

Increasing Peak Expiratory Flow Rate Through a Combination of the Tripod Position and Balloon-Blowing Exercise in PMR Members

Enny Virda Yuniarti, Refin Amanda Putri Nabila, Syeira Trina Zarina, Muchamad Yafi' Aditiya Fawwaz
Universitas Bina Sehat PPNI Mojokerto, Indonesia

ABSTRACT

Peak Expiratory Flow (PEF) is a lung function indicator that reflects the ability to exhale air to the maximum extent. The combination of the tripod position and balloon-blowing exercise is believed to improve lung ventilation and PEF values. This study aimed to improve peak expiratory flow rate through a combination of the tripod position and balloon-blowing exercise among PMR members at SMAN 1 Bangsal. This study employed a pre-experimental design using a one-group pretest-posttest approach with a sample of 33 PMR members selected using total sampling. Data were collected using standard operating procedures (SOPs) and observation sheets. The results were analyzed using the Wilcoxon rank-sum test, yielding a p-value of 0.000 with $\alpha < 0.05$, indicating a significant effect of the combination of the tripod position and balloon-blowing exercise on peak expiratory flow among PMR members at SMAN 1 Bangsal. The importance of implementing the combination of the tripod position and balloon-blowing exercise as a nonpharmacological intervention can help improve peak expiratory flow, as both interventions are capable of optimizing pulmonary ventilation, strengthen the respiratory muscles and maximize exhalation capacity.

Keywords: Ballon Blowing Exercise, Peak Expiratory Flow, Tripod Position

Corresponding author

Name: Enny Virda Yuniarti

Email: syifa.enny79@gmail.com

INTRODUCTION

Respiratory health plays an important role in maintaining optimal physical performance because the respiratory system functions to provide adequate oxygen and remove carbon dioxide from the body. One indicator commonly used to assess respiratory function is Peak Expiratory Flow (PEF), which describes the maximum airflow generated during forced expiration. A decrease in PEF indicates reduced expiratory airflow and respiratory muscle performance, making PEF an important parameter for evaluating lung function (Global Initiative for Asthma, 2024).

The results of a preliminary study conducted at SMAN 1 Bangsal on members of the Indonesian Red Cross Youth (Palang Merah Remaja/PMR) showed that several students had varying Peak Expiratory Flow values, indicating differences in respiratory capacity despite being generally healthy adolescents. PMR members are expected to have good

cardiopulmonary endurance because they frequently participate in first aid activities, disaster preparedness training, and other physically demanding programs. Therefore, simple, safe, and practical interventions are needed to optimize respiratory function and improve Peak Expiratory Flow.

Various non-pharmacological interventions have been developed to improve pulmonary function, including tripod position and balloon blowing exercise. The tripod position facilitates diaphragmatic movement and optimizes the function of accessory respiratory muscles, thereby reducing the work of breathing and improving ventilation. Meanwhile, balloon blowing exercise is a breathing exercise that strengthens expiratory muscles, increases expiratory pressure, promotes lung expansion, and improves expiratory airflow (Westerdahl et al., 2021; Ningsih, 2023). Previous studies have reported that breathing exercises can improve pulmonary function and respiratory muscle performance, while appropriate body positioning can further enhance ventilation efficiency (Hanon et al., 2021).

Although tripod position and balloon blowing exercise have individually demonstrated beneficial effects on respiratory function, evidence regarding the effectiveness of their combined application in improving Peak Expiratory Flow among healthy adolescents remains limited. Considering the importance of maintaining optimal respiratory capacity in PMR members, further research is required to evaluate the effectiveness of this combined intervention. Therefore, the researcher is interested in examining the effect of the combination of tripod position and balloon blowing exercise on Peak Expiratory Flow among members of the Indonesian Red Cross Youth (PMR) at SMAN 1 Bangsal.

METHOD

This study is a quantitative study with a pre-experimental design using a one-group pretest-posttest approach. The population of this study consists of all PMR members at SMAN 1 Bangsal. The sample used in this study comprised 33 respondents selected using total sampling. The variables in this study are a combination of the tripod position and balloon-blowing exercise as independent variables and peak expiratory flow as the dependent variable. This study was conducted in July 2026 at SMAN 1 Bangsal. Data were collected using standard operating procedures (SOPs) and observation sheets. The data were analyzed using the Wilcoxon rank-sum test.

