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ORIGINAL ARTICLE

Enhancing Respiratory Function in Asthma Patients Through Balloon-blowing Exercises in a 90/90 Bridge Position Using a Ball

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ABSTRACT

Introduction: Asthma is a health problem that causes decreased respiratory function, impacting patients' productivity and quality of life. One therapy that effectively improves asthma patients' respiratory status is breathing exercises Balloon-Blowing in a 90/90 Bridge Position Using a Ball. This study aimed to analyze the effect of the Balloon-Blowing Exercise in a 90/90 Bridge Position Using a Ball to improve respiratory function in asthmatic patients. **Materials and methods:** This study used a quasi-experimental design, pre and post-test, using a control group. The number of respondents involved in this study was 64 respondents divided into two groups, with 32 respondents. Respondents were selected based on the researcher's inclusion and exclusion criteria through a consecutive sampling approach. Balloon-Blowing Breathing Exercise in a 90/90 Bridge Position Using a Ball was given to the treatment group 5 times a week for four weeks, with each exercise's duration being five cycles. The measurement of the Peak Expiratory Flow Rate (PEFR) is carried out before the respondent does the exercise at the beginning of the meeting and after the last exercise. **Results:** The PEFR measurement results were then analyzed statistically using the Mann-Whitney U test, and the significance value was p = 0.000, which means that there were differences in the results of PEFR measurements in the treatment group and the control group. **Conclusion:** The study's conclusion shows that the Balloon-Blowing Breathing Exercise in a 90/90 Bridge Position Using a Ball affects improving respiratory function in Asthma patients. *Malaysian Journal of Medicine and Health Sciences* (2025) 21(SUPP7): 65-71. doi:10.47836/mjmhs.21.s7.9

Keywords: Asthma, Balloon-blowing in a 90/90 bridge position using a ball, Breathing exercise, PEFR, Respiratory function

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INTRODUCTION

Asthma is a significant global health issue that requires urgent attention (1). No less than three hundred million people worldwide are infected with Asthma, and it is estimated that the prevalence of Asthma will increase every year, especially in developing countries (2,3). Approximately 250,000 people die from asthma attacks each year, with the highest rates occurring in lower middle-income countries (2). The results of the 2023 Indonesian health survey (Fig. 1) showed that Indonesia had an average national asthma prevalence of 1.6% (95% CI: 1.6 - 1.7%) with an average percentage of asthma recurrence in the last 12 months reaching an average of 58.3% (95% CI: 56.8 - 59.7%). East Java is one of the provinces in Indonesia that has an average percentage of asthma prevalence and asthma recurrence rates above the national figures, namely 1.7% (95% CI: 1.6 - 1.8%) and 62.2% (95% CI: 58.8 - 65.5%) (4). Based on a preliminary study conducted by the research team, data demonstrate that Asthma is included in the top 5 respiratory system diseases at the Rogotrunan Health Center, Lumajang Regency, East Java Province, with a tendency for the number of sufferers to increase from 2018 to 210 sufferers and in 2019 to 311 sufferers.

Asthma is a condition marked by symptoms like coughing, shortness of breath, wheezing, and chest tightness caused by restricted airflow due to inflammation in the respiratory tract (1). In severe asthma attacks, individuals may experience difficulty speaking, bluish lips, ineffective relief from medication, extreme stress or fatigue from the effort of breathing, and noticeable deep sucking movements in the throat or chest while trying to breathe (5). These symptoms may develop due to various factors, including physical activity, exposure to allergens or irritants, weather changes, or viral infections in the respiratory system (6). Uncontrolled asthma symptoms can hurt the quality of life of sufferers,

not only by increasing the burden of treatment costs, but sufferers also experience obstacles in daily activities, significantly decreased work productivity, changes in work function, and even contribute to death (2,7–9).

