

Combination of Nebulizer and Active Cycle of Breathing Technique (ACBT) to Reduce Shortness of Breath in Asthma Patients

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ABSTRACT

Introduction: Asthma is a chronic inflammatory disorder of the airways that experiences continuous inflammation, causing increased airway *hyperresponsiveness* that causes symptoms of shortness of breath, chest heaviness, *wheezing* especially at night or during the day. *The World Health Organisation* says there are currently 235 million asthma sufferers in the world. The Riskesdas survey results showed the highest prevalence of asthma in 2018 at 4.8%. DIY 3.5% and data from the Bantul district health office in 2018, asthma in Bantul district as many as 5,572 people. **Methods:** quantitative research with *quasi-experimental* methods. using *pre test and post test one group design* with a combination of *Nebulizer* and *Active Cycle of Breathing Technique (ACBT)*. before and after treatment, the sample measured shortness of breath using the Borg Scale to determine the level of shortness of breath. Sampling using *total sampling* technique with sampling that uses all the population as a sample on the condition that it meets the inclusion and exclusion criteria. **Results:** based on the test results of the *Wilcoxon signed rank test* obtained a sig value of $p=0.000$, namely the combination of *Nebulizer* and *Active Cycle of Breathing Technique* can reduce shortness of breath in asthmatics. **Conclusion:** data analysis shows a value of $p=0.000$ ($p<0.05$) indicating that there is an effect of the combination of *Nebulizer* and *Active Cycle of Breathing Technique* on reducing shortness of breath in asthmatics.

Keywords: *Nebulizer, Active Cycle of Breathing Technique, Asthma*

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INTRODUCTION

Asthma is a condition in which people with overactive airways experience coughing, shortness of breath and reversible airway narrowing. Asthma is also a common disease that varies in severity, ranging from mild wheezing to acute airway closure that can be life-threatening. It usually appears in childhood and is associated with other features of atopy, such as eczema and hay fever. Asthma is a chronic inflammatory disorder of the airways that involves many cells and elements. Persistent inflammation causes increased hyperresponsiveness in the airways, causing symptoms such as shortness of breath, chest heaviness, wheezing, especially at night or during the day (Rahmah & Pratiwi, 2020). Asthma is an urgent disease that must be treated quickly, asthma that often recurs will fatal if not treated quickly and immediately. There are

several types of namely childhood asthma where this type of asthma attacks children and the main risk factors are genetic predisposition, history of allergies, respiratory viral infections, bacteria and tobacco exposure.

One of the main factors that increase the likelihood of developing asthma in early childhood tends to be genetic (Resti et al., 2017). Allergic Asthma which is caused by allergies which are sensitised to allergens causing asthma symptoms and respiratory tract inflammation. Allergic asthma is a common asthma phenotype. This type of asthma is usually accompanied by other comorbidities including atopic dermatitis and allergic rhinitis and a history of eczema (Akar-Ghibril et al., 2020). Occupational Asthma, which is asthma caused by work, can usually develop after a single, very high exposure to irritating chemicals. It causes a direct burning



effect on the airways and is not related to the immune system. This type of asthma can also be caused by sensitisation or can become allergic to certain chemical agents. This sensitisation process occurs after a single exposure but can develop over time (Nabila et al., 2020).

The negative impact of asthma that is not treated quickly can be a decrease in productivity, a decrease in quality of life, and can even experience respiratory failure which will cause death. Asthma can be caused by environmental factors where these factors will cause asthma exacerbations, such as allergens, respiratory infections, exercise, hyperventilation, weather changes, food, air pollution, drugs, cigarette smoke, and excessive emotional expression (Ramadhani, 2023). Heavy smokers who have asthma disease will affect a faster decline in lung function and will experience irreversible airflow limitations (Vanessa Bellou et al., 2022). Asthma recurrence can also be caused by a lack of knowledge and education related to health so that patients are not willing to immediately prevent asthma recurrence and lack of support from the family in preventing asthma recurrence.

According to the World Health Organisation (WHO) there are currently 235 million asthma sufferers in the world. Every year there are 80% of deaths that occur due to asthma attacks, mostly affecting low and middle income households. The prevalence of asthma continues to increase, especially in developing countries due to lifestyle changes and increasing air pollution (Sulistiyawati et al., 2020). In Indonesia, asthma is among the ten most common diseases and deaths. Of Indonesia's total population of 265 million in 2018, the Riskesdas survey results showed the highest prevalence of asthma in 2018 at 4.8% with the highest number of women at 2.5% and 2.3% of men (Rahman et al., 2019 in Syafriningrum et al., 2023). Over the past five years, the number of asthma patients in Indonesia has decreased. Judging from the results of Riskesdas data in 2013, the prevalence of asthma decreased from 4.5% in 2018 to 2.4%. Based on data from the Ministry of Health, the prevalence of asthma in Yogyakarta Special Region Province in 2023 reached 3.5% and

according to data from the Bantul Health Office in 2018, there were 5,572 people with asthma in Bantul.

