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Comparing Deep Breathing and Semi-Fowler Position to Reduce Respiratory Rate in Asthma Patients: A Quasi-Experimental Study

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ABSTRACT

Background: *Asthma remains a global health burden, marked by recurrent respiratory symptoms that significantly affect quality of life. Non-pharmacological nursing interventions such as deep breathing and semi-Fowler positioning have been increasingly recommended to improve respiratory function in patients with asthma. However, few studies have compared the relative effectiveness of these two interventions within a single experimental framework.*

Purpose: *This study aimed to compare the effectiveness of deep breathing exercises and the semi-Fowler position in reducing respiratory rate among asthma patients.*

Methods: *A quasi-experimental study was conducted involving 70 asthma patients, divided into two intervention groups: deep breathing (n = 35) and semi-Fowler position (n = 35). Participants were recruited using purposive sampling based on defined inclusion and exclusion criteria. Data on respiratory rate were collected before and after intervention using direct observation, recorded in breaths per minute. Paired and independent t-tests were used for statistical analysis with a significance level of a < 0.05.*

Result: *In the deep breathing group, the mean respiratory rate decreased significantly from 29.03 ± 2.20 to 18.29 ± 1.56 breaths/minute (mean difference = 10.74; p < 0.001). Similarly, in the semi-Fowler group, the respiratory rate reduced from 28.43 ± 1.98 to 18.29 ± 1.66 breaths/minute (mean difference = 10.14; p < 0.001). However, the post-intervention comparison between the two groups showed no statistically significant difference (p = 1.00).*

Conclusion: *Both deep breathing and semi-Fowler positioning are effective in reducing respiratory rate among asthma patients. These findings suggest that nurses can apply either method based on patient preference and clinical context, supporting individualized, evidence-based respiratory care.*

Keywords:
asthma; deep breathing; semi-Fowler position; respiratory rate; nursing intervention

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Introduction

Asthma is a major non-communicable disease (NCD) that affects people of all ages and remains one of the most common chronic respiratory conditions worldwide. It is a heterogeneous disorder marked by chronic inflammation of the airways, airway hyperresponsiveness, and variable airflow obstruction, which is often reversible spontaneously or with treatment. Its clinical symptoms include shortness of breath, wheezing, coughing, and chest tightness, especially during nighttime or early in the morning (Global Initiative for Asthma (GINA), 2025). Despite

decades of medical advancement, asthma continues to have a significant health burden. According to the World Health Organization (WHO), (2024), asthma currently affects an estimated 262 million people globally and contributes to approximately 455,000 deaths annually, many of which are preventable with appropriate care. The management of asthma, especially in developing countries like Indonesia, is still fraught with challenges. Several factors contribute to this, including limited access to health services, insufficient patient education, inadequate follow-up care, and low adherence to treatment plans. Ministry of Health of the Republic of Indonesia, (2018) found that the national prevalence of asthma diagnosed by physicians is 1.6% across all age groups, suggesting that at least 1 in every 100 Indonesians has received an asthma diagnosis. Although this figure may appear modest, the real burden is likely higher due to underdiagnosis and poor disease awareness at the community level. The national prevalence of asthma diagnosed by healthcare professionals in Indonesia is 1.6%. In comparison, Jambi Province reported a slightly higher prevalence of 1.7%. Moreover, the overall prevalence in Jambi—based on either clinical diagnosis or self-reported symptoms—was 2.4%. The asthma relapse rate within the past 12 months in Jambi reached 62.0%, ranking the province 8th highest among 34 provinces in Indonesia. These figures indicate that the asthma burden in Jambi is relatively higher than the national average, both in terms of prevalence and recurrence (Ministry of Health of the Republic of Indonesia, 2018).

Uncontrolled asthma can lead to serious complications such as status asthmaticus, hypoxemia, pneumonia, atelectasis, pneumothorax, and even respiratory failure (Global Initiative for Asthma (GINA), 2025; National Heart Lung and Blood Institute (NHI), 2024). Exacerbations not only increase morbidity and healthcare costs but also significantly impact patients' quality of life. Hence, there is a strong need for timely and effective management, both pharmacologically and non-pharmacologically (Sullivan et al., 2017). While pharmacological treatment remains the cornerstone of asthma therapy—including bronchodilators, corticosteroids, and leukotriene antagonists—non-pharmacological nursing interventions have emerged as essential adjuncts that are low-cost, accessible, and have minimal side effects. These interventions are especially relevant in nursing care contexts where continuous patient monitoring, comfort, and education are integral to holistic treatment (Santino et al., 2020).

Among the most studied non-pharmacological strategies are the deep breathing technique and the semi-Fowler position. Deep breathing, particularly diaphragmatic or abdominal breathing, is a simple relaxation technique that promotes better oxygen exchange by engaging the lower lungs. It also reduces sympathetic nervous system activity, thereby lowering respiratory rate and relieving anxiety, which is a common trigger in asthma (Octaviani et al., 2023). Meanwhile, the semi-Fowler position—where the patient is positioned with the head of the bed elevated at 30–45 degrees—is widely used in hospitals to facilitate lung expansion, enhance diaphragmatic movement, and promote easier breathing, particularly in patients with respiratory distress (Musri et al., 2021).