Pathophysiological changes in people with bronchial Asthma require various efforts to prevent or reduce exacerbations, including pharmacological management and non-pharmacological interventions through breathing exercises (10). Breathing exercises have been shown to complement pharmacological therapy by enhancing overall muscle function, particularly the respiratory muscles, improving lung function, and enhancing the quality of life in individuals with bronchial asthma (11). Previous research results show that several types of breathing exercises have been implemented to improve respiratory function in people living with Asthma, including breathing exercises using inspiratory muscles, yoga pranayama breathing exercises, Buteyko breathing exercises, Papworth breathing exercises, and diaphragmatic breathing exercises (12,13). Although reported to be able to improve respiratory function, these breathing exercises have limitations, including difficult technique mastery, requiring professional guidance, and requiring long-term compliance to the exercises to be able to feel improvements in respiratory function (14–16). Another breathing method is the balloon-blowing exercise in a bridge position using hip and knee flexion (90/90 position) (17). The balloon-blowing breathing exercise was reported to be easy to do independently. It significantly improved lung function when applied to 20-year-old female students, COPD patients, post-radical mastectomy patients, post-chest trauma patients, patients with lower respiratory tract damage, and smokers (17–20). Although considered effective in improving lung function, reports proving the effectiveness of the Balloon-Blowing Exercise in a 90/90 Bridge Position Using a Ball breathing exercise to improve lung function in asthma patients require further research.

The decrease in lung function in patients with bronchial Asthma can be assessed by the decrease in peak expiratory flow rate (PEFR) (21). PEFR measures the air forcefully exhaled from the lungs in a single quick breath and serves as a dependable indicator of proper ventilation and any airflow obstruction (22). Previous studies have reported that PEFR measurement is a simple and easy yet crucial diagnostic tool used to assess the severity of Asthma. PEFR measurement is also an essential measure of the effectiveness of treatment with bronchodilator therapy (23). PEFR measurement in this study is an indicator to prove whether or not the research objective has been achieved, namely to prove the effectiveness of the Balloon-Blowing Exercise in a 90/90 Bridge Position Using Ball breathing exercises on improving lung function in asthma patients.

MATERIALS AND METHODS

Research design

The research employs a quasi-experimental quantitative design using a pre-test and post-test method across two groups. This approach involves manipulating independent variables with two different interventions.

Population and Sample

This study was conducted in the working area of the Rogotrunan Health Center, Lumajang Regency, from October 2020 to December 2020. The subjects of the study were asthma patients living in the area. Participants were selected using a purposive consecutive sampling method with the following inclusion criteria: 1) not experiencing an asthma attack, 2) willing to be a respondent by signing an informed consent form, 3) aged 16–60 years, and 4) have never received similar interventions from researchers or other health workers. Exclusion criteria included: 1) suffering from chronic diseases such as heart disease, diabetes, or status asthmaticus, 2) being uncooperative, and 3) being unwilling to be a respondent.

From the selection process, 64 participants met the criteria and were willing to participate. Simple randomization was done using a lottery to divide the participants into two groups fairly. Each participant was given a serial number, and then the numbers were entered into a lottery box. The selected participants were included in the treatment group, while the remaining numbers were included in the control group. With this method, participants were divided evenly, 32 people each for the treatment and control groups. The treatment group received an asthma education and management program for three months, while the control group underwent standard care without additional intervention.

During the study, all participants in the treatment group attended every intervention session. No participants were removed from the treatment group or absent from activities until data collection was completed. Participants show a perfect attendance rate (100%) in the treatment group and a high commitment from all participants in the treatment and control groups. All participants provided their consent through the research informed consent process.

Balloon-Blowing Exercise in a 90/90 Bridge Position Using a Ball Procedure

The intervention administered to participants involved performing a Balloon-Blowing Exercise while in a 90/90 Bridge Position using a ball. This exercise regimen is conducted in five cycles, with sessions occurring five times a week over a period of four weeks. During the intervention, participants will receive guidance and

supervision from a data collection team. This team will first undergo training on the proper technique for executing the Balloon-Blowing Exercise in a 90/90 Bridge Position using a ball. The procedure for balloon blowing exercise is as follows: 1) Lie back with heels against a wall, with the soles of feet raised and knees and hips bent at a 90-degree angle. Ensure the tailbone is slightly off the mat while the back remains flat. 2) Place a 4- to 6-inch ball between the knees. 3) Place the right arm overhead and hold a balloon in the left hand. 4) Inhale through the nose and exhale through the mouth, feeling the muscles in the back of the thighs engage. 5) Inhale again through the nose and slowly inflate the balloon. 6) Hold for three seconds with the tongue on the roof of the mouth to prevent air from escaping the balloon. 7) Without pinching the neck of the balloon, inhale again through the nose and slowly inflate it again while stabilizing the balloon with the hands. 8) Ensure that the neck and cheeks are relaxed while inflating the balloon. 9) After the fourth breath, pinch the neck of the balloon and release it from the mouth, letting the air out. 10) Relax and repeat for up to five cycles.

