondents' oxygen saturation stands at 96%. If people with COPD have never done balloon blowing exercise workout, the function of the muscles of respiration is not going well (19). Thereby reducing ventilation and oxygenation, and its result becomes congested uncontrolled (20). Patients who routinely perform breathing exercises can positively affect the development of his lungs (21). Breathing exercises are designed to improve the function of the muscles of respiration, increase ventilation, and oxygenation (1).

Balloon blowing exercise improving working intercostal muscles responsible for developing the respiratory expansion, lifting the diaphragm and ribs (15). This allows oxygen diffusion to occur when inspiration and removes carbon dioxide when expiration (22). Balloon blowing exercise effective to improve the ability of the lungs to expand and take in the air (23), does not affect the size or the number of alveoli contained in the lungs (24). The

alveoli are air sacs that emit carbon dioxide during respiration and oxygen into the blood during inhalation (3).

CONCLUSION

In conclusion, there is an effect of giving balloon-blowing exercise training to increase FEV1 values and oxygen saturation in COPD patients.

RECOMMENDATION

Some recommendation was suggested for nursing practice as follows:

a. Patients with COPD are expected to comply with the pharmacological treatment program and continue to do balloon-blowing exercises regularly, using the exercise instructions following the module.
b. Hospitals are generally expected to improve nursing services that are not only focusing on pharmacological therapy. Physical exercises and breathing control should also accompany pharmacologic treatment. Balloon blowing exercise workout quickly applied to patients with COPD.
c. A hospice nurse is expected to use intervention balloon blowing exercise workout as an independent nursing intervention provided to patients with COPD.

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