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ACTIVE CYCLE OF BREATHING TECHNIQUE (ACBT) AGAINST PEAK EXPIRATORY FLOW IN COPD PATIENT

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ABSTRACT

COPD patients often experience the accumulation of secretions in the respiratory tract. To overcome the buildup of secretions in the respiratory tract, the Active Cycle Of Breathing Technique (ACBT) can be applied to the respiratory tract and increase the value of peak expiratory flow. This study aims to determine the effect of active cycle of breathing technique therapy (ACBT) therapy on peak expiratory flow in COPD patients. This research is a Pre-experimental type research that uses a One Group Pretest-Posttest design with the provision of ACBT intervention done 1x on the respondent. Instruments in evaluating lung function lung function of this study using the Peak Flow Meter. The sample in this study amounted to 30 respondents who had been selected through purposive sampling based on inclusion and exclusion criteria by researchers. Data analysis technique data in this study using the Paired T-Test test with the help of the SPSS program. Before being given ACBT intervention, the average value of peak respiration flow was found to be 83.67 lpm and after the ACBT intervention, the average value of peak flow of respiration was found to be 185.00 lpm. The results of statistical test analysis using Paired T-test obtained the results of p-value obtained 0.000 < α0.05 then there is a difference in the average value of peak expiratory flow before and after ACBT in patients with Chronic Obstructive Pulmonary Disease. This study concludes that there is a significant effect of the application of the Active Cycle of Breathing Technique (ACBT) intervention on the value of peak respiration flow in COPD patients.

Keywords

Active Cycle of Breathing Technique, COPD, Peak Expiratory Flow

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is one of the non-communicable diseases that is still a health problem in the world and has a high mortality rate after heart disease, stroke, cancer, and diabetes mellitus (Adiana & Maha Putra, 2023). COPD is a disease that can be prevented and treated. COPD patients often experience a buildup of secretions in

the respiratory tract. The buildup of secretions in the airways causes a decrease in the peak expiratory flow rate. In an effort to overcome the problem of secretion buildup in the respiratory tract, the Active Cycle Of Breathing Technique (ACBT) can be applied so that it can loosen the airway and increase the value of peak expiratory flow (SHEN et al., 2020).

According to data reported by the World Health Organization (WHO), COPD is still the third cause of death in the world after heart disease, stroke, and COPD which caused the death of 3.23 million people in 2019 (WHO, 2024). Based on research data at Dr. Wahidin Sudirohusodo Mojokerto Hospital in 2023, the number of patients with Chronic Obstructive Pulmonary Disease (COPD) problems is 785 people. A research study conducted by researchers as many as 3 COPD patients complained of shortness of breath, cough experienced by patients with/without sputum production. A total of 3 COPD patients, the average peak expiratory current value is 100 L/minute, indicating an obstruction of the airway.

Smoking is one of the factors causing the occurrence of COPD cases which accounts for 70% of cases and is also followed by the air pollution factor which is a factor in the formation of COPD (WHO, 2024). Until now, the awareness of the Indonesian people about the dangers of smoking is very low, as evidenced by the very high level of cigarette consumption. The high level of cigarette consumption can cause health problems for both active and passive smokers. Health problems due to cigarettes most often occur in the lungs, namely COPD consisting of asthma, bronchitis, emphysema (Pahlawi et al., 2022)

COPD itself is characterized by obstruction in the airway due to difficulty in removing sputum. Sputum buildup in the airways can lead to dyspnea (Hanifah & Hisni, 2023). COPD patients often experience complaints in the form of shortness of breath, productive cough with sputum, limited activity due to decreased lung capacity. This condition causes the function of the peak expiratory current (APE) to decrease due to disturbances in the movement of air in and out of the alveoli (Zuriati & Suriya, 2020) . Lungs that are inflamed by pollutants and cigarettes cause narrowing in the airways. Chronic inflammation often causes fibrotic changes and scarring. When the scar tissue is damaged, the normal elastic lung recoil disappears and the lungs collapse. Collapsed lungs cause hyperinflation and decreased expiratory flow rate (Samuel, 2019).

The need for intervention to reduce shortness of breath so as not to lead to more severe conditions and even death. Efforts are made to reduce shortness of breath in COPD patients, namely by giving pharmacological but non-pharmacological therapy. Pharmacological therapy in COPD patients is the administration of bronchodilators, corticosteroids, and combination inhalation. Meanwhile, non-pharmacological therapy is by giving warm drinks, chest physiotherapy, effective cough, and Active Cycle Of Breathing Technique (ACBT) (Rusminah & Agung P, 2023). ACBT is an active breathing technique to clean the airways, especially in a person with lung disease which is characterized by excessive sputum production that causes obstruction of the airways. In addition, excess sputum buildup causes infection and inflammation of the airways. This ACBT technique can reduce sputum so that it can loosen the airway due to excess sputum accumulation (Pratama, 2021). In addition, this ACBT technique is more effective in helping the process of restoring lung function including the patient's peak expiratory flow (Ardiansyah et al., 2021).