PEFR measurement

Respondents were given a pre-test to measure PEFR using a peak flow meter. PEFR measurements were carried out three times, and the best value was obtained. This value will be compared with the estimated value, which will be calculated based on the respondent's gender, age, and height then classified into three parts:

1) Green zone: if the PEF value is 80-100% of the estimated PEF value, it indicates good lung function.
2) Yellow zone: if the PEF value is 50-<80% of the estimated PEF value, airway narrowing starts to occur.
3) Red zone: if the PEF value is <50% of the estimated PEF value, it indicates an airway obstruction.

PEFR measurements using a peak flow meter were repeated after respondents carried out the Balloon-Blowing Exercise in a 90/90 Bridge Position Using a Ball procedure for four weeks to see changes in respondents' PEFR in both groups.

Data analysis

Statistical analysis of PEFR measurements from pre-test and post-test was performed using IBM SPSS Statistics 25. The selection of statistical tests was based on preliminary data exploration, indicating that the assumptions of the paired t-test, particularly normality, were not met. Therefore, the Wilcoxon Signed-Rank test was used for within-group analysis, as it is an appropriate non-parametric alternative for non-normally distributed data. In addition, the Mann-Whitney U test was used to compare differences between groups. The significance threshold was set at $\rho < 0.05$.

Ethical Clearance

This study has been approved by the Health Research Ethics Commission (KEPK) of the Faculty of Dentistry, Jember University, as meeting the ethical standards for health research, under the reference number 1005/UN25.8/KEPK/DL/2020.

RESULTS

In this section, the study's results will be presented, including data on respondent characteristics and the results of respiratory function measurements measured through the Peak Expiratory Flow Rate (PEFR) before and after the intervention. Respondent characteristic data includes information on gender, age, history of asthma, and Asthma Control Test (ACT) scores as listed in Table I. Data on PEFR measurement results in the treatment and control groups as listed in Fig. 1 and Fig. 2. Statistical analysis evaluated significant differences in PEFR values before and after Balloon-Blowing exercises in the 90/90 Bridge position using a ball, as listed in Table II.

Table I: Characteristics of Respondents

Demographic Variable	Treatment Group		Control Group	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Gender				
Male	7	21.9	9	28.1
Female	25	78.1	23	71.9
Age				
16-26	8	25.00	6	18.75
27-37	6	18.75	4	12.50
38-48	5	15.63	5	15.63
49-59	4	12.50	6	18.75
60-70	7	21.87	8	25.00
≥71	2	6.25	3	9.37
Smoking Status				
Smoking	5	15.6	3	9.4
Non-Smoking	27	84.4	29	90.6
Long History of Suffering Asthma				
< 1 year	3	9.37	1	3.1
1-5 year	7	21.88	7	21.9
6-10 year	4	12.50	3	9.4
>10 year	18	56.25	21	65.6

CONTINUE

Table I: Characteristics of Respondents (CONT.)

Demographic Variable	Treatment Group		Control Group	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Asthma Control Test (ACT)				
Very poorly controlled asthma	14	43.75	32	50
Not well controlled asthma	12	37.50	25	39
Well controlled asthma	6	18.75	7	11

Table II: PEFR Measurement Values and Statistical Analysis of Treatment and Control Groups

	Treatment Group		Control Group	
	Pre-test	Post-test	Pre-test	Post-test
Minimum PEFR L/min	100	160	70	70
Maximum PEFR L/min	530	580	340	340
Mean±SD L/min	248.28±109.99	304.68±110.83	146.09±66.65	145.31±66.52
Wilcoxon Signed Rank Test Asymp. Sig. (2-tailed)	ρ=0.000		ρ=0.102	
Mann Whitney U Test	ρ=0.000			