Health education can influence a person by providing information directly about things that are still not understood, providing information about health education to patients can increase patients' understanding of asthma so that patients can immediately prevent asthma recurrence itself (Arvida. Bar et al., 2021). Based on the results of previous studies, it was stated that respondents with asthma were more often female than male with an average age of 47 years (Hanna Hisinger et al., 2022).

A nebulizer is a device used as a treatment for patients with respiratory tract disorders using liquid vapour that has been mixed with medicine. Inhalation therapy is beneficial for patients suffering from respiratory tract diseases, the main advantage of inhalation therapy is that the drug can be delivered directly into the respiratory tract and then the vapour is mixed with the drug.

directly into the lungs, resulting in higher local concentrations with a much lower risk of systemic side effects (Sondakh et al., 2020).

Furthermore, there is an Active Cycle of Breathing Technique (ACBT) intervention to reduce shortness of breath and help release secretions from the lungs so that gradually breathing patterns in asthma patients will be more regular. Active Cycle of Breathing Technique (ACBT) is an airway technique for patients with lung disease using breath control, chest expansion and strong expiratory techniques (blowing and coughing) in a mechanism designed to reduce shortness of breath, help release secretions from the lungs and maximise oxygen access into the lungs, and restore respiratory muscle activity (Suryati et al., 2018).

METHODS

This type of research is *quasi-experimental* research where it does not control respondents in their free activities (Dicky Hastjarjo, 2019). While the research design was carried out during the *pre test and post test one group design* by giving a combination of *Nebulizer* and *Active Cycle of Breathing Technique* (ACBT), Before



being given treatment, the sample was measured for shortness of breath first using the Borg Scale measuring instrument to determine the level of shortness of breath. Then after undergoing treatment the patient is immediately measured again for the level of breathlessness using the Borg scale measuring instrument.

Sampling in this study using *total sampling* techniques. the samples that researchers use are samples selected through a series of assessment processes so that they represent the population. The sample that the researcher used was asthma patients at Respira Yogyakarta Hospital, this exercise was carried out 1× in one meeting with the duration of the study for 3 weeks with the number of samples obtained as many as 30. With the following inclusion criteria: Patients suffering from asthma who experience increased shortness of breath, male and female patients, aged 20-65 years, willing to be a sample as evidenced by signing a letter of consent, a borg scale value of 5 (severe shortness of breath). Exclusion criteria are as follows: have a history of heart disease, have a history of hypertension, patients who are not willing to be research subjects. Drop out criteria are patients who do not participate in the study in full until the research time is completed.

The independent variables in this study are *Nebulizer* and *Active Cycle of Breathing Technique* (ACBT). The dependent variable in this study is a decrease in shortness of breath in asthmatics.



Figure 1. *Nebuliser* and *Active Cycle of Breathing Technique* (ACBT) administration

The data processing method in this study was univariate analysis in the form of age, gender, family history and borg scale scores. Data analysis using statistical tests based on the results of the sample normality test. The normality test uses the *Shapiro-Wilk test* to determine whether the data is normally distributed ($p>0.05$) or not normally distributed ($p<0.05$). If the results are obtained normally distributed, then to test the hypothesis using a parametric statistical test, namely the *Paired Sample t-test*, if the data is not normally distributed using a non-parametric test, namely the *Shaphiro Wilk Test*. Hypothesis testing to determine whether the effect of giving *Nebulizer* and *Active Cycle of Breathing Technique* (ACBT).

This research was conducted after the issuance of an Ethical Certificate from Respira Lung Hospital Yogyakarta Number: 036/KEPK/XII/2024.

RESULTS

The results of this study regarding the characteristics of respondents including age, gender, height and weight can be seen in table 4.1 as follows:

Table 1. Respondent Characteristics

Respondents	Rent	Mean±SD (n=30)
Age	24-65	47.07±12,25
Height	145-178	159.03±7,74
Body weight	23-85	57±13,75

Description n = Number of Respondents

Based on the results of research and SPSS calculations, the table above shows the characteristics of respondents in this study in the form of age with a mean of 47.07. In the characteristics of respondents based on height, the mean is 159.03. In the characteristics of respondents based on body weight with a mean of 57. In the characteristics of respondents based on the borg pre scale value with a mean of 4.97. In the characteristics of respondents based on the borg post scale value with a mean of 1.67.

Table 2. Characteristics of Respondents Based on Gender

Gender	F	%
Male	14	46,7
Women	16	53,3
Total	30	100

Based on the results of research and SPSS calculations, it is known that the percentage of gender is mostly female, 16 respondents each (53.3%) while the fewest are 14 respondents (46.7%).

