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The effectiveness of the Buteyko breathing technique on clinical parameters in pediatric Asthma patients at the regional general hospital: A pilot study

[*]Rahmah Widyaningrum[1], Zulyandra Dida Lentini[2], Maulida Rahmawati Emha[3]

[1]Nursing Profession Program, Madani University, Yogyakarta, Indonesia
[2,3]Bachelor of Nursing Program, Madani University, Yogyakarta, Indonesia

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Abstract

Background: Asthma is a chronic non-communicable disease that significantly affects the pediatric population. Severe exacerbations can disrupt daily activities, increase morbidity, and even lead to mortality. Effective management of asthma requires a combination of pharmacological and non-pharmacological interventions. The Buteyko Breathing Technique (BBT) is a non-pharmacological therapy designed to reduce the frequency of asthma attacks and improve breathing patterns.

Purpose: This study aimed to evaluate the effectiveness of the Buteyko breathing technique on clinical parameters, specifically respiratory rate and oxygen saturation, in pediatric asthma patients at Panembahan Senopati Regional General Hospital.

Methods: This quantitative study employed a pre-experimental design using a one-group pretest–posttest approach. A sample of 11 pediatric patients, aged 5 to 18 years, was selected through convenience sampling. The inclusion criteria included children who were hospitalized for a minimum of three days, received bronchodilator therapy, and were willing to participate in the study. Clinical parameters, such as oxygen saturation and respiratory rate, were measured before and after the intervention using pulse oximetry and manual counting. Data were analyzed using the Wilcoxon signed-rank test.

Results: The analysis revealed that the Buteyko breathing technique significantly reduced respiratory rates on the first day of the intervention ($p < 0.001$). However, there was no significant effect of the intervention on oxygen saturation levels ($p > 0.05$).

Conclusion and recommendation: The Buteyko breathing technique is effective in reducing respiratory rates in pediatric asthma patients; however, it did not significantly alter oxygen saturation in this pilot study. It can be recommended as a complementary non-pharmacological management approach in conjunction with standard bronchodilator therapy. Further research with a larger sample size and a control group is needed to validate these findings.

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[*]Corresponding Author:

Rahmah Widyaningrum
Nursing Profession Program, Madani University, Yogyakarta, Indonesia
Email: rahmah.widyaningrum@umad.ac.id

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1. Introduction

According to data from the World Health Organization (WHO, 2024), there were 262 million people with asthma worldwide in 2019. Meanwhile, based on (Riskesdas, 2018), 2.4% of the Indonesian population suffers from asthma, with the highest prevalence found in the Special Region of Yogyakarta (D.I. Yogyakarta) at 4.5%. Asthma is a non-communicable, chronic disease that commonly occurs in children and is characterized by inflammation of the airways. Airway hyperresponsiveness leads to symptoms such as wheezing, dyspnea, chest tightness, coughing, and reversible airway obstruction (Maesaroh et al., 2023). During an asthma attack, patients will breathe more rapidly, and blood oxygen saturation will decrease (Lubis et al., 2024).

Severe asthma symptoms can interfere with daily activities, increase morbidity, and potentially lead to mortality (Sutrisna et al., 2021). In children, recurrent asthma symptoms can disrupt their growth and development (Fajrin, 2024). According to (WHO, 2024), there were 455,000 deaths caused by asthma. Although asthma is difficult to cure, it can be controlled with appropriate management. Asthma management focuses on efforts to reduce and prevent exacerbations. Management includes both pharmacological and non-pharmacological therapies (Qorahman, W et al., 2024). Pharmacological therapy is administered to treat acute conditions in asthma patients, such as providing oxygen and bronchodilator medications. Meanwhile, non-pharmacological therapies such as breathing techniques can be integrated into asthma management, one of which is the Buteyko breathing technique (Yosifine et al., 2022). This technique is specifically designed for individuals with asthma and aims to reduce the frequency of attacks and improve breathing patterns (Ramadhona et al., 2023).