Based on the above problems, the author is interested in researching the effect of the use of active cycle of breathing technique (ACBT) therapy on the peak expiratory flow in COPD patients.

METHOD

This study is a Pre-experimental type of research that uses a One Group Pretest-Posttest design with the provision of ACBT intervention carried out 1x on the respondents. The instrument in evaluating lung function from this study uses the Peak Flow Meter tool which is carried out before and after the application of ACBT therapy. The population of this study was all COPD patients on the first day of treatment in the Jayanegara infectious inpatient room at Wahidin Sudiro Husodo Hospital, Mojokerto City. The sample in this study is 30 respondents who have been selected through a purposive sampling technique based on inclusion criteria and exclusion criteria by the researcher. The inclusion criteria in this study are COPD patients aged 16 years – 45 years, patients with cough complaints and patients with oxygen support devices attached. Meanwhile, the exclusion criteria in this study are patients who have used bronchodilator therapy.

The data analysis technique in this study uses the Paired T-Test with the help of the SPSS program. This research has passed the ethics test and obtained ethical feasibility from the health research ethics commission of the Institute of Science Technology and Health Insan Cendekia Medika Jombang with letter number No.191/KEPK/ITSKES-ICME/IX/2024.

RESULTS

1. Characteristics of Respondents

Table 1. Frequency Distribution Based on Respondent Characteristics

Characteristics of Respondents	Frequency F	%
Age		
16-25	4	13,3
26-35	5	16,7
36-45	21	70,0
Gender		
Male	23	76,3
Female	7	23,1
History of lung disease		
Dyspnea	15	50,0
Emfysema	15	50,0
Smoking History		
Yes	24	80,0
No	6	20,0
Total	30	100,0

Source: Primary Data, 2024

The results of table 1 show that almost all respondents are male as many as 23 respondents (76.3%). The age of the respondents was mostly 36-45 years old, as many as 21 respondents (70.0%). The history of pulmonary disease in some respondents had a history of dyspnea as many as 15 respondents (50.0%) and had a history of emphysema as many as 15 respondents (50.0%). Smoking history was obtained almost all respondents had a smoking history of 24 respondents (80.0%).

2. Peak Expiratory Flow Rate Before *Active Cycle of Breathing Technique* Therapy

Table 2. Peak Expiratory Flow Rate Before Active Cycle of Breathing Technique Therapy

Variable	Mean	Median	Standar Deviasi	Min-Max	95% CI	
					Lower	Upper
Peak Expiratory Flow Before ACBT	83.67	80.00	22.967	60-150	75.09	92.24

Source: Primary Data, 2024

The results from table 2 show that the value of the peak expiratory current before ACBT is obtained with a minimum value of 60 L/min and a maximum value of 150 L/min. The result of the average value of peak respiration current was obtained of 83.67 with a standard deviation value of 22.967.

3. Peak Expiratory Flow Rate After *Active Cycle of Breathing Technique* Therapy

Table 3. Peak Expiratory Flow Rate After Active Cycle of Breathing Technique Therapy

Variable	Mean	Median	Standar Deviasi	Min-Max	95% CI	
					Lower	Upper
Peak Expiratory Flow After ACBT	185.00	175.00	83.869	100-450	154.06	215.94

Source: Primary Data, 2024

The results from table 3 show that the value of the peak expiratory current after ACBT is obtained with a minimum value of 100 L/min and a maximum value of 450 L/min. The result of the average value of peak respiration flow was obtained of 185.00 with a standard deviation value of 83.869.

4. Normality Test

Table 4. Normality Test

	Kolmogorov-Smirnov		
Variable	**Statistic**	**df**	**Sign.**
Pretest	1.260	29	0.083
Posttest	1.067	29	0.205

Source: Primary Data, 2024

The results of table 4 show the results of the normality test using the Kolmogorov-Smirnov statistical test which obtained a pretest significance value of 0.083 and posttest of 0.205 so that it can be concluded that the data is normally distributed.