Table 3. Characteristics by Age

Age (Years)	F	%
24-43	9	29,8%
44-52	10	33,3%
53-65	11	36,6%
Total	30	100%

Based on the table above, the samples given Nebulizer and Active Cycle of Breathing Technique (ACBT) had an age of 24-43 years as many as 9 respondents (29.8%), age 44-52 as many as 10 respondents (33.3%) and age 53-65 as many as 11 respondents (36.6%).

Table 4. Characteristics Based on Family History

Family History	F	%
Yes	17	56,7%
No	13	43,3%
Total	30	100%

Based on the table above, it can be seen that those given Nebulizer and Active Cycle of Breathing Technique (ACBT) who gave yes answers were 17 respondents (56.7%) while those who answered no were 13 respondents (43.3%).

Table 5. Characteristics Based on Frequency of Shortness of Breath

Group	n	Rent			
		Pre test	Mean	Post test	Mean
Nebu and ACBT	30	4-5	4,97	1-3	1,67

Description
 Nebu and ACBT= Nebuliser and Active Cycle of Breathing Technique (ACBT)
 Pre test= before
 Post test= after
 n= number of

Based on the table above, it is known that the average shortness of breath in asthma patients before being given a nebulizer and active cycle of breathing technique (ACBT) with a mean of 4.97 and after being given a nebulizer and active cycle of breathing technique (ACBT) obtained a mean value of 1.67.

Table 6. Shapiro Wilk Test

Frequency of Shortness of Breath	Shapiro wilk test
Pre test	0,000
Post test	0,000

Based on the calculations and results from SPSS from Shapiro Wilk above, it is found that the pre-test Shapiro Wilk value has a p-value of 0.000, while the post-test has a p-value of 0.000. From these results it can be seen that both p-values are 0.000. From these results it can be seen that both P values <0.05, it can be concluded that the borg scale data is not normally distributed.

Table 7. Hypothesis Test Using Wilcoxon Signed Rank Test Effect of Nebulizer and ACBT

Group	n	Sig (2 tailed)
Nebu and ACBT	30	0,000



Based on the calculation and SPSS results of the Wilcoxon test above, it is known that the respondents who were given a nebulizer and active cycle of breathing technique with a p-value of $p < 0.05$ so it can be concluded that there is a very significant effect of giving a nebulizer and active cycle of breathing technique in reducing shortness of breath in asthmatics.

DISCUSSION

This study was conducted by appointing two independent variables, namely *Nebulizer* (X1), *Active Cycle of Breathing Technique* (X2) on asthma patients (Y) at Respira Lung Hospital Yogyakarta, with the following results: Based on the results of research on asthma patients who experience shortness of breath, there are 30 respondents, of the 30 respondents, most of them are female, 16 respondents each, while 14 respondents are male.

The same results were also explained by the research of Sukma et al., (2023) which showed that of the 30 samples, there were 20 female respondents and 10 male respondents. This is also supported by research Litanto et al., (2021) which explains that female patients with asthma attacks until they have to be hospitalised are reported to have a higher prevalence than male patients. According to the American Lung Association data shows that among adults aged >18 years, 62% of women are more likely to experience asthma symptoms with a prevalence rate of 35% higher than men.

Asthma recurrence in women is often associated with their reproductive cycle. Hormonal fluctuations that occur during the menstrual cycle may play an important role in the pathophysiology of asthma resulting in worsening of symptoms in women asthma symptoms become more severe during the pre to menstrual phase.

Based on age in accordance with the inclusion criteria, namely from 30 respondents aged 24-65 years. Where it was found that the age of 24-43 years was 9 respondents, the age of 44-52 was 10 respondents and the age of 53-65 was 11 respondents. 17 respondents had asthma due to heredity and 13 respondents did not. This is in

accordance with research by Hisinger-mölkänen & Honkamäki (2022) that asthma diagnosed in adults is more often associated with environmental and lifestyle factors than asthma diagnosed in children which again is often associated with atopy and genetic factors.

Based on the results of the study of 30 respondents, the average body weight was 57kg who experienced asthma. This is in line with research by Caroline et al., (2019) which states that obesity is recognised as an important risk factor for being diagnosed with asthma. There may be a common genetic basis for obesity and asthma. Obesity is also recognised as a potential risk factor for more severe asthma. Therefore, obesity is a potentially modifiable risk factor for asthma patients. Being overweight not only leads to the development of asthma, but also negatively affects the clinical manifestations of asthma including symptoms and response to asthma. Weight loss is expected to have the opposite effect which might improve the clinical status of individuals with asthma.

