The Effect of Ballon Blowing Exercise on Respiratory Rate in Patients Chronic Obtructive Pulmonary Disease at Sumberglagah Regional Hospital

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ABSTRACT
Chronic Obstructive Pulmonary Disease (COPD) is a chronic lung disease characterized by persistent and progressive airflow obstruction. This can trigger an increase in respiratory rate due to shortness of breath. The purpose of this study was to determine the effect of *Balloon Blowing Exercise* on respiratory rate in COPD patients. This study used a pre-experimental design with *a one-group pre-test and post-test approach.* The study population was all COPD patients in the inpatient unit of Sumberglagah Regional Hospital, Pacet District, Mojokerto Regency, with a sample of 30 respondents taken through a *purposive sampling technique.* Data collection was carried out by measuring respiratory rate before and after the intervention. Data analysis used the *Wilcoxon Signed Rank-Test.* The results showed a *p-value* of 0.000 or <ÿ (0.05), which means there is a significant effect of *Balloon Blowing Exercise* on respiratory rate in COPD patients. Research on *Balloon Blowing Exercise* has proven effective in reducing *the Respiratory Rate,* because this exercise can extend the expiratory phase which triggers the release of more CO_2 from the lungs and involves the respiratory muscles, so that by improving ventilation, preventing *water trapping* and respiratory muscle training can reduce the workload of the respiratory system, which has an impact on reducing the respiratory frequency.
Keywords: Balloon Blowing Exercise, COPD, *Respiratory Rate*
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INTRODUCTION

According to WHO 2022, over the past three decades, there has been a shift in the prevalence of diseases from communicable to non-communicable (NCDs). NCDs are the leading cause of death globally, claiming approximately 41 million lives annually (Indonesian Ministry of Health, 2023). COPD is one of the NCDs that is a global health problem, contributing significantly to morbidity, mortality, and an increased risk of lung cancer (Cheng et al., 2021). COPD is a respiratory disease that causes airflow limitation due to chronic bronchitis and emphysema (Camac et al., 2021). Signs and symptoms that appear in sufferers of this disease include shortness of breath, coughing, gasping, phlegm production, and limited air circulation (Carbone et al., 2023).

This condition is caused by narrowing or obstruction of the airways, which makes it difficult to exhale. As a result, patients often experience an increased respiratory rate in response to unmet oxygen needs. If shortness of breath is not treated promptly, it can lead to hypoxemia, a buildup of carbon dioxide, and respiratory failure, which can be fatal because the oxygen supply to the brain is disrupted. If the brain is deprived of oxygen within 3 to 7 minutes, brain cells will begin to die, ultimately leading to death (Sanga et al., 2020).

The prevalence of COPD worldwide reaches 12% of the general population, of which 44.16% experience mild obstruction, 44.22% experience moderate obstruction, and the remainder experience severe obstruction (Varmaghani et al., 2019). In Southeast Asia, the prevalence is 6.3%, while in Indonesia it reaches 9.2 million people, or around 3.7%, with the mortality rate from this disease reaching 60% of the total deaths in Indonesia (Firdausi et al., 2021). In East Java, the number of sufferers of this disease is estimated at around 8.95 million people, or around 3.6% (Ministry of Health of the Republic of Indonesia, 2021). The prevalence in East Java, which is almost the same as the national figure, indicates that the treatment and health programs related to COPD are not evenly distributed in Indonesia. Therefore, it is important to improve health programs related to COPD, both at the national and local levels, to reduce the prevalence and mortality rate from this disease.

Pulmonary rehabilitation is a comprehensive and multidisciplinary management approach that has been proven to benefit people with COPD. The goal of pulmonary rehabilitation is to reduce symptoms, improve functional status, enhance quality of life, and reduce healthcare costs. The pulmonary rehabilitation program consists of three components: physical exercise, psychosocial support, and breathing exercises (Antariksa et al., 2011). Therefore, non-pharmacological respiratory relaxation therapy can be implemented as part of the treatment of this disease. One method that will be applied is the Balloon Blowing Exercise. It can prolong the expiratory phase, which can trigger the expulsion of more CO_2 from the lungs and engage the respiratory muscles. Thus, by improving ventilation, preventing water trapping and exercising the respiratory muscles, it can reduce the workload of the respiratory system, which has an impact on reducing the respiratory frequency.