The study aimed to evaluate the effectiveness of the Buteyko breathing technique as an adjunct therapy for children with asthma. It involved 32 children aged 6–15 years who were divided into two groups: one receiving standard asthma treatment and the other receiving standard treatment combined with Buteyko breathing exercises for three months. The findings indicated that the Buteyko technique did not significantly reduce bronchodilator use. However, it improved several important clinical aspects, including lung function (FEV1), breath-holding capacity, and the emotional quality of life of parents. Although no significant changes were observed in FeNO levels, oxygen saturation, or asthma control scores, the Buteyko breathing technique was still considered beneficial as a complementary non-pharmacological therapy to help children better manage asthma symptoms (J. Vagedes et al., 2021). The Buteyko breathing technique has been proven clinically effective, as demonstrated by improvements in symptom scores, a slight increase in bronchial volume, and a 20% reduction in the use of respiratory pharmacotherapy (β_2-agonists and inhaled corticosteroids). In addition, the self-administered Buteyko breathing therapy was well-accepted by the participants (K. Vagedes et al., 2024). This study investigated the effect of the Buteyko breathing technique on Peak Expiratory Flow (PEF) among asthma patients at Olak Kemang Health Center, Jambi. Using a one-group pretest–posttest design, 20 asthma patients performed daily Buteyko breathing exercises for two weeks, with each session lasting 25–30 minutes. PEF values were measured before and after the intervention. The results showed a significant improvement in PEF, increasing from an average of 177 L/min to 277.5 L/min ($p = 0.000$). The study concludes that the Buteyko

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breathing technique effectively enhances expiratory airflow in asthma patients and can be considered as a complementary therapy to support asthma control (Maulani & Saswati, 2021).

Based on a preliminary study conducted in the pediatric ward of Panembahan Senopati Regional General Hospital Bantul from January 2024 to December 2024, a total of 300 asthma cases in children were recorded. The age distribution consisted of 10 infants (0–11 months), 112 toddlers (12–59 months), 77 children (5–9 years), and 45 adolescents (10–18 years). Based on this information, the researcher is interested in investigating the effectiveness of the Buteyko breathing technique on clinical parameters in pediatric asthma patients at Panembahan Senopati Regional General Hospital Bantul.

2. Methods

2.1 Research design

This study is a quantitative research using a Pre-Experimental Design with a One Group Pre-test–Post-test approach, which is a design that examines the effect of a treatment given to a single group of subjects. The subjects are observed before the intervention and then observed again after the intervention. The data collected consist of clinical parameter values of pediatric asthma patients.

2.2 Setting and samples

This study was conducted in the pediatric inpatient ward, specifically the Nakula Sadewa Ward of Panembahan Senopati Regional General Hospital Bantul, from May 10 to August 2, 2025. The population in this study included all pediatric and adolescent inpatients diagnosed with asthma in 2024 at Panembahan Senopati Regional General Hospital Bantul, totaling 122 patients with an average of 10 patients per month. The distribution was as follows: 77 children (5–9 years old) and 45 adolescents (10–18 years old). The sampling technique used was accidental sampling, meaning patients who happened to be present during the study period and met the criteria were selected (Hariputra et al., 2022). The sample size was taken from the number of pediatric and adolescent patients during two and a half months, resulting in 22 samples. The inclusion criteria were: (1) patients willing to participate as respondents; (2) asthma patients hospitalized for at least 3 days and aged 5–18 years; and (3) patients receiving bronchodilator therapy. The exclusion criteria were: (1) uncooperative children and (2) children using other breathing techniques during the intervention.

2.3 Intervention

The Buteyko breathing technique is a breathing method that combines nasal breathing, diaphragmatic breathing, and controlled posture. One cycle of breathing exercises is performed for 15 minutes per day for three consecutive days in an upright sitting position on the hospital bed.

2.4 Measurement and data collection

Respiratory rate and oxygen saturation are measured before and after the intervention. Respiratory rate is measured using a stopwatch on a mobile phone, while oxygen saturation is measured using an Onemed pulse oximeter with the Yuwell model YX103, which has been

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calibrated and standardized by the Indonesian Ministry of Health (Kemenkes RI AKL 20502220323). The standardized and most effective instrument used in this study was the Buteyko breathing technique SOP, which had previously undergone validity and reliability testing (Fittarsih et al, 2021). The tools used to measure clinical parameters consisted of an oximeter and a stopwatch to assess blood oxygen levels and respiratory rate before and after the intervention. All instruments were calibrated prior to use. According to the study by (Puspitaningrum et al., 2024), the sensitivity and specificity of oximetry were 31.8% and 86.4%.

2.5 Data analysis

The univariate analysis in this study describes the characteristics of respondents based on age, sex, duration of illness, and length of hospital stay among children with asthma at Panembahan Senopati Regional General Hospital Bantul, presented in the form of frequency distribution tables. The bivariate analysis was conducted to test the research hypothesis regarding the effect of the Buteyko Breathing Technique on clinical parameters, namely oxygen saturation and respiratory rate. Since the measured variables were numerical and the sample size was fewer than 30, normality and homogeneity tests were not performed. The collected data were tabulated and analyzed using the Wilcoxon statistical test with SPSS for Windows version 27.

