



EFFECTIVENESS OF ACTIVE CYCLE OF BREATHING TECHNIQUE ON RESPIRATION RATE IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE PATIENTS: A SCOPING REVIEW

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ABSTRACT

A prolonged cough, excessive sputum production, narrowing of the airways, and shortness of breath or a decrease in respiration rate were symptoms caused by COPD. One of the breathing exercise methods that could help expel sputum, maintain lung elasticity, reduce shortness of breath, and improve lung function was the Active Cycle of Breathing Technique (ACBT). ACBT was often given to patients with lung problems; therefore, a review was necessary to determine the effectiveness of ACBT on the respiration rate of COPD patients. Objective: This study aimed to determine the effectiveness of the Active Cycle of Breathing Technique on the respiration rate of patients with COPD. Method: Literature sources were searched using online databases such as ScienceDirect, ProQuest, CambridgeCore, Oxford Academic, SpringerLink, and Google Scholar. The keywords used for the search included Active Cycle of Breathing Technique, Respiration Rate, and COPD Patients. The articles obtained were then analyzed to identify differences and similarities among the articles. The articles were identified using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) method. The extracted data were compiled into a table. Results: From a total of 3,835 articles, 5 articles met the inclusion criteria. Conclusion: The review results indicated that the Active Cycle of Breathing Technique (ACBT) was effective in reducing the respiratory rate (RR) in patients with COPD.

Keywords: active cycle of breathing technique; COPD; respiration rate

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is one of the non-communicable diseases that has a high health burden in the world. The World Health Organization (WHO) in the global status report on noncommunicable diseases mentions COPD as a respiratory disease that is included in the top four non-communicable diseases. The mortality rate of COPD is quite high at 74%, followed by heart disease, stroke, cancer, and diabetes mellitus (Adiana & Maha Putra, 2023). According to research data from the Regional Chronic Obstructive Pulmonary Disease Working Group conducted in 12 Asia Pacific countries, the average prevalence of COPD is 6.3%, the lowest data in Singapore and Hong Kong (35%), and the highest in Vietnam (6.7%). The prevalence of COPD in Southeast Asia is estimated at 6.3% (Ritonga, Khairunnisa, & Herlina, 2024). Globally, the number of COPD cases will continue to increase every year due to an increase in risk factors. Some of the risk factors for COPD include air pollution (vehicle fumes, dust, and industrial exhaust gases), exposure to cigarette smoke both active and passive. Smoking contributes up to 90% of COPD cases (Zuriati et al., 2020). Alpha-1 Antitrypsin deficiency (a rare genetic condition) may also increase the risk of COPD. The use of illicit drugs such as methadone and cocaine can cause emphysema, a form of COPD, through structural damage to the lungs. HIV infection can be an independent risk factor for COPD, independent of cigarette smoke exposure or drug use. Research suggests that autoantibodies may be involved in the pathogenesis of COPD, although the exact mechanism is still under research (GOLD Global Initiative For Chronic Obstructive Lung

Disease, 2023). Symptoms of COPD include a cough that lasts more than three months a year, often accompanied by excessive sputum production (Cahyono & Yuniartika, 2020).

Wheezing sounds when breathing, resulting from narrowing of the airway. Significant weight loss may occur due to loss of appetite and increased caloric requirements for breathing (Utama, 2020). Progressive airflow limitation and hyperinflation, accompanied by shortness of breath or dyspnea and worsening changes in breathing patterns lead to activity limitations. COPD patients' chest shape changes to barrel chest due to trapped air in the lungs. Lack of oxygen in the blood can cause mood changes, decreased concentration, and other neurological symptoms. (Wahyudi et al., 2021). One of the breathing exercise methods that can be applied is the Active Cycle of Breathing Technique (ACBT) exercise. Breathing exercises are nursing interventions in the management of patients with respiratory problems. ACBT exercises help remove secretions and maintain lung function. The development (compliances) and elasticity of the lungs are trained so that the air flow released from the lungs becomes more optimal and reduces shortness of breath or dyspnea. As a professional nurse must be able to help lung disease patients to heal physically, improve breathing patterns and break the chain of complaints (Cahyono & Yuniartika, 2020; Huriah & Wulandari Ningtias, 2017). Some previous studies belonging to Zuriyati, (2020) and Huriah (2017) showed several methods of breathing exercises on respiration rate in patients with respiratory disorders. Therefore, it is necessary to conduct a review with this scoping review. This study aims to explore the evidence based regarding effectiveness of ACBT Exercise in reducing respiratory rate in patients with COPD.