The general objective of this study is to determine the effect of balloon blowing exercise on respiratory rate in patients with chronic obstructive pulmonary disease (COPD). To achieve this objective, this study will specifically identify respiratory rate before balloon blowing exercise intervention, identify respiratory rate after balloon blowing exercise intervention, and analyze the effect of balloon blowing exercise on respiratory rate.

The results of this study are expected to enrich knowledge in the field of nursing, particularly in the management of COPD patients. These findings can serve as a basis for To develop non-pharmacological interventions to improve the quality of care and pulmonary rehabilitation in patients. Practically, this study provides direct benefits to respondents by reducing shortness of breath, increasing breathing capacity, and promoting pulmonary rehabilitation through balloon blowing exercises. For healthcare providers, this study can

serve as a recommendation for proposed standard operating procedures (SOPs) for treating COPD patients with shortness of breath.

METHOD

This study used a pre-experimental design with a one-group pre-test and post-test approach. The study population was all COPD patients in the inpatient unit of Sumberglagah Regional Hospital, Pacet District, Mojokerto Regency, with a sample of 30 respondents taken through a purposive sampling technique. Data collection was carried out by measuring the Respiratory Rate before and after the intervention. Data analysis used the Wilcoxon Signed Rank-Test.

FINDING AND DISCUSSION
RESEARCH RESULT
Table 1 : Frequency Distribution Of Respondent Characteristic Based On Age, Gender And Physical Activity

No	Age	Frequency (n)	Persentage (%)
1	Adults 41-50 Years	1	3,3
2	Adults 51-60 Years	5	16,7
3	Adults >60 Years	24	80,0
	Gender		
1	Man	21	70,0
2	Woman	9	30,0
	Physical Activity		
1	Sometimes	14	46,7
2	Never	16	53,3
	Total	**30**	**100**

Source : Primary Data, June 2025

Based on the data presented in Table 1, it can be seen that almost all respondents were in the age group above 60 years. In terms of gender, the majority of respondents were male. Regarding physical activity, most respondents did not engage in any physical activity. The total number of respondents in this study was 30 people.

Table 2 :Distribution of Respiratory Rate Frequency Before Ballon Blowing Exercise Therapy (Pre-Test) At Sumberglagah Regional Hospital, Pacet Distric, Mojokerto Regency, April-June 2025

No	Variables	Minimum	Maximum	Mean	Std.deviation
1	RR *Pre-test*	22	25	23,37	0,890

Source : Primary Data, June 2025

Based on Table 2, the average *(mean)* RR value before *the Balloon Blowing Exercise* intervention was 23.37 times/minute. With a standard deviation *(Std. deviation)* of 0.890, it shows that the *Respiratory Rate* data in the pre-test group tended not to vary much from the average value.

Tabel 3 : Distribution of Respiratory Rate Frequency After Therapy Ballon Blowing Exercise (Pre-Test) At Sumberglagah Regional Hospital, Pacet Distric, Mojokerto Regency, April-June 2025

No	Variables	Minimum	Maximum	Mean	Std.deviation
1	RR *Post-test*	20	24	21,93	1,112

Source : Primary Data, June 2025

Table 3 presents the distribution of respiratory frequency (RR) of patients after *the Balloon Blowing Exercise* intervention (post-test) obtained information on the average *(Mean)* RR value of patients was 21.93 times/minute. With a standard deviation *(Std. deviation)* of 1.112, it shows that the distribution of RR data in the post-test group was slightly more varied compared to the pre-test data, but still within a relatively small range.