From the results of the auscultation examination, 25 respondents experienced shortness of breath accompanied by wheezing and 5 respondents experienced shortness of breath but not wheezing. One of the symptoms that indicates the narrowing of the respiratory tract in asthma patients is the additional sound of wheezing. Wheezing describes the sound produced by the turbulence of gas flow through a narrow airway. When obstruction is more severe, wheezing sounds are more prominent and can be heard in the early phase of expiration. Wheezing sounds that occur repeatedly and persist can be expected due to focal airway obstruction, such as bronchial narrowing due to foreign body aspiration or due to neoplasm (Aini et al., 2024).

From the results of interviews with respondents who have been conducted, it is found that more patients experience shortness of breath at night than in the morning. On average, patients experience shortness of breath more often in cold weather and patients who experience shortness of breath due to exposure to cigarette smoke are more than patients who do not experience recurrence when exposed to cigarette smoke.



Based on strenuous activity, 22 respondents experienced shortness of breath during strenuous activity and 8 respondents did not. Asthma patients with shortness of breath who often relapse while in dusty areas are more than patients who do not experience shortness of breath when in dusty areas.

The results of research conducted by researchers at Respira Lung Hospital Yogyakarta show that there is an effect of the combination of Nebulizer and Active Cycle of Breathing Technique (ACBT) on reducing shortness of breath in asthmatics, where this intervention is carried out once in one meeting.

Based on the results of the frequency distribution analysis, it is known that out of 30 samples, respondents who experienced a decrease in shortness of breath after being given a combination of Nebulizer and Active Cycle of Breathing Technique were 30 people, which means that all samples experienced a significant decrease in shortness of breath.

The results of data analysis conducted by researchers at Respira Yogyakarta Hospital regarding the effect of nebulizer on reducing shortness of breath in asthma patients show that out of 30 respondents given nebulizer treatment with the type of drug meprovent 2.5 mL whose content is Salbutamol and Ipratropium Bromide mixed with Pulmicort 1mg / 2ml with the patient sitting upright in a chair where the inhalation of this nebulizer lasts for 10 minutes. It was found that there were significant results or there was a difference in the value of the borg scale before and after the intervention.

This study is in line with research by Sukma et al., (2023) which shows that out of 30 samples, 22 people (73.3%) of respondents experienced a decrease in shortness of breath after being given a nebulizer. Nebulizers are considered the best choice for patients with inflammation, especially asthma because nebulizers can convert bronchodilators from liquid to aerosol or very fine particle form. Inhalation administration is the administration of medication by inhalation into the respiratory tract.

From the pharmacological basis of strong inhalation therapy for respiratory diseases is to

produce aerosol particles optimised for pulmonary seposition, faster onset of action, small doses and minimal side effects from low or low drug concentrations in the blood, easy to use and provide therapeutic benefits. The same results were also explained by Lestari at al., (2020) that giving nebulizers to asthma patients can cause drugs to be delivered directly to the lungs. Drug delivery to the lungs is very fast compared to other routes, for example subcutaneous or oral.

The results of data analysis conducted by researchers at Respira Yogyakarta Hospital regarding the effect of Active Cycle of Breathing Technique in reducing shortness of breath in asthmatics showed that after respondents were given nebulizer treatment and continued with the administration of Active Cycle of Breathing Technique consisting of Breathing Control (BC), Thoracic Expansion Exercise (TEE), and Forced Expiration Technique (FET) with a dose of 3-5 repetitions in one meeting, there was a significant reduction in shortness of breath.

ACBT is an airway technique for patients with lung disease that uses breath control, chest expansion and forceful expiratory techniques of blowing and coughing. This mechanism is designed to reduce shortness of breath, help release secretions from the lungs and maximise oxygen access to the lungs and can also restore respiratory muscle activity. In addition to clearing respiratory flow ACBT can also maintain lung function and increase maximum expiratory flow (Arifin, 2019 in Syafriningrum & Sumarsono, 2022).

This study is in line with research by Ifitah Rahmawati et al., (2022) where ACBT significantly improved arterial oxygenation with PaCO₂ during one exercise. ACBT has a direct effect on alveolar ventilation where improvements in ventilation can be seen with a decrease in borg scale values. Deep breathing techniques performed during an ACBT cycle can stimulate airflow between secretions present in the lungs, facilitating secretion mobilisation and may improve ventilation. One ACBT cycle includes exercises that increase thoracic expansion while holding the breath. In the forced expiration or huffing phase of ACBT a form of



dynamic compression and collapse of the airways leading to the mouth from the same pressure point can help clear remaining phlegm and stimulate the cough reflex. ACBT techniques also provide an important effect in increasing the depth of breathing, oxygenation and muscle strength which of the three ACBT techniques is a part of the mechanism used to reduce shortness of breath and improve quality of life.

CONCLUSION

Based on the results of research that has been conducted for 3 weeks involving 30 respondents, it can be concluded that there is a significant effect on the combination of Nebulizer and Active Cycle of Breathing Technique (ACBT) on reducing shortness of breath in asthmatics.

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