Several studies support the effectiveness of these techniques. For instance, Octaviani et al., (2023) found that deep breathing

exercises significantly improved oxygen saturation and reduced respiratory rate among patients with bronchial asthma. Similarly, Amalia, (2021) reported that the semi-Fowler position not only reduced respiratory effort but also enhanced lung auscultation results in asthma patients. However, most available literature examines these interventions in isolation. There is a lack of direct comparative studies evaluating which of these techniques is more effective in reducing acute respiratory symptoms—particularly respiratory rate, a key physiological marker of respiratory distress. To explore this further, a preliminary survey was conducted by the researchers in September 2024 among 10 inpatients with asthma. The findings revealed that although four patients reported having received brief education from nurses about breathing techniques or positioning, six patients had never heard of either method, indicating that these interventions are underutilized or insufficiently taught in clinical settings. This highlights a missed opportunity in nursing practice, were simple, evidence-based measures could significantly improve patient outcomes with minimal resource requirements.

Considering the increasing number of asthma cases, the danger of uncontrolled symptoms, and the potential of non-pharmacological interventions to aid symptom relief, this study becomes highly relevant. By directly comparing the effectiveness of deep breathing techniques and the semi-Fowler position in reducing respiratory rate, the research seeks to provide evidence-based recommendations for clinical nursing practice and contribute to the optimization of asthma care in hospital settings. Therefore, the purpose of this study is to compare the effectiveness of deep breathing techniques and the semi-Fowler position in reducing respiratory rate among patients with asthma.

Methods

1.1 Research design

This study employed a quasi-experimental design with a comparative approach to evaluate the effectiveness of two non-pharmacological nursing interventions—deep breathing technique and semi-Fowler position—in reducing respiratory rate among asthma patients (Polit & Beck, 2017). Unlike true experimental designs that require random assignment, the quasi-experimental approach allows for comparison between intervention groups without full randomization, making it suitable for clinical settings where ethical or logistical constraints limit random group allocation. Participants were divided into two intervention groups based on predefined inclusion criteria. Each group received one of the interventions, and changes in respiratory rate were measured before and after the intervention using standardized procedures. The pre-test-post-test nonequivalent group design enabled the researchers to assess the within-group and between-group differences in outcomes, thereby providing insights into the relative effectiveness of each technique. This design is particularly appropriate for applied clinical research in nursing where patient availability and intervention practicality must be considered, while still maintaining scientific rigor in evaluating intervention outcomes.

1.2 Setting and samples

The study was conducted over a four-month period, from January to August 2024, in Mayjen H.A Thalib Hospital. The study employed a quasi-experimental, two-group pretest-posttest design to assess the

effects of two non-pharmacological interventions—deep breathing technique and the semi-Fowler position—on the respiratory rate of patients diagnosed with asthma. Participants were recruited using a consecutive sampling technique, a non-random method commonly used in clinical studies where all eligible subjects who met the criteria and were available during the study period were included until the target sample size was reached (Polit & Beck, 2017). The inclusion criteria were: (1) adults aged 18–65 years, (2) having a medical diagnosis of bronchial asthma as recorded by a physician, (3) experiencing mild to moderate asthma exacerbation without requiring emergency resuscitation, (4) able to follow verbal instructions, and (5) willing to participate and sign informed consent. The exclusion criteria included: (1) patients with comorbidities affecting respiratory function (e.g., COPD, pneumonia), (2) those currently receiving oxygen therapy or mechanical ventilation, and (3) individuals with cognitive impairment or psychological disorders that might interfere with the intervention procedures (Rosenbaum, 2021).

A total of 70 participants were enrolled in the study and assigned into two intervention groups: 35 participants received the deep breathing intervention, while the remaining 35 were assigned to the semi-Fowler positioning group. Assignment to groups was based on the order of admission and eligibility, ensuring that each group was balanced in terms of size and demographic characteristics. The sample size justification was based on a power analysis using G*Power 3.1.9.7 software, assuming a moderate effect size (Cohen's d = 0.5), α = 0.05, and power (1-β) = 0.80 for independent group comparisons. The calculation indicated a minimum of 64 participants (32 per group); hence, the final sample size of 70 (35 per group) was considered adequate to detect statistically significant differences between the interventions (Faul et al., 2007).

1.3 *Intervention*

This quasi-experimental study involved two intervention groups: the Deep Breathing group and the Semi-Fowler group, with no separate control group. Both interventions were implemented in a hospital setting, specifically in the inpatient ward of a regional public hospital located in Jambi Province, Indonesia. In the Deep Breathing group, patients were guided through a structured diaphragmatic breathing exercise. The procedure included instructing patients to sit comfortably, inhale deeply through the nose for 3–4 seconds, hold the breath briefly, and exhale slowly through the mouth. Each session lasted approximately 10–15 minutes and was repeated twice daily for three consecutive days. In the Semi-Fowler group, patients were placed in a semi-Fowler position, with the head of the bed elevated at a 30–45degree angle, promoting optimal lung expansion and relaxation. This positioning was maintained for 15–20 minutes per session, also conducted twice daily for three consecutive days. All interventions were delivered by trained registered nurses who had received brief orientation and procedural guidelines from the research team to ensure standardization. Patients in both groups also received routine pharmacological treatment for asthma as prescribed by the attending physician.