Table 4 : Effect of *Ballon Blowing Exercise* on *Respiratory Rate* in COPD Patients

	Mean			95% CI	
Variables	Mean Pre	Mean Post	Difference	Minimum *Pre-Post*	Maxsimum *Pre-Post*
RR	23,37	21,93	1,44	23.03-21,52	23.70-22,35
Sig.(2-tailed) = 0,000 < 0.05					

Source : Primary Data, June 2025

Tabel 4 presents the results of *the Wilcoxon Signed Rank-Test* showing the Sig.(2-) value. tailed) = 0.000 < 0.05 H0 is rejected and Ha is accepted, which means there is an effect of *Balloon Blowing Exercise* on *the respiratory rate* in COPD *(Chronic Obstructive Pulmonary Disease) patients.* The results of the statistical test are attached.

DISCUSSION
Respiratory Rate Characteristics Before Balloon Blowing Exercise Intervention

Table 2 presents the study results, which show that the average respiratory rate of COPD patients at the pre-test stage was 23.37 breaths/minute. Under this condition, the average respondent was in the grade 4 dyspnea category. An average respiratory rate of 23.37 breaths/minute clinically indicates tachypnea, given that the normal respiratory rate range in adults is 12–20 breaths/minute (Wihantoro et al. 2021).

According to Lindayani (2017), increased respiratory rate in COPD patients is a response to unmet oxygen needs. This condition is caused by narrowing or obstruction of the airways, which makes expiration difficult. Chronic bronchitis and emphysema cause respiratory muscle abnormalities, characterized by muscle tension. The loss of lung flexibility in these conditions leads to hyperinflation and airway obstruction, thus impeding expiration.

As a result, the volume of air entering and leaving the lungs becomes unbalanced, causing air to become trapped (water trapping). Breathing volume decreases and breathing becomes shallower, resulting in alveolar hypoventilation and increased O2 consumption. Therefore, this pre-test Respiratory Rate data serves as an important baseline for evaluating the impact of the Balloon Blowing Exercise intervention on the patient's breathing patterns.

According to Sumiarty and Sulistyo (2020), several factors influence increased respiratory rate in COPD patients, including age, gender, and physical activity. Based on the age of respondents with a pre-RR of 23.37 beats/minute, the average age tends to fall into category 4, namely >60 years, with a mean value of 3.92 and a standard deviation of 0.289. This indicates that elderly respondents tend to have a pre-RR around 23 before intervention.

This is in line with the research theory conducted by Nurmayanti et al., 2019. Which states that individuals aged 60 years and above experience an aging process that causes a decline in the performance of the lungs, heart, and blood vessels which makes the age group over 60 years more susceptible to increased respiratory rates when there is a disturbance or need for additional oxygen.

Furthermore, based on gender, it can be concluded that patients with RR-Pre 23 tend to be male, as found before the intervention. With an average value of 1.33, this is closer to category code 1 (Male) than to category code 2 (Female). This is supported by table 4.1, which states that most respondents were male. This is in line with the theory (Paulin et al., 2015; De Mateis et al., 2019; Orozco Levi et al., 2006, in Gold, 2020). In addition to having a history of smoking, men are also more frequently exposed to workplace pollutants (e.g., dust, chemicals) which can contribute to the development of COPD and worsen lung function. Long-term exposure to these risk factors causes more severe or more progressive lung damage in men, so their respiratory system must work harder to get enough oxygen. This causes an increase in RR as a compensatory mechanism.

In addition to age and gender, based on physical activity, respondents with RR-Pre 23 had a balanced physical activity pattern, with participants exercising occasionally and never exercising. The mean of 2.50 confirms the results of the previous crosstabulation table, where the number of "sometimes" and "never" patients was equal (6 each out of a total of 12 patients in the RR-Pre 23 group).

In COPD patients, the respiratory system is already compromised, with airflow limitation and water trapping leading to increased respiratory effort even at rest. A sedentary lifestyle, such as infrequent or even no exercise, worsens their functional capacity. Respiratory muscles, for example, become weak and less efficient, so even light

physical activity can trigger an excessive increase in respiratory rate. This explains why physical activity is a significant factor influencing respiratory rate in COPD patients.