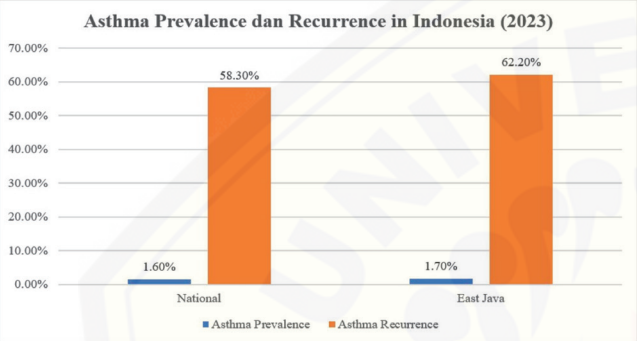

Fig. 1: Asthma Prevalence and Recurrence in Indonesia 2023 (4). The blue bar shows the prevalence and proportion of individuals diagnosed with asthma. The orange bar shows the rate of asthma recurrence in individuals who have been previously diagnosed. The national prevalence and recurrence were recorded at 1.60% and 58.30%, respectively, while in East Java, it was slightly higher, at 1.70% for prevalence and 62.20% for recurrence.

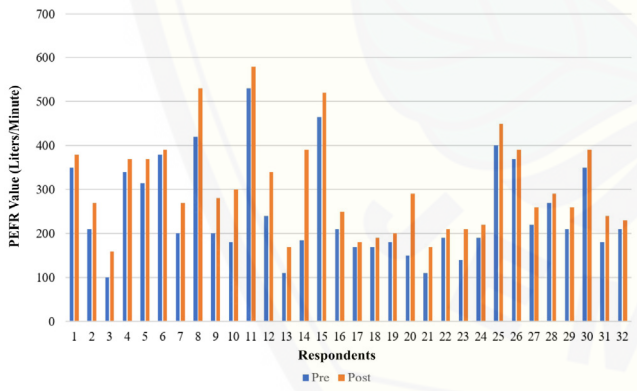

Fig. 2: PEFR Measurement Results of Treatment Groups. The figure shows the Peak Expiratory Flow Rate (PEFR) measurement results of the treatment groups before (pre-test) and after (post-test) the intervention. The data include 32 respondents who participated in the study. Each bar represents the PEFR values (in liters per minute. Significant improvement is observed in the post-test results compared to the pre-test, suggesting the effectiveness of the intervention on respiratory function in the treatment group.

Characteristics of Respondent

Table I shows the demographic characteristics of the 64 participants divided into the treatment and control groups. Most of the participants were female, with a percentage of 78.1% in the treatment group and 71.9% in the control group. Based on age distribution, the largest age group in the treatment group was 60-70 years (21.87%), while in the control group, the largest age group was also in the range of 60-70 years (25%). For smoking status, 15.6% of participants in the treatment group were smokers, while in the control group, the percentage was 9.4%. In addition, most participants in both groups had a long history of asthma. In the treatment group, 56.25% of participants had a history of asthma for more than ten years, while in the control group, 65.6% had a history of asthma for more than ten years. Based on the Asthma Control Test (ACT), 43.75% of participants in the treatment group and 50% in the control group had very uncontrolled asthma.

Statistical analysis showed no significant difference in demographic characteristics between the treatment and control groups. For gender, the Chi-Square test yielded $p = 0.773$, indicating no significant difference. Similarly, the age distribution based on the Chi-Square test showed $p = 0.929$. Smoking status was analyzed using the Fisher's Exact Test with the result $p = 0.708$. For a long history of asthma, the Chi-Square test yielded $p = 0.712$, and for asthma control based on ACT, the Chi-Square test showed $p = 0.563$. These results indicate that both groups had balanced demographic characteristics at the beginning of the study.

PEFR Measurement

Fig. 2 show that the PEFR measurement results in the treatment group increased after respondents performed Balloon-Blowing Exercises in a 90/90 Bridge Position

Using a Ball. Fig. 3 show that the post-test results of PEFR measurements in the control group decreased. The statistical analysis results in Table II compare the treatment group and the control group in measuring Peak Expiratory Flow (PEFR) before and after the intervention. In the treatment group, the minimum PEFR value increased significantly from 100 L/minute at the pre-test to 160 L/minute at the post-test, while the maximum PEFR value increased from 530 L/minute to 580 L/minute. The average PEFR also increased from 248.28±109.99 L/minute to 304.68±110.83 L/minute after the intervention. Analysis using the Wilcoxon Signed Rank Test showed that this change was statistically significant with a value of ρ=0.000 (p<0.05), indicating a positive effect of the intervention given to the treatment group.