METHOD

This study used a *scoping review* approach. The purpose of this approach is to identify the findings that have been made regarding the Effectiveness of ACBT Exercise on RR in COPD Patients. There are several steps in preparing a review according to the *Arksey and O'Malley* Method, including: 1) identifying research questions, 2) identifying relevant literature sources, 3) selecting literature that is suitable for the topics and methods used in this study, 4) extracting, mapping and accumulating references to be used, 5) compiling and presenting the results of the literature that has been analyzed (Winardi & Musak, 2021).

Stage 1: Identify the research question

The question in this study is "What is the Effectiveness of ACBT Exercise on RR in COPD Patients?"

Stage 2: Identify Literature Sources

The topic and objectives developed in this study are to understand the effectiveness of ACBT exercise on RR in COPD patients. The selected articles met the inclusion criteria, namely, original articles published in the last 5 years (2019-2024), in English or Indonesian, and using quantitative methods, original articles, and full text while the exclusion criteria included case studies, correlation studies, prevalence, or diagnosis, published in the form of review studies such as literature observation, concept analysis, systematic observation, and meta-analysis. Literature sources were searched using *Pubmed*, *EBSCOhost*, *Science Direct*, *Scopus*, *SpringerLink*, and *Google Scholar*. The keywords used were "Effectiveness of ACBT Training AND Regarding Respiration Rate in COPD Patients" OR "Effectiveness of ACBT Training on RR in COPD Patients".

Stage 3: Literature Selection

The articles to be used were identified first to ensure the quality and validity of the data. There are several steps to filter the literature obtained according to the research topic including; 1) checking the main topic to ensure the article is in accordance with the subject matter of the

study, the main topic in the preparation of this article is related to breathing exercises, especially ACBT, Respiration rate, and patients with respiratory problems, respiratory problems of patients included in COPD. Checking the appropriate topic will make it easier for the author to group appropriate topics. 2) the author checks the author of the article to ensure that the article to be obtained is in accordance with the scope of the main topic of the author is an academic from a campus or health faculty, clinical practitioners who work in accordance with the scope of the topic in this case means that it can be doctors, nurses and physiotherapy, 3) the author evaluates the article through the journal name, volume, edition, and year of publication, the author determines the year of publication of the article to be reviewed in the last 5 years (2019- 2024), 4). Researchers read the research abstract first before later selecting the full article, only by reading the article researchers will be able to more clearly see the appropriate topics for review. Abstracts on research articles provide a complete summary such as problems, objectives, methods, results, and conclusions. This method can be done systematically to improve the accuracy of article selection so as to separate suitable titles, and those that are not suitable. Abstracts of articles were reviewed to meet the inclusion criteria.

Stage 4: Extracting and Mapping

Extracting, mapping and accumulating references used. Selected articles were analyzed for differences and duplication. (Arksey & O'Malley, 2005). Data extraction will be done by creating a table that contains several components such as author, year of publication, title, research design, sample and research results. The purpose of creating a data extraction table is to facilitate the author to analyze the review results. Figure 1 below shows the process of searching and selecting articles using PRISMA (*Preferred Reporting Items for Systematic Reviews and Meta-Analyses*) (Moher, Liberati, Tetzlaff, & Altman, 2009).