Based on the description above, researchers stated that the increased respiratory rate in COPD patients, with an average RR value of 23.37 breaths/minute, is caused by pathological mechanisms in the respiratory system, such as narrowing or obstruction of the airways, chronic bronchitis, emphysema, and respiratory muscle abnormalities, which are related to factors such as age, gender, and physical activity. This condition causes expiratory difficulty, water trapping, reduced breath volume, alveolar hypoventilation, and increased oxygen consumption.

Respiratory Rate Characteristics After Balloon Blowing Exercise Intervention

Table 3 presents the characteristics of the patients' Respiratory Rate (RR) after the Balloon Blowing Exercise intervention. The data show a mean RR of 21.93 breaths/minute, with a standard deviation of 1.112.

After the Balloon Blowing Exercise intervention, the highest Respiratory Rate was 22 breaths/minute, found in almost half of the respondents (9). This post-test distribution indicates a shift toward a lower respiratory rate, closer to the normal range of 12-20 breaths/minute in adults (Wihantoro et al., 2021). Although the majority of respondents still experienced tachypnea (RR >20 breaths/minute), this distribution pattern indicates a positive response to the intervention. This suggests that Balloon Blowing Exercise has the potential to help COPD patients achieve a more efficient breathing pattern and reduce the workload.

Distribution of frequency and percentage of respondents by category of Respiratory Rate reduction after the intervention. Most respondents experienced a decrease of 1 breath/minute, and nearly half experienced a decrease of 2 breaths/minute. This is in line with research by Junaidin (2020), which stated that administering a Balloon Blowing Exercise intervention for 3 consecutive days can reduce respiratory rate by 1 to 2 breaths per minute. This research is supported by research conducted by Yunica (2021), which stated that the balloon blowing technique helps elevate the diaphragm and rib muscles, and is effective in expanding the lungs to increase the ability to inhale oxygen and exhale carbon dioxide, which is useful for improving respiratory function.

The average age of respondents who experienced a decrease of 1 to 2 breaths/minute tended to be those aged 60 and over, approaching the age range (51-60 years). Among males and those with moderate physical activity, a decrease of 1 breath/minute was sometimes observed, but never a decrease of 2 breaths/minute. Meanwhile, a significant decrease of 3 breaths/minute tended to occur in respondents aged 60 and over, females with occasional physical activity. Or even no change after the intervention in respondents aged over 60 years, female, and sedentary. Overall, almost half of the respondents, with an average value of 21.93 beats/minute, were aged over 60 years, male, and had a balanced physical activity pattern between occasional and never exercising.

The mechanism of Balloon Blowing Exercise on respiratory rate, according to Astriani (2020), is that Balloon Blowing Exercise can prolong the expiratory phase, which

helps prevent small airway collapse and reduce water trapping. This helps patients expel more air from the lungs, thereby improving gas exchange. Tunik et al. (2023) explain that this exercise involves the use of respiratory muscles, thereby helping to strengthen them and increase respiratory efficiency. By improving ventilation, preventing water trapping, and strengthening respiratory muscles, Balloon Blowing Exercise can reduce the work of breathing, which impacts the respiratory rate.

From the description above, the researcher stated that the Balloon Blowing Exercise intervention is effective as a non-pharmacological management in reducing the Respiratory Rate as an indication of reduced shortness of breath experienced by COPD sufferers, this is supported by previous research findings and clear physiological mechanisms regarding how this exercise improves respiratory function.

Analysis Of The Effects Before And After Balloon Blowing Exercise On Respiratory Rate In Copd Patients

Table 4 presents the results of a statistical analysis of the effect of the Balloon Blowing Exercise intervention on the Respiratory Rate (RR) in COPD patients. The data presented shows a change in the mean RR value before (Pre) to 23.37 beats/minute. The mean RR value (Post) decreased to 21.93 beats/minute. The difference between the mean RR values (Pre) and (Post) was 1.44 beats/minute, indicating a positive effect of the intervention. The statistical significance test yielded a P-value of 0.000 ($p < 0.05$), proving a highly significant effect of Balloon Blowing Exercise on reducing the Respiratory Rate in COPD patients.