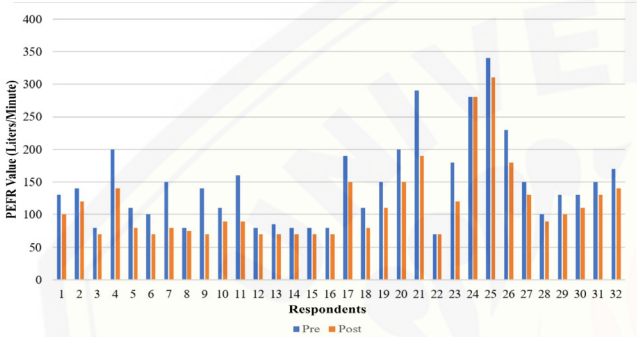

Fig. 3: PEFR Measurement Results of Control Group. The figure illustrates the Peak Expiratory Flow Rate (PEFR) measurement results of the control group before (pre-test) and after (post-test) the study period. A total of 32 respondents are included in the data. Each bar represents the PEFR values (in liters per minute. There is no significant change between pre-test and post-test results, indicating that no intervention was applied, and respiratory function remained stable within the control group.

In contrast, the control group had no significant change in the PEFR value. In both the pre-test and post-test, the minimum and maximum PEFR values remained constant at 70 L/min and 340 L/min, respectively. The average PEFR decreased slightly from 146.09±66.65 L/min in the pre-test to 145.31±66.52 L/min in the post-test. The Wilcoxon Signed Rank Test revealed a p-value of p=0.102 (p>0.05), suggesting no significant change in the control group. In contrast, the Mann-Whitney U Test comparison between the two groups indicated a statistically significant difference in the change of PEFR, with a p-value of p=0.000 (p<0.05), that demonstrates that the intervention administered to the treatment group was considerably more effective in enhancing respiratory function, as indicated by PEFR than the control group.

DISCUSSION

This study demonstrates the effectiveness of balloon-blowing exercises in a 90/90 bridge position using a ball for enhancing respiratory function. Comparing the PEFR measurements taken before and after the experiment revealed a significant increase in the PEFR of the experimental group relative to the control group. These findings align with previous research, which indicated that balloon-blowing breathing exercises led to notable improvements in lung function (VC, ERV, IRV, FVC, FEV1, FEV1/FVC, and PEF) in various populations, including women in their 20s, COPD patients, those recovering from radical mastectomy, post-chest trauma patients, individuals with lower respiratory tract damage, and smokers (17–20).

Asthma is a disease associated with intermittent narrowing of the airways. Narrowing the airway can change airway function, resulting in decreased respiratory function (24). Decreased lung function in asthma patients is often evidenced by decreased PEFR values (25,26). The increase in the PEFR value after the experiment in the experimental group was related to efforts to blow up the balloon, trying to inflate it while still holding the air in the balloon from coming out. It is reported that increasing the volume of the balloon will increase expiratory muscle contractions, and the abdominal muscles will become more active (27). The expiratory phase and expiratory muscle strength influence peak expiratory flow. Therefore, the balloon-blowing exercise may have strengthened the expiratory and abdominal muscles and may have led to an increase in peak expiratory flow in our study. In addition, the 90/90 bridge position has also been reported to increase chest wall expansion, which increases peak expiratory flow (17).

This study has several limitations. First, there is a potential selection bias due to the non-use of a randomized controlled trial (RCT) design caused by time constraints and the COVID-19 pandemic in 2020. The pandemic caused social restrictions and public concerns, so many potential participants were reluctant to participate. Participant accessibility was also limited due to mobility restrictions and strict health procedures. In addition, the limited number of assistants who could assist in data collection and the challenges in implementing field activities that required direct interaction with participants also became obstacles. Strict health protocols affected the smoothness and speed of data collection. Time constraints due to limited scheduling also affected the number and frequency of measurements. Variability in individual abilities to inflate and maintain balloon deflation can affect intervention outcomes. Finally, respiratory function measurements were not in-depth due to limited equipment and medical personnel resources.

CONCLUSION

This study concluded that balloon-blowing exercise using a ball in a 90/90 bridge position significantly improved lung function (PEFR) in people with asthma. Therefore, this exercise can improve respiratory function in people living with asthma.

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