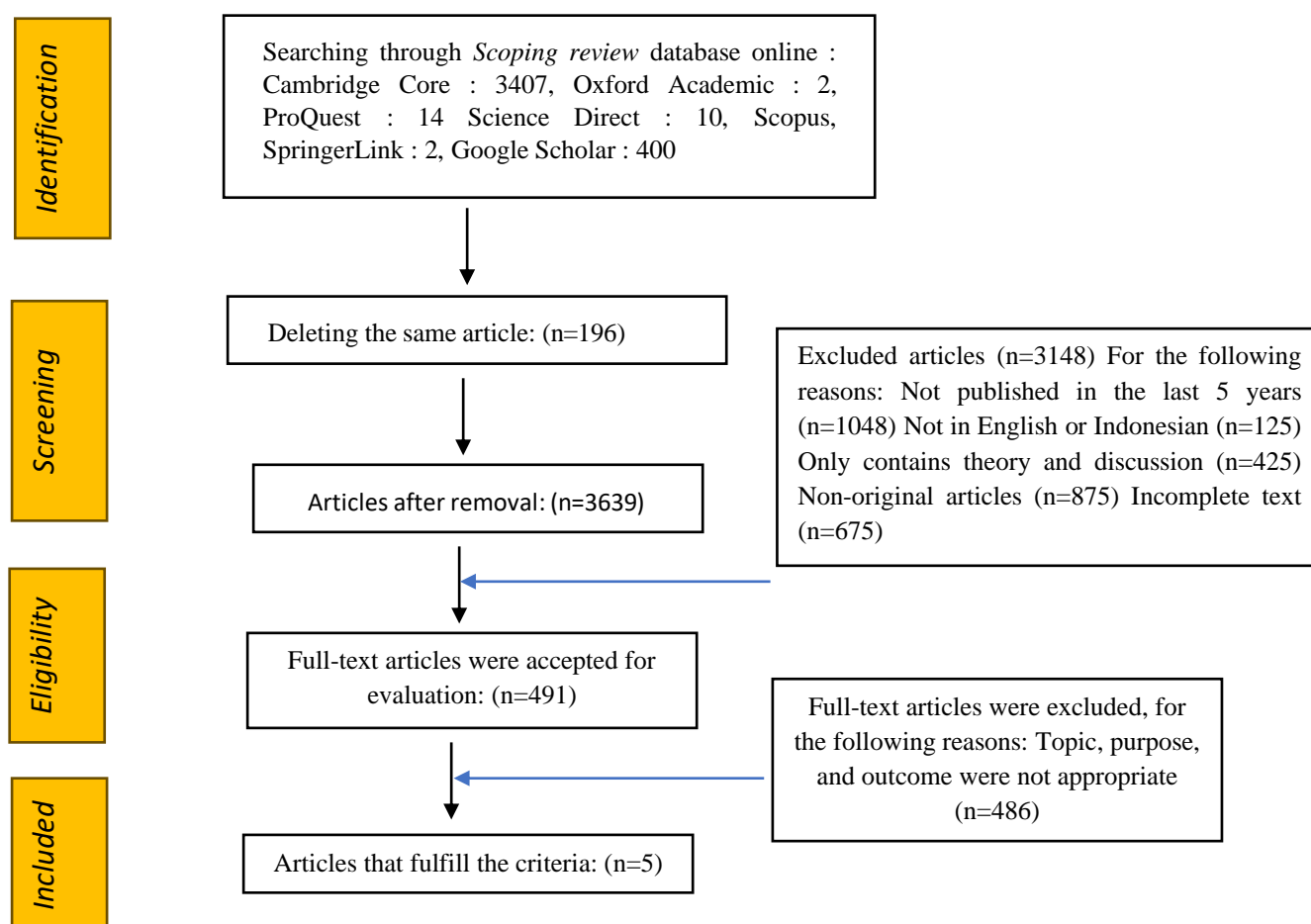


Figure 1. PRISMA Flowchart (Moher et al., 2009)

Stage 5: Summarize and Report Results

This research was summarized descriptively by comparing the reviewed articles. The summary focuses on specific findings, including significant and non-significant results, intervention type, and intervention method. This stage aims to present the findings of the entire review describing how ACBT practice affects RR in patients with COPD and identifying trends and variations in the studies. Findings will be reported structurally in relation to the effectiveness of the intervention based on the evidence findings.