5. Effect of *Active Cycle of Breathing Technique* on Peak Expiratory Flow

Table 5. Effect of Active Cycle of Breathing Technique on Peak Expiratory Flow

Variable	Mean		diff	95% CI		*P Value*
	Pre	Post		Lower	Upper	
Expiratory Peak Flow	83.67	185.00	-7.613	-128.557	-74.109	0.000

Source: Primary Data, 2024

The results of table 5 show that the results of the statistical test using the Paired T-Test obtained a value of 95% Confidence Interval at a lower value of -128,557 and an upper value of -74,109, meaning that there is a difference before and after ACBT with a difference value of -7,613. The result of the p-value was 0.000 < α 0.05, so it can be concluded that there is a difference in the

average value of peak expiratory flow before and after ACBT in patients with Chronic Obstructive Pulmonary Disease.

DISCUSSION

Peak Expiratory Flow Rate Before *Active Cycle of Breathing Technique* Therapy

The results showed that the value of the peak expiratory flow before the Active Cycle of Breathing Technique (ACBT) was carried out with an average value of 83.67 with a standard deviation value of 22.967. Peak expiratory flow (APE) is the achievement of the highest airflow during the expiratory process and there is a change in the shape, size and volume of the airway that continues to enlarge. This peak expiratory current is used to assess the ventilation capacity of the lungs that depends on the effort to achieve the highest expiratory (Singhal et al., 2022).

Reduction in APE values is often found in patients with Chronic Obstructive Pulmonary Disease (COPD) due to decreased ventilation due to respiratory obstruction that causes lung collapse. Patients with COPD often experience hypoxemia, hypoxia and hypercapnea which cause airflow throughout exhalation to decrease resulting in depression at the peak of expiratory flow (Agreta et al., 2023). In addition, a decrease in peak respiratory flow is often caused by several factors, namely age, and smoking history. The results of the study found that most of the respondents (70.0%) were 36 – 45 years old. Age causes a decrease in the value of PEA, this is because the older the age will experience a decrease in body function, especially the weakening of the function of the respiratory muscles to the occurrence of atrophy which can increase the resistance to the airway so that the maximum expiratory flow decreases (Astuti, 2022).

Another factor that causes a decrease in APE value is a history of smoking. The results of the study have been obtained that almost all respondents (80.0%) have a history of smoking. The content of cigarettes itself contains addictive substances that are harmful to health whose effects result in heart disease, cancer, lung disease, and other health problems. Frequent exposure to cigarettes increases the risk of hyperlapsia or an increase in mucus cells and hypertrophy of mucosal cells in the respiratory tract which causes an increase in inflammatory cells and damage to the alveoli due to pulmonary constriction (Wiraguna et al., 2022). A long history of smoking can cause a decline in lung function. As a result of pathological changes in the lungs due to frequent exposure to cigarettes, it causes narrowing of the airways so that the flow of air into the lungs will decrease. The incoming airflow cannot reach the maximum value so that is what causes a decrease in the value of APE (Slamet et al., 2024).

Based on the presentation of the facts of the research results and the theory above, the researcher assumes that before the Active Cycle of Breathing Technique (ACBT) therapy, the peak expiratory flow in COPD patients decreases. The decreased peak flow of expiratory is due to a lack of oxygen transport to the lungs. There is an increase in the performance of the respiratory muscles when trying to put oxygen into the body is inhibited due to excess sputum making breathing patterns more irregular. So that there is a blockage of sputum in the airway so that the entry of oxygen into the pulmonary ventilation cannot be maximized. In addition, there are several factors that cause a decrease in APE values, including old age due to the decline in organ function, and also a history of smoking that causes inflammation in the lungs and narrowing of the airways so that the air flow into the lungs will decrease.

Ekspirasi Peak Expiratory Flow *Rate* After Active Cycle of Breathing Technique Therapy

The results showed that the value of the peak expiratory flow after the Active Cycle of Breathing Technique (ACBT) was carried out with an average value of 185.00 with a standard deviation value of 83.869.

Active Cycle of Breathing Technique (ACBT) is a breathing exercise technique used to maintain bronchial cleanliness, reduce the level of inflammation and infection in the lungs and improve lung function by removing secretions. The Active Cycle of Breathing Technique (ACBT) consists of 3 phases, namely breathing control, chest expansion exercises, and forced expiratory exercises (Athawale et al., 2020). The Active Cycle of Breathing Technique (ACBT) is one intervention to reduce the effort required when tightness recurs and aid relaxation with deeper breathing, which can result in improved breathing patterns through decreased breathing rate (Djamaludin et al., 2021).

This Active Cycle of Breathing Technique (ACBT) can increase arterial oxygen and PaCO2 in 1 experiment. This deep breathing technique in the ACBT cycle can stimulate airflow between secretions in the lungs, facilitate the mobilization of secretions and improve ventilation. ACBT also increases transpulmonary pressure which causes the lungs to expand from the collapsed lung units. The chest expansion technique by holding the breath can increase airflow in the area of obstruction and can improve ventilation. The forced expiration or huffing technique can clear the phlegm in the airways that form obstructions so that it can stimulate the cough reflex. Reduced obstruction due to excess sputum can increase oxygenation to the maximum extent (Syafriningrum & Sumarsono, 2023).