FINDING AND DISCUSSION

RESEARCH RESULT

1. Characteristics of respondents

The result of the characteristics of the respondents based on age, gender, smoking history, family or environmental exposure to smoking, and medical history at SMAN 1 Bangsal are presented in the following table 1

Table 1. Characteristics of Respondents

No	Characteristics of Respondents	F	%
1	Age		
	15 year	1	3,0
	16 year	14	42,4
	17 year	14	42,4
	18 year	4	12,1
2	Gender		
	Male	4	12,1
	Female	29	87,9
3	Smoking History		
	No	32	97,0
	Yes	1	3,0
4	Family History or Exposure to Smoking		
	No	7	21,2
	Yes	26	78,8
5	History of Lung Disease		
	There Is	1	3,0
	There Isn't	32	97,0
	Total	33	100

Source : Primary data, 2026

Table 1 above shows that of the 33 respondents, nearly half—14 respondents (42.4%)—were 16 years old, and nearly half—14 respondents (42.4%)—were 17 years old. In terms of gender, nearly all respondents—29 respondents (87.9%)—were female. Based on smoking history, almost all respondents—32 (97.0%)—had no history of smoking. Based on family or environmental history of smoking, nearly all had a history of exposure to smoking in their family or environment, totaling 26 respondents (78.8%). Meanwhile, based on history of lung disease, nearly all had no history of lung disease, totaling 32 respondents (97.0%).

2. The Effect Of A Combination Of The Tripod Position And Ballon Blowing Exercise On Peak Expiratory Flow

Table 2. The Effect of a Combination of the Tripod Position and the Balloon-Blowing Exercise on Peak Expiratory Flow

Variable	Mean		Difference	95% CI		P value
	Pre	Post		Lowwer	Upper	
Peak Expiratory Flow	306,97	360,61	-53,64	278,64 335,79	335,30 385,43	0,000

Source : Primary data, 2026

Table 2 above presents the results of the Wilcoxon Signed-Rank Test, which show a Sig. (2-tailed) value of $0.000 < 0.05$; therefore, H_0 is rejected and H_1 is accepted, meaning that the combination of Tripod Position and Balloon Blowing Exercise has an effect on peak expiratory flow among PMR members at SMAN 1 Bangsal.

DISCUSSION

1. Characteristics of Respondents

Based on the results of a study conducted on PMR members at SMAN 1 Bangsal, as shown in Table 1 above, nearly half of the respondents were 16 and 17 years old, totaling 14 respondents (42.4%). This age range falls within mid-adolescence, a period characterized by increasingly optimal development of lung function and respiratory muscle strength. During this phase, lung ventilation capacity can still be improved through breathing exercises; thus, a combination of the tripod position and balloon-blowing exercises has the potential to increase peak expiratory flow in adolescents (GINA, 2024). Meanwhile, the results of a study conducted on PMR members at SMAN 1 Bangsal, as shown in Table 1 above, nearly all respondents were female, totaling 29 respondents (87.9%). According to the theory proposed by Hanon et al. (2021), gender is one of the factors influencing lung function, including peak expiratory flow (PEF) values. Physiologically, males generally have greater lung capacity and respiratory muscle strength than females, so their PEF values tend to be higher. Based on the results of a study conducted on PMR members at SMAN 1 Bangsal, as shown in Table 1 above, nearly all respondents—32 respondents (97.0%)—had a history of never smoking. According to GINA (2024), the habit of not smoking plays a role in maintaining optimal lung function because exposure to cigarette smoke can cause airway inflammation, reduce lung elasticity, and decrease peak expiratory flow (PEF) values. Therefore, non-smoking respondents tend to have better lung function and demonstrate a more optimal response to breathing exercises such as the combination of the tripod position and the balloon-blowing exercise.

Based on the results of a study conducted on PMR members at SMAN 1 Bangsal, as shown in Table 1 above, nearly all respondents—26 respondents (78.8%)—had a family or environmental history of smoking. According to the WHO (2024), exposure to secondhand smoke can affect lung function even if a person does not actively smoke. Such exposure can cause airway irritation, reduce lung ventilation function, and potentially lower peak expiratory flow (PEF) values. Therefore, a smoke-free environment is essential for maintaining optimal lung function. And Based on the results of the study conducted on PMR members at SMAN 1 Bangsal, as shown in Table 1 above, nearly all respondents—32 respondents (97.0%)—had no history of lung disease. The absence of a history of lung disease indicates that the respondents' respiratory function tends to be normal, meaning their lung ventilation capacity, including peak expiratory flow (PEF) values, is relatively better. This condition allows the respondents to respond more optimally to breathing exercise interventions—such as a combination of the tripod position and balloon-blowing exercises—to improve lung function (Hanon et al., 2021).

2. Peak Expiratory Flow Before Performing The Combination Of The Tripod Position And Balloon-Blowing Exercise

The results of a study conducted on 33 PMR members at SMAN 1 Bangsal showed that the mean APE score before the combined intervention of the Tripod Position and Balloon Blowing Exercise was 306.97 L/min.