RESULT

The researcher managed to identify 5 articles related to the effectiveness of ACBT Exercise on the RR of patients with COPD. Based on the findings of these articles, it can be concluded that interventions provided to patients with COPD have a significant impact in reducing respiratory rate or RR. Interventions aimed at reducing respiration rate in COPD patients are shown in table 1.

Table 1.
Research Review Results (n=5)

Author/Year	Title	Objective	Method	Research Result
(Subiakto, T., Nasihin, Dalami, E., & Natasya, E., 2023)	<i>Effectivnes Active Cycle of Breathing Technique Therapy on Dyspnea in Pulmonary Tuberculosis Patients at Tangerang Hospital</i>	This study was conducted to determine the effect of active cycle breathing technique therapy on shortness of breath in pulmonary TB patients at Tangerang Regency Hospital.	This research method uses a <i>quasy experiment</i> with a <i>one group pretest-posttest design</i> approach	The results showed that there was a difference in the scale of shortness of breath before and after giving ACBT Therapy to shortness of breath of pulmonary tuberculosis patients with a P value of 0.000 <0.05. The statistical results showed a decrease in the scale of shortness of breath by 2.44 points.
(Apriani, N., Rayasari, E., Anggraini, D., & Atun, S, 2023)	<i>Active Cycle of Breathing to Respiratory Rate in Patients with Lung Tuberculosis</i>	The purpose of this study was to determine the effect of ACBT Exercise on the respiratory frequency of pulmonary tuberculosis patients at the Regional General Hospital Dr. Hi. Abdul Moeloek Lampung Province in 2020	This research method uses <i>quasy experiment</i>	The results showed that the average respiratory frequency score before active breathing cycle training was 27.2 and after training was 23.2. The mean respiratory frequency score before deep breath training was 27.3 and after training 26.1. There is an effect of active breath training on the respiratory rate of pulmonary TB patients (p value 0.000). There is an effect of deep breath training on reducing RR in pulmonary TB patients (p value 0.001). There is a difference between active breath training and deep breath training in reducing RR in patients with pulmonary TB at Dr. Hi. Abdul Moeloek Lampung Province in

Author/Year	Title	Objective	Method	Research Result
(Philips, J., Hing, W., Pope, R., & Canov, A., 2023)	<i>Comparative Effects of Buteyko Breathing Technique and Active Cycle of Breathing Technique on Dyspnea and Quality of Life in Patients with Chronic Obstructive Pulmonary Disease</i>	This study aims to compare the effectiveness of Buteyko Breathing Technique (BBT) and Active Cycle Breathing Technique (ACBT) in reducing dyspnea and improving quality of life in COPD patients	This RCT at Jinnah Hospital, Lahore, 40 COPD patients (mean age 59.70 ± 5.89 years; 70% male) were assigned to either BBT or ACBT groups.	2020 (P value 0.000) The pre-treatment MBS in the BBT group was 6.7 ± 1.56, decreasing to 2.9 ± 1.21 post-treatment. The SGRQ score also showed an increase from 71.5 ± 8.44 to 36.8 ± 6.6. In the ACBT group, the MBS score decreased from 7.3 ± 1.56 to 3.95 ± 1.36, and the SGRQ score from 71.6 ± 8.46 to 42.55 ± 6.61. Between-group comparisons showed a more significant improvement in the BBT group, with post-treatment p-values of 0.01 for MBS and 0.009 for SGRQ.
(Zuriati., Surya., Zahlimar, 2020)	<i>Effectiveness Active Cycle of Breathing Technique (ACBT) with Pursed Lips Breathing Technique (PLBT) to tripod position in increase oxygen saturation in patients with COPD, West Sumatera</i>	To determine the Effectiveness of Active Cycle Breathing Technique (ACBT) with Lip Pucker Breathing Technique (PLBT) to tripod position to improve oxygen saturation in COPD patients in West Sumatera.	This research is a quantitative research with quasi experimental design.	This study shows that there is a difference in the increase in oxygen saturation of COPD patients who are effective in the tripod position group with Active Cycle Breathing Technique (ACBT) with a p value of 0.00, while in the tripod position group with active breathing cycle and lip cycle there is a difference in p-value 0.
(Cai S, Yao J, Han M, Luo X, Yu Y, Lu X, et al., 2024)	<i>The effect of cognition in combination with an ACBT on dyspnea-related kinesiophobia in patients with moderate to severe COPD</i>	The purpose of this study was to develop a cognitive intervention program combined with ACBT techniques with the aim of evaluating the effectiveness of the program in improving dyspnea-related kinesiophobia in patients with moderate to severe COPD.	This study used an RCT design	Findings from four collections of dyspnea belief questionnaires showed that the combined intervention had a better impact on reducing dyspnea-related kinesiophobia than routine care (p<0.05) and the impact persisted even after the intervention, in addition to improving dyspnea and quality of life, increasing exercise capacity, and decreasing the BODE index.