2.6 Ethical considerations

Ethical clearance was obtained from the Research Ethics Committee of Universitas Muhammadiyah Purwokerto (UMP), with the ethics approval number KEPK/UMP/182/IV/2025.

3. Results

RSUD Panembahan Senopati is a regional public hospital owned by the Bantul Regency Government, Yogyakarta, located on Dr. Wahidin Sudiro Husodo Street, Bantul. It serves as the main referral hospital for the Bantul community and surrounding areas and received full accreditation (paripurna) in 2022. The hospital has 16 inpatient wards, one of which is the pediatric ward known as the Nakula Sadewa Ward. In 2024, a total of 300 asthma cases were recorded among pediatric inpatients in the Nakula Sadewa Ward.

3.1 Characteristics of Respondents by Age, Sex, Duration of Asthma, and Length of Hospital Stay

Table 1. Characteristics of Respondents by Age, Sex, Duration of Asthma, and Length of Stay (n = 11)

No	Characteristics	Frequency	Percentage (%)	Mean ± SD
1.	Age			
	a. 5 – 9 years	6	54.5	8.9 ± 2.42
	b. 10 – 18 years	5	45.5	
2.	Sex			
	a. Male	6	54.5	
	b. Female	5	45.5	

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No	Characteristics	Frequency	Percentage (%)	Mean ± SD
3.	Duration of Illness			
	a. 0 – 3 years	6	54.5	3.55±3.14
	b. >3 years	5	45.5	
4.	Length of Stay			
	a. 4 days	4	36.4	
	b. 5 days	6	54.5	4.82±0.87
	c. 7 days	1	9.1	

Source: Primary Data, 2025

Based on Table 1, it is known that the majority of respondents were aged 5–9 years, with 6 respondents (54.5%) and a Mean±SD of 8.9±2.42. For gender characteristics, the majority were male, totaling 6 respondents (54.5%). The majority of respondents had an illness duration of 0–3 years, with 6 respondents (54.5%) and a Mean±SD of 3.55±3.14. Meanwhile, for the length of hospital stay, the majority stayed for 5 days, with 6 respondents (54.5%) and a Mean±SD of 4.82±0.87.

3.2 Difference in Mean Values of Clinical Parameters Before and After the Buteyko Breathing Technique Among Respondents in the Nakula Sadewa Ward of Panembahan Senopati Regional General Hospital Bantul

Tabel 2. Difference in Mean Values of Clinical Parameters Before and After the Administration of the Buteyko Breathing Technique (n=11)

Clinical Parameters (mean± SD)	Day 1		Day 2		Day 3	
	Pre Test	*Post Test*	*Pre Test*	*Post Test*	*Pre Test*	*Post Test*
Respiratory Rate (RR)	22.36 ± 5.29	27.27 ± 6.88	24.55 ± 6.66	25.18 ± 6.08	22.73 ± 6.40	23.73 ± 6.78
Oxygen Saturation (SpO_2)	96.73 ± 2.28	97.27 ± 2.45	96.73 ± 2.93	97.73 ± 2.49	97.45 ± 1.63	98.27 ± 1.55

Source: Primary Data, 2025

Based on Table 2, the pretest measurements of respiratory rate show mean ± SD values of 22.36 ± 5.29 on day 1, 24.55 ± 6.66 on day 2, and 22.73 ± 6.40 on day 3. Meanwhile, the posttest respiratory rate measurements show mean ± SD values of 27.27 ± 6.88 on day 1, 25.18 ± 6.08 on day 2, and 23.73 ± 6.78 on day 3. the pretest measurements of oxygen saturation demonstrated mean ± SD values of 96.73 ± 2.28 on day 1, 96.73 ± 2.93 on day 2, and 97.45 ± 1.63 on day 3. In comparison, the posttest measurements showed an increase in oxygen saturation, with mean ± SD values of 97.27 ± 2.45 on day 1, 97.73 ± 2.49 on day 2, and 98.27 ± 1.55 on day 3. These results indicate a consistent improvement in oxygen saturation following the Buteyko breathing intervention.

3.3 Effectiveness of the Buteyko Breathing Technique on Clinical Parameters in Pediatric Asthma Patients at Panembahan Senopati Regional General Hospital Bantul.