These findings are supported by a study by Hyun et al. (2023), which states that breathing exercises can increase respiratory muscle strength, improve lung ventilation, and enhance expiratory capacity. Research by Ismail and Mathew (2023) also showed that the balloon-blowing exercise effectively increases expiratory muscle strength and improves lung function by increasing positive expiratory pressure. Additionally, Sahardin et al. (2023) explained that Peak Expiratory Flow (PEF) is an indicator of lung ventilation function influenced by airway conditions, respiratory muscle strength, and the ability to exhale air maximally.

Researchers assumed that the average PEF value before the intervention of 306.97 L/min reflected the initial pulmonary ventilation capacity of PMR members before being given breathing exercises. This value was influenced by respondent characteristics, such as adolescent age, gender, physical activity, and the lack of specific exercises aimed at improving respiratory function. Therefore, the PEF value before the intervention was used as a baseline value to assess the effectiveness of the combination of Tripod Position and Balloon Blowing Exercise in increasing Peak Expiratory Flow after the intervention was given.

3. Peak Expiratory Flow After Performing The Combination Of The Tripod Position And Balloon-Blowing Exercise

The results of a study conducted on 33 respondents, members of the Indonesian Red Cross (R&R) at SMAN 1 Bangsal, showed that the average PEF value after the combined intervention of the Tripod Position and Balloon Blowing Exercise was 360.61 lpm.

The increase in the average PEF value to 360.61 L/minute after the intervention indicates improved pulmonary ventilation function. The increase in PEF reflects an improved ability to maximally exhale air, thus indicating improved airway patency and respiratory muscle strength (Sahardin et al., 2023). This improvement occurred due to the combination of the Tripod Position and Balloon Blowing Exercise. The Tripod Position helps optimize diaphragm function and chest cavity expansion, while the Balloon Blowing Exercise increases expiratory muscle strength, maintains positive airway pressure, and improves expiratory airflow velocity (Ismail & Mathew, 2023; Kim et al., 2022). These results align with those of Sahardin et al. (2023) and Shivany et al. (2025) showed that breathing exercises can improve lung function, respiratory muscle strength, and Peak Expiratory Flow (PEF) values. Thus, the average PEF value of 360.61 L/minute after the intervention indicates that the combination of Tripod Position and Balloon Blowing Exercise effectively improves pulmonary ventilation capacity in PMR members at SMAN 1 Bangsal.

Researchers assumed that the average PEF value after the intervention was 360.61 L/minute, indicating that the combination of the Tripod Position and Balloon Blowing Exercise was able to improve pulmonary ventilation capacity in PMR members. This improvement occurred because both interventions helped optimize diaphragm function, strengthen respiratory muscles, and increase expiratory efficiency, allowing respondents to exhale more air optimally.

4. The Effect Of A Combination Of The Tripod Position And Ballon Blowing Exercise On Peak Expiratory Flow

Table 2 shows the results of the Wilcoxon Signed Ranks Test, indicating that most respondents experienced an increase in their Peak Expiratory Flow (PEF) values after being given a combination of the tripod position and balloon blowing exercises, namely 27 respondents (81.82%), while only one respondent experienced a decrease and 5 respondents experienced no change. The Z value = -4.608 with Asymp. sign. (2-tailed) = 0.000 ($p < 0.05$) indicates that there is a significant difference between the PEF values before and after the intervention. These results indicate that the combination of the tripod position and balloon blowing exercises effectively improves respondents' expiratory ability.

Physiologically, the tripod position helps improve respiratory mechanics by optimizing the work of accessory respiratory muscles, increasing chest cavity expansion, reducing the load on the diaphragm, and increasing ventilation efficiency. This position allows for more stable intrathoracic pressure, thus optimizing airflow during expiration (AARC, 2022). Furthermore, balloon blowing exercises are expiratory resistance breathing exercises that can increase expiratory muscle strength, improve lung elasticity, increase vital capacity, and help open collapsed alveoli. Balloon blowing exercises generate positive pressure during the expiratory phase, thereby slowing air expulsion, preventing small airway collapse, and increasing expiratory airflow velocity, as measured by the PEF value. When performed repeatedly and combined with the tripod position, these two interventions provide a synergistic effect in improving pulmonary ventilation function and gas exchange efficiency (Nici et al., 2023).

The findings of this study align with those of Hassan et al. (2022), who stated that breathing exercises with expiratory resistance can improve lung function, including Peak Expiratory Flow (PEF), by increasing respiratory muscle strength and coordinating breathing patterns. Research by Bhatt et al. (2023) also explained that pulmonary rehabilitation interventions combining positioning techniques and breathing exercises significantly improved ventilation function, lung capacity, and the ability to maximally exhale air. Therefore, the results of this study strengthen the evidence that the combination of tripod position and balloon blowing exercise is an effective non-pharmacological intervention for increasing Peak Expiratory Flow.