DISCUSSION

The results showed that there was a difference in the scale of shortness of breath before and after giving Active Cycle Of Breathing Technique (ACBT) therapy to shortness of breath of pulmonary tuberculosis patients with a P value of 0.000 <0.05. The statistical results showed

a decrease in the scale of shortness of breath by 2.44 points. Research conducted (Suryati, Primal, & Sy, 2018) showed that based on the results of the active cycle breathing technique (ACBT) and the lip breathing technique (PLBT), it was calculated that the decrease in numbers for 3.69 and 2.25 respectively, for a value of 0.000 p. It was concluded that the active cycle breathing technique (ACBT) and the technique breathing lips (PLBT) can reduce respiratory frequency of COPD patients where the active cycle breathing technique (ACBT) exercise is more influential to reduce respiratory frequency. The results of research conducted (Pratama, Post, & Paru, 2021) The results obtained after 4 times of therapy were a decrease in shortness of breath as evidenced by the Modified Borg scale from scale 4 to scale 1, and a reduction in sputum retention with auscultation results in the form of ronchi in the posterior segment of the apical upper lobe bilaterally to ronchi in the posterior segment of the apical upper lobe dextra. Research conducted (Kabeakan, 2021).

The results of the study There is an effect of breathing patterns before administering the Active Cycle Of Breathing Technique (ACBT) technique on improving breathing patterns in pulmonary tuberculosis patients with a value of $M \pm SD = 17.1081 \pm 2.94188$. There is an effect of breathing patterns after giving the Active Cycle Of Breathing Technique (ACBT) technique to improve breathing patterns in pulmonary tuberculosis patients with a value of $M \pm SD = 27.0400 \pm 2.82076$. There is a difference in the effect of breathing patterns before and after giving the Active Cycle Of Breathing Technique (ACBT) technique on improving breathing patterns in pulmonary tuberculosis patients with a significant value of $0.000 < 0.005$. Physiotherapy management carried out in the form of exercise therapy with ACBT techniques.

ACBT is an airway clearance technique with breathing control methods, thoracic expansion and force expiration techniques (huffing and coughing) for patients with lung disease with mechanisms that aim to reduce shortness of breath, help clear secretions from the lungs, maximize the entry of oxygen into the lungs, and restore the performance of respiratory muscles (Arifin, 2019). This is reinforced by a study conducted by Elsayed et al., which is a cohort design study with a sampling of 45 respondents with a frequency of exercise 3x / week for 2 consecutive months. This study measured functional capacity and shortness of breath using the six minutes walking test and dyspnea index questionnaire. The results of this study state that the ACBT technique is effective in clearing the airway and increasing functional capacity in patients with bronchiectasis with a significance value of six minutes walking test and dyspnea index of 0.0001 (Elsayed, Kamal, & Fathy, 2015).