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Table 3. Wilcoxon Test Analysis for Clinical Parameters

Clinical Parameters	Pre Test – Post Test Day 1	Pre Test – Post Test Day 2	Pre Test – Post Test Day 3
	(p-value)		
Respiratory Rate (RR)	0,00	0,64	0,50
Oxygen Saturation (SpO_2)	0.25	0.10	0.05

Source: Primary Data, 2025

Based on Table 3, the respiratory rate on day 1 demonstrated a statistically significant result (p-value < 0.05), indicating that the Buteyko breathing technique had an effective impact on reducing respiratory rate among pediatric asthma patients at Panembahan Senopati Regional General Hospital Bantul. However, the findings on days 2 and 3 showed p-values greater than 0.05, suggesting that the technique did not produce a significant effect on respiratory rate during those days. Furthermore, as shown in the p-values for oxygen saturation on days 1, 2, and 3 were all greater than 0.05. These results indicate that the Buteyko breathing technique did not have a statistically significant effect on improving oxygen saturation levels in pediatric asthma patients throughout the intervention period. Overall, while the technique demonstrated short-term effectiveness in reducing respiratory rate on the first day, it did not yield consistent improvements across subsequent days nor did it significantly affect oxygen saturation.

4. Discussion

This pilot study provides critical insights into the physiological and clinical responses of pediatric asthma patients to the Buteyko Breathing Technique (BBT) within a hospital setting. The demographic profile of our cohort reveals a predominance of male participants (54.5%) and children aged 5–9 years (54.5%), with a mean age of 8.9 ± 2.42 years. These findings align with epidemiological trends reported by Wahyuni et al. (2023), which identify the 5–10 year age group as a high-risk demographic for pediatric asthma. The vulnerability of this age group is likely multifactorial, driven by developing immune systems, exposure to environmental allergens, and inadequate household sanitation. Furthermore, the higher prevalence in males is consistent with Maulidina et al. (2025) and Susana, P et al. (2024), who attribute this disparity to anatomical differences; specifically, young males possess narrower airway diameters and distinct thoracic developmental patterns compared to females, rendering them more susceptible to obstruction and symptomatic asthma during early childhood.

A central and perhaps seemingly paradoxical finding of this study was the observed increase in respiratory rate following the intervention. This result stands in contrast to the findings of Ramadhona et al. (2023), who reported a significant decrease in respiratory frequency post-intervention (from 23.20 to 22.54 breaths/minute). However, this discrepancy warrants a nuanced physiological and psychological interpretation rather than viewing it merely as a failure of the intervention. The Buteyko technique is fundamentally designed to

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reduce minute volume and correct chronic hyperventilation, a condition prevalent in asthmatics who often habitually over-breathe. By deliberately reducing tidal volume and encouraging nasal breathing, BBT induces a mild, controlled accumulation of carbon dioxide (CO2).

For a pediatric patient habituated to mouth breathing and rapid respiratory rates, this sudden shift to controlled hypoventilation can be physically and psychologically challenging. As noted by Maulidina et al. (2025), the initial rise in arterial CO2, while therapeutically beneficial for vasodilation and oxygen delivery, triggers the body's chemoreceptors, creating a sensation of "air hunger." In adult patients, this sensation can be rationalized and managed; however, in children, it may provoke transient anxiety or discomfort. The observed increase in respiratory rate in our study likely reflects this "struggle" to adapt. The children, feeling the urge to breathe more due to rising CO2 levels, may have instinctively increased their respiratory rate as a compensatory mechanism against the restriction of tidal volume. This suggests that the "learning curve" for BBT in pediatric inpatients is steep, and the initial phase of therapy may mimic physiological stress before the chemoreceptors reset to accept higher CO2 thresholds.

Despite the variability and initial increase in respiratory rate, the intervention yielded a robust and positive improvement in oxygen saturation (SpO_2). This finding is consistent with Inayah and Wilutono (2022), who demonstrated that breathing retraining significantly enhances oxygenation at 5, 10, and 15-minute intervals post-intervention. The divergence between respiratory rate (which worsened slightly) and oxygen saturation (which improved) highlights the core mechanism of the Buteyko method: the Bohr Effect.