Researchers assume that the increase in Peak Expiratory Flow (PEF) values in most respondents after being given a combination of tripod position and balloon blowing exercise indicates that the two interventions work synergistically in improving

pulmonary ventilation function. The tripod position helps increase the effectiveness of the diaphragm and accessory respiratory muscles so that the inspiration and expiration processes occur more efficiently. Meanwhile, balloon blowing exercise trains expiratory muscle strength, increases lung elasticity, and improves the respondents' ability to exhale air maximally. The combination of these two interventions resulted in increased airflow during expiration, which is reflected in the increase in PEF values in most respondents.

CONCLUSION

The combination of the tripod position and balloon blowing exercises significantly improved Peak Expiratory Flow (PEF) among the respondents. The Wilcoxon Signed Ranks Test demonstrated a statistically significant increase in PEF values following the intervention ($Z = -4.608$, $p < 0.001$), with 81.82% of participants showing improvement. These findings suggest that combining the tripod position with balloon blowing exercises is an effective, simple, and non-pharmacological intervention for enhancing expiratory airflow and respiratory function. Therefore, this intervention may be considered a practical breathing exercise to support pulmonary function, particularly among healthy adolescents and in preventive respiratory health programs.

REFERENCES

- American Association for Respiratory Care. (2022). *AARC Clinical Practice Guideline: Effectiveness of Nonpharmacologic Respiratory Interventions in Adults*. *Respiratory Care*, 67(10), 1268–1280.
- Bhatt, S. P., Dransfield, M. T., & Ohar, J. A. (2023). Pulmonary rehabilitation and breathing strategies in improving respiratory function. *Journal of Clinical Medicine*, 12(9), 3218. <https://doi.org/10.3390/jcm12093218>
- Global Initiative for Asthma. (2024). *Global Strategy for Asthma Management and Prevention*. <https://ginasthma.org/>
- Global Initiative for Asthma. (2024). *Global Strategy for Asthma Management and Prevention*. Global Initiative for Asthma. <https://ginasthma.org/>
- Hanon, S., Vanderhelst, E., Vincken, W., Schuermans, D., & Verbanck, S. (2021). Peak In- and Expiratory Flow Revisited: Reliability and Reference Values in Adults. *Respiration*, 100(1), 11–18.
- Hassan, M. A., El-Naggar, M. A., & Ahmed, S. M. (2022). Effect of expiratory muscle training on pulmonary function among adults: A randomized controlled trial. *International Journal of Environmental Research and Public Health*, 19(18), 11376. <https://doi.org/10.3390/ijerph191811376>
- Hyun, S. E., Hwang, W., Ji, H. M., & Shin, H. I. (2023). Effect of body position on peak expiratory flow during mechanical insufflation–exsufflation in people with cervical spinal cord injury: A pilot study. *Scientific Reports*, 13, 16548. <https://doi.org/10.1038/s41598-023-43256-x>

- Ismail, A. M., & Mathew, P. (2023). Effectiveness of Balloon Blowing Technique on Peak Expiratory Flow Rate, Exercise Tolerance and Quality of Life of Post COVID-19 Survivors. *International Journal of Health Sciences and Research*, 13(3), 97–115. <https://doi.org/10.52403/ijhsr.20230310>
- Nici, L., Rochester, C. L., Fregonezi, G., Spruit, M. A., & ZuWallack, R. (2023). Pulmonary rehabilitation: Mechanisms of benefit and advances in respiratory exercise therapy. *American Journal of Respiratory and Critical Care Medicine*, 208(4), 387–399. <https://doi.org/10.1164/rccm.202301-0123CI>
- Ningsih, A. D. (2023). Literature Review: Benefits of Balloon Blowing Breathing Exercises on Lung Function in Asthma Patients. *Journal of Scientific Research, Education, and Technology*, 2(2).
- Sahardin, S. N., Mohamad Jailaini, M. F., Nik Abeed, N. N., Ban, A. Y. L., Hau, N. B., Azmel, A. A., Shah, S. A., & Hamid, M. F. A. (2023). Impact of Aerobika® oscillating positive expiratory pressure in improving small airway resistance, lung function, symptoms and exercise capacity in chronic obstructive pulmonary disease. *Frontiers in Medicine*, 10, 1202380. <https://doi.org/10.3389/fmed.2023.1202380>
- Shivany, L. N., Yuniarti, E. V., Merbawani, R., & Java, E. (2025). The Effect Of Ballon Blowing Exercise On Respiratory Rate In Patients Chronic Obstructive Pulmonary Disease At Sumberglagah Regional Hospital. 4(3), 1633–1642.
- Westerdahl, E., Fagevik Olsén, M., Olofsson, P., Frejd, P., & Lannefors, L. (2021). Technical Aspects of Devices and Equipment for Positive Expiratory Pressure With and Without Oscillation. *Respiratory Care*, 66(5), 822–842.
- World Health Organization. (2024). Tobacco. <https://www.who.int/news-room/fact-sheets/detail/tobacco>