The results showed the mean score of breathing frequency before active breathing cycle training was 27.2 and after training was 23.2. The mean respiratory frequency score before deep breath training was 27.3 and after training was 26.1. There is an effect of active breath training on the respiratory rate of pulmonary TB patients (p value 0.000). There is an effect of deep breath training on reducing RR in pulmonary TB patients (p value 0.001). There is a difference in breath training with deep breathing exercises in reducing RR in pulmonary TB patients at Dr. Hi. Abdul Moeloek Lampung Province in 2020 (P value 0.000). The results of research conducted (Suryati et al., 2018). Showing the results of research from the two respondents both showed a decrease in respiratory rate patients after being given Active Cycle Of Breathing Technique (ACBT) therapy intervention. The first patient respiratory rated from 29 x/min to 18 x/min and the second patient respiratory rated from 28 x/min to 21 x/min. The study conducted (Elsayed et al., 2015). All 45 patients were stable during the study period. Functional capacity and dyspnea levels improved significantly after the treatment sessions with a mean difference of 48.06 for the six-minute walk test and 29.2 for the dyspnea index. Active Cycle of Breathing Technique (ACBT) can reduce respiratory rate (RR) in patients with Chronic Obstructive Pulmonary Disease (COPD).

This disease is characterized by progressive airflow limitation and hyperinflation, accompanied by shortness of breath or dyspnea, and changes in breathing patterns. ACBT helps reduce complaints of shortness of breath in COPD patients through several mechanisms. ACBT increases lung elasticity and compliance, which in turn increases lung ventilation. Increased lung ventilation leads to increased CO₂ removal and O₂ intake (Apriyanti, Rusiandy, Podesta, & Harison, 2023). The pre-treatment MBS in the BBT group was 6.7 ± 1.56 , decreasing to 2.9 ± 1.21 post-treatment. The SGRQ score also showed an increase from 71.5 ± 8.44 to 36.8 ± 6.6 . In the ACBT group, the MBS score decreased from 7.3 ± 1.56 to 3.95 ± 1.36 , and the SGRQ score from 71.6 ± 8.46 to 42.55 ± 6.61 . Between-group comparisons showed a more significant improvement in the BBT group, with post-treatment p-values of 0.01 for MBS and 0.009 for SGRQ.

The results of research conducted (Huriah & Wulandari Ningtias, 2017) . ACBT has a significant effect on the amount of sputum and thoracic expansion in the intervention group rather than the control group with a p value = 0.026 for the amount of sputum and p = 0.004 for thoracic expansion, while on the VEP1 value, ACBT does not have a significant effect with a p value = 0.058. Active Cycle of Breathing Technique (ACBT) is effective in helping sputum discharge and increasing thoracic expansion of COPD patients, but less effective in increasing VEP1 values. The results of research conducted (Jain & Mistry, 2017). To compare between groups, an independent paired t-test was performed, while a paired t-test was performed to compare all variables within each group. Significant differences were found in SpO₂ (p = 0.003, p<0.05) and PaO₂ (p = 0.011, p<0.05) with MCPT+IS, and significant differences were found in BHT (p = 0.000, p<0.05), RR (p = 0.001, p<0.05), and PaCO₂ (p = 0.007, p<0.05) with ACBT+IS. Breathing Exercise, which is one part of ACBT, is designed to train respiratory muscles and restore ventilation distribution, help reduce the work of respiratory muscles and correct decreased gas and oxygen exchange. Breathing Exercise with the Thorax Expansion Exercise method aims to improve lung function and increase the amount of air that can be pumped by the lungs so that it can maintain the performance of the respiratory muscles and can maintain and increase thoracic cage expansion (Mukhlis & Pringsewu, 2021). Respiratory muscle training as part of the ACBT cycle has been shown to increase muscle endurance strength during inspiration and increase functional capacity in COPD patients (Zuriati et al., 2020).