Based on the results of research conducted on COPD patients at Sumberglagah Regional Hospital, Pacet District, In Mojokerto, almost all respondents were over 60 years of age, with a decrease of 1 to 2 breaths per minute. However, there were a number of respondents in the <60 age group who fell into this category. According to J. Smith et al. (2020), this difference is because older individuals typically experience decreased lung elasticity and respiratory muscle strength, so they feel the effects of breathing exercises such as the Balloon Blowing Exercise more strongly. This intervention can stimulate respiratory muscles and improve breathing patterns, resulting in a decrease in respiratory rate of up to 2 breaths per minute. Meanwhile, according to L. Johnson (2019), younger individuals still have more adaptive respiratory systems, so the changes are less drastic. They may already have natural compensation for respiratory disorders, so the effects of the intervention appear milder, with a decrease of only 1 breath per minute. On the other hand, an interesting finding was seen in the only respondent who experienced a very significant decrease in respiratory rate, namely 3 breaths per minute.

Broadly speaking, the main point lies in the concept of "room for improvement." Elderly people with decreased lung function due to aging and COPD (as described by Nurmayanti et al., 2019) have a higher Respiratory Rate (RR) and poorer baseline respiratory health. Therefore, it's not that aging lungs respond better, but rather that a poorer baseline provides a greater opportunity for significant improvement from the intervention.

A thorough analysis of the association between post-intervention Respiratory Rate reduction and gender could not be conducted to draw definitive conclusions. The significant predominance of male respondents in this study sample, largely out of the total respondents in Table 4.1, severely limited the number of female respondents. This limited number of female respondents prevented the study from identifying significant differences in the effects of the Balloon Blowing Exercise intervention between men and women.

Besides being associated with age and gender, a decrease in respiratory rate can be linked to physical activity. Case studies have shown that a decrease in respiratory rate of 1 breath/minute tends to occur in respondents who occasionally engage in physical activity, while those with a sedentary lifestyle tend to experience a decrease of up to 2 breaths/minute. This phenomenon can be scientifically explained by the concept of "room for improvement." According to A. M. Smith et al. (2019), individuals with a sedentary lifestyle generally have lower baseline respiratory function, accompanied by significant weakness in the respiratory muscles and less than optimal gas exchange efficiency.

In this situation, the Balloon Blowing Exercise intervention, although relatively simple, can provide a substantial stimulus to trigger initial adaptations with more visible changes. Small increases in respiratory muscle strength and coordination in a sedentary group can significantly reduce the workload of breathing, resulting in a more measurable decrease in respiratory rate. Conversely, respondents who occasionally exercise may have slightly better baseline respiratory fitness levels before the intervention. Although the interventions continue to provide benefits, they may have reached a certain threshold of adaptation, so the magnitude of observed improvements tends to be modest. These results underscore that the Balloon Blowing Exercise can be a highly effective starting point for interventions, particularly for COPD patients with very low levels of physical activity, with the potential to achieve more significant improvements in respiratory function.

Based on the description above, the researcher states that the results of this study provide strong empirical evidence to support the implementation of Balloon Blowing Exercise as an effective non-pharmacological therapy modality in pulmonary rehabilitation programs for COPD patients in health care facilities, such as Sumberglagah Regional Public Hospital, Pacet District, Mojokerto Regency.

CONCLUSION

Most COPD patients at Sumberglagah Regional Hospital, Pacet District, Mojokerto Regency, before being given Balloon Blowing Exercise intervention experienced an increase in respiratory rate with an average (Mean) RR of 23.37 times/minute. Then after being given Balloon Blowing Exercise intervention, most experienced a decrease with an average (Mean) RR of 21.93 times/minute. The difference in the average RR value (Pre) and (Post) of 1.44 times/minute indicates a positive effect of the intervention. The results of the statistical test using the Wilcoxon Signed Rank-Test showed a Sig. (2-tailed) value = 0.000 <0.05 H0 was rejected and Ha was accepted, which means there was an effect of Balloon Blowing Exercise on the respiratory rate in COPD (Chronic Obstructive Pulmonary Disease) patients at Sumberglagah Regional Hospital, Pacet District, Mojokerto Regency.

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