Based on the presentation of the facts of the research results and the theory above, the researcher assumes that after the Active Cycle of Breathing Technique (ACBT) is performed, the peak flow of expiration increases. The application of ACBT can train tidal volume breathing which functions to reduce dyspnea. This is because ACBT therapy helps in relaxing the airways by removing excess sputum that causes obstruction in the airways. The ACBT technique can be done in 1 trial in removing sputum so that this ACBT therapy can help relieve respiratory symptoms such as shortness of breath, short/heavy breathing in COPD patients that occur due to the accumulation of mucus in the respiratory tract. This ACBT therapy can increase the APE value because oxygen transport to the lungs begins to flow smoothly without any obstacles so that the capacity and ventilation of the lungs are well filled and efforts to achieve expiratory can be maximized.

Effect of ACBT on Peak Respiratory Flow

The results of the study showed that before the Active Cycle of Breathing Technique (ACBT) was given, the average peak respiratory flow (APE) value was 83.67 and after the Active Cycle of Breathing Technique (ACBT) was given, the average increased to 185.00 so that there was an increase from the peak respiratory flow of -7.613. The results of the statistical test using the Paired T-Test obtained a value of 95% Confidence Interval (CI) between a value of -128,557 to a value of -74,109 with a p-value of $0.000 < \alpha\ 0.05$, so it can be concluded that there is a difference in the average value of peak expiratory flow before and after ACBT in patients with Chronic Obstructive Pulmonary Disease.

This study is in line with research that has been conducted by (Mousa & Abdelaal, 2021) which states that the therapy of Active Cycle of Breathing Technique (ACBT) can increase the value of peak expiratory flow with a significance

value of 0.001 in patients with chronic bronchitis. Another study from (Zhong et al., 2022) also proved that Active Cycle of Breathing Technique (ACBT) therapy can significantly increase peak respiratory flow in the ACBT group compared to the control group without ACBT with an average APE value of 308.7 L/min with a significance value of 0.001 in patients with esophagatomy in reducing complications in the lungs after surgery.

Active Cycle of Breathing Technique (ACBT) therapy is a airway cleaning strategy using breathing aids that aim to improve lung ventilation through a respiratory modification therapy technique that can reduce recurrent respiratory infections and prevent airway damage and strengthen respiratory function (Janani & Saravan, 2024). The administration of Active Cycle of Breathing Technique (ACBT) therapy has been effectively applied to moderate to severe COPD patients in reducing shortness of breath in patients (Cai et al., 2024). Another study from (Gulati et al., 2020) revealed that the application of Active Cycle of Breathing Technique (ACBT) therapy was effective in reducing dyspnea and helping patients in coughing and producing more phlegm in COPD patients.

The Active Cycle of Breathing Technique (ACBT) is performed by controlling breathing, chest expansion to loosen and release secretions to improve ventilation, and huffing to move secretions to upper breathing for immediate expulsion. This action can be repeated (Gulati et al., 2020). The secretion can loosen the airways so that tightness is reduced. This Active Cycle of Breathing Technique (ACBT) therapy can be used in patients with COPD as well as with cardiac surgery patients in restoring the function of the lungs (APE, VEP) which can quickly clear secretions in the respiratory tract (Gulati et al., 2020).

Based on the presentation of the facts of the research results and the theory above, the researcher assumes that Active Cycle of Breathing Technique (ACBT) therapy also increases PEA in COPD patients. The success of Active Cycle of Breathing Technique (ACBT) therapy will cause the peak respiratory flow value to become normal so that it can help the patient in reducing tightness and also expelling phlegm. This Active Cycle of Breathing Technique (ACBT) therapy can be applied as a nursing intervention in the management of airway clearance due to excess sputum through breathing control cycles, chest expansion, and forced expiration. ACBT therapy can reduce complaints of tightness which works by removing excess sputum from the airways so that the increase in oxygen intake is smooth. The entry of oxygen into the airway smoothly can result in an increase in the value of the peak expiratory current so that it can achieve the highest expiratory value.

CONCLUSIONS

The results of this study can be concluded that there is a significant influence in the application of the Active Cycle of Breathing Technique (ACBT) intervention on the value of peak respiratory flow. The results of this study are evidenced by the difference in the average value of peak expiratory flow before and after the Active Cycle of Breathing Technique (ACBT) in patients with Chronic Obstructive Pulmonary Disease. The limitation of this study is that the researcher does not assess the respondents' BMI so that the discussion is limited.

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