This study shows that there is a difference in the increase in oxygen saturation of COPD patients who are effective in the tripod position group with Active Cycle Breathing Tecnique (ACBT) with a p value of 0.00 while in the tripod position group with active breathing cycle and lip cycle there is a difference in p-value 0.023. The results of research conducted (Pramudya & Netra Wirakhmi, 2023) show that nonpharmacological therapy in the form of ACBT therapy is very effective in reducing the frequency of breathing of patients with pulmonary tuberculosis, from the results obtained by the author after performing ACBT therapy there is a reduction in the frequency of breathing to normal from initially 32x/minute on the second day to 28x/minute and the third day to 22x/minute. Research Results (Suryati et al., 2018). This study shows that there is a decrease in respiratory frequency in COPD patients after being given an active cycle of breathing techniques (ACBT) and lip moving techniques (PLBT). Based on the results of the active cycle of breathing techniques (ACBT) and lip breathing techniques (PLBT), it was calculated that the decrease in numbers for 3.69 and 2.25 respectively, for a value of 0.000 p. It was concluded that the active breathing cycle technique (ACBT) and lip breathing technique (PLBT) could reduce the respiratory frequency of COPD patients where the active cycle of breathing techniques (ACBT) was more influential in reducing respiratory frequency. ACBT training is more influential in reducing respiratory frequency compared to pursed lips breathing technique (PLBT) (Suryati et al., 2018). Based on the results of the study, it was found that there was an effect of giving Active Cycle Of

Breathing Technique (ACBT) therapy, the frequency of respiratory rate in patients with pulmonary tuberculosis, the frequency of respiratory rate in patients with pulmonary tuberculosis at the Imelda General Hospital, Indonesian Workers Medan.

The results of this study are supported by several previous researchers, research conducted by Pakpahan et al., (2021) which states that the Active Cycle Of Breathing technique shows differences in respiratory frequency before and after being given a combination of chest physiotherapy and Active Cycle Breathing Technique in the intervention group and control group. In the intervention group there was a significant difference in breathing frequency before and after the intervention, in the control group there was also a significant difference in breathing frequency. Overall, ACBT involves a series of breathing techniques that include breathing control, thoracic expansion exercises (deep breathing), and expiratory (Kabeakan, 2021).

The findings from the four times collection of dyspnea belief questionnaires showed that the combined intervention had a better impact on reducing dyspnea-related kinesiophobia than routine care ($P < 0.05$) and the impact persisted even after the intervention, in addition it could improve dyspnea and quality of life increased exercise capacity, and decreased the BODE index. Research results (Huriah & Wulandari Ningtias, 2017) . ACBT has a significant effect on the amount of sputum and thoracic expansion in the intervention group than the control group with a p value = 0.026 for the amount of sputum and $p = 0.004$ for thoracic expansion, while on the VEP 1 value, ACBT does not have a significant effect with a p value = 0.058. Active Cycle of Breathing Technique (ACBT) is effective in helping sputum discharge and increasing thoracic expansion of COPD patients, but less effective in increasing VEP values. Research results (Syafriingrum, Sumarsono, Studi, Fisioterapi, & Malang, 2023).

The results of the respiratory rate (RR) evaluation showed that the value decreased after 3 procedures of providing ACBT exercise therapy intervention. In the first therapy examination, the RR value was 28, the second therapy still showed the same value as the first day. In the third therapy there was a change to reach 26. While in the next therapy it reached 22. It trains tidal volume breathing, which helps to relax the respiratory tract and relieve symptoms of short or heavy breathing. ACBT helps to remove mucus from the respiratory tract. This mucus discharge is able to free the airway and improve oxygenation so that the respiratory rate decreases and the breathing pattern becomes normal (Suryati et al., 2018). Improvement of Alveolar Ventilation ACBT has a direct effect on alveolar ventilation, alveolar ventilation refers to the volume of air that reaches the alveoli (air sacs in the lungs) and participates in gas

CONCLUSION

Respiration Rate is an important parameter in COPD disease. One of the interventions that can be used easily and precisely to reduce RR is the ACBT Exercise. The results of this review show that ACBT exercise is effective in reducing RR in COPD patients.

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