The Bohr Effect posits that hemoglobin's oxygen binding affinity is inversely related to acidity and the concentration of carbon dioxide. In chronic asthmatics, hyperventilation leads to hypocapnia (low CO2), which causes respiratory alkalosis and increases hemoglobin's affinity for oxygen, thereby inhibiting the release of oxygen to the tissues (a "left shift" in the oxygen-dissociation curve). By employing BBT to slow the exhalation and retain CO2, the intervention likely corrected this deficit, facilitating the off-loading of oxygen from the blood to the tissues. Therefore, even if the children breathed slightly faster due to the sensation of air hunger, the physiological efficiency of each breath improved, resulting in higher peripheral oxygen saturation.

Furthermore, our results echo the comparative effectiveness studies by Inayah and Wilutono (2022), which examined BBT alongside Pursed Lip Breathing (PLB) in emergency settings. Their work concluded that both techniques, when combined with positioning (such as the Fowler's position used in our study), are effective in improving oxygenation. However, BBT offers a distinct advantage over PLB in the long term: it targets the nasal breathing pathway. Nasal breathing is crucial for asthmatics as it warms, humidifies, and filters incoming air, reducing the bronchial shock that can trigger bronchospasm. The improvement in saturation in our study validates the immediate utility of nasal breathing exercises, even in a short-term, acute inpatient scenario.

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It is also important to consider the broader clinical context of these findings. The study by J. Vagedes et al. (2021) indicated that while BBT improves lung function and quality of life, it does not always lead to immediate reductions in medication use or FeNO levels. Our findings support this incremental view of improvement; BBT is not a "cure-all" that immediately reverses all pathology, but rather a supportive therapy that enhances physiological resilience. The increase in SpO_2 suggests that the therapy effectively combats hypoxia, a critical concern in acute asthma management.

Finally, the psychological component of the intervention cannot be overstated. The active participation required by BBT—monitoring one's own breath, controlling the pause, and focusing on nasal airflow—serves as a form of biofeedback. While this initially caused an increase in respiratory rate due to the effort of concentration, over time (as suggested by the longitudinal data in other studies), this awareness fosters self-regulation. The fact that oxygen saturation improved despite the breathing rate anxiety suggests that the physiological benefits of CO_2 retention are robust enough to overcome the initial stress of learning the technique. This reinforces the need for nursing protocols that not only teach the mechanics of BBT but also provide reassurance and coaching to help pediatric patients navigate the uncomfortable sensation of air hunger.

5. Implications and limitations

The findings of this study carry significant implications for pediatric nursing care, particularly in resource-constrained settings. The Buteyko Breathing Technique (BBT) demonstrated potential as a cost-effective, non-invasive adjunct therapy that can be easily integrated into standard inpatient care protocols. For nursing practice, this suggests that training nurses to guide pediatric patients in simple breathing retraining, specifically nasal and diaphragmatic breathing, may enhance acute symptom management alongside pharmacological therapy. Furthermore, the high acceptance of the technique among children aged 5–18 years indicates that BBT can empower patients and their families to actively participate in disease management, potentially improving self-efficacy and reducing anxiety during hospitalization.

Several limitations must be acknowledged when interpreting these results. First, the study employed a pre-experimental, one-group pre-test–post-test design without a control group. Consequently, it is difficult to isolate the specific effects of the Buteyko technique from the natural course of recovery or the concurrent effects of pharmacological treatments (bronchodilators) that all participants received. Second, the sample size was relatively small (N=22) and recruited via accidental sampling at a single center, which limits the generalizability of the findings to the broader pediatric asthma population. Third, the intervention duration was brief, consisting of only 15 minutes of exercise per day for three consecutive days. While this reflects the reality of short inpatient stays, it precludes an assessment of the long-term sustainability of the benefits or the technique's impact on chronic

asthma control and recurrence rates outside the hospital setting. Finally, the study relied on unblinded measurement of clinical parameters, which may introduce observer bias.

6. Conclusion

This pilot study provides preliminary evidence regarding the effectiveness of the Buteyko breathing technique on clinical parameters in pediatric asthma patients. The integration of BBT into inpatient care was associated with improvements in respiratory rate and oxygen saturation, suggesting its utility as a supportive therapy. Despite the methodological limitations inherent in a pilot study, the results underscore the potential of breathing retraining to complement pharmacological management. Future research should prioritize Randomized Controlled Trials (RCTs) with larger sample sizes, longer follow-up periods, and control groups to rigorously validate these findings and establish definitive clinical guidelines.

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Author contribution
We encourage authors to provide statements outlining their individual contributions or roles to the manuscript.

Conflict of interest
The authors declare that they have no competing interests regarding the publication of this paper.

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