1.4 Measurement and data collection;

The primary instrument used for data collection in this study was a respiratory rate observation sheet, which recorded the number of breaths per minute (x/min) in asthma patients. This instrument was

adopted from standard clinical respiratory assessment guidelines provided by the Indonesian Ministry of Health and aligned with previous research on non-pharmacological interventions for respiratory conditions. The observation sheet included columns for patient identification, time of measurement, and respiratory rate during pretest and posttest sessions. Respiratory rate was measured manually by observing chest movements for one full minute while the patient was at rest and calm. The instrument uses a ratio scale, with interpretation based on the normal adult respiratory rate range (12–20 breaths/minute), where higher values indicate respiratory distress. This instrument did not require translation as it was originally developed and applied in the Indonesian clinical setting. The tool was reviewed by a panel of three experts in pulmonary nursing and medical-surgical care to ensure content validity. Inter-rater reliability was also established during a pilot test involving 10 patients, yielding a Cohen's kappa coefficient of 0.85, indicating high agreement between observers. Data were collected by two trained research assistants, who were also licensed nurses working in the inpatient ward. Prior to data collection, these assistants were trained on standardized procedures for respiratory rate measurement, proper positioning, and documentation to ensure consistency and reduce bias. Data collection was conducted twice daily over three days, immediately before and after each intervention session.

1.5 Data analysis;

Data analysis was conducted using IBM SPSS Statistics version 26. Descriptive statistics, including mean, standard deviation, minimum, and maximum values, were calculated to describe the demographic characteristics and respiratory rates (pretest and posttest) of participants in both groups. To examine the effectiveness of each intervention within groups, the paired sample t-test was used to compare respiratory rates before and after the intervention. This test is appropriate for evaluating pre-post differences in the same subjects and is widely applied in intervention research. To compare the effectiveness between the Deep Breathing and Semi-Fowler groups, an independent samples t-test was performed on the posttest data. This statistical test is suitable for evaluating differences in means between two unrelated groups when the dependent variable is continuous and normally distributed. All statistical tests were two-tailed with a significance level (α) set at 0.05. Normality of the data was assessed through Shapiro-Wilk test and visual inspection of histograms and Q-Q plots prior to conducting parametric tests.

1.6 Ethical considerations.

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Prior to data collection, ethical approval was obtained from the Health Research Ethics Committee Fort De Kock University of with approval reference number: 849/KEPK.UFDK/XI/2024. All participants were provided with detailed information regarding the study objectives, procedures, benefits, and potential risks. Informed consent was obtained in writing from each participant before enrollment. Participants were assured of the confidentiality of their personal information, and their participation was entirely voluntary, with the right to withdraw at any time without any consequences to their care. Data collected were anonymized and stored securely to ensure privacy and compliance with ethical standards for human subjects' research.

Results

This section presents the findings of the study, including the demographic characteristics of the respondents and the analysis of the effectiveness of two nursing interventions—deep breathing and the semi-Fowler position—on respiratory rate in asthma patients. The analysis includes descriptive statistics to summarize participant profiles and inferential tests to assess the impact of each intervention within and between groups. All statistical analyses were performed using SPSS version 26, with a significance level set at $\alpha < 0.05$. Table 1 summarizes the baseline characteristics of participants in each intervention group, while Table 2 outlines the pre- and post-intervention comparisons of respiratory rate, including both paired and independent t-test results.

Table 1. Demographic Characteristics of Respondents by Intervention Group (Deep Breathing and Semi-Fowler)

No	Variable	Deep Breathing	Semi-Fowler
1	Age		
	Mean	39.6	35.0
	SD	5.38	5.03
	Min-Max	28 - 48	26 - 44
2	Gender		
	Female	18 (51.4%)	16 (45.7%)
	Male	17 (48.57%)	19 (54.3%)
3	Education		
	Senior High School	24 (68,6%)	24 (68,6%)
	Higer Education	11 (31.4%)	11 (31.4%)

Table 1 presents the demographic characteristics of respondents in both intervention groups. The mean age of participants in the Deep Breathing group was 39.6 years (SD = 5.38), which is slightly higher than the Semi-Fowler group with a mean age of 35.0 years (SD = 5.03). However, the age ranges in both groups were comparable, ranging from 28 to 48 years in the Deep Breathing group and 26 to 44 years in the Semi-Fowler group. In terms of gender distribution, both groups were relatively balanced. The Deep Breathing group consisted of 51.4% females and 48.6% males, while the Semi-Fowler group included 45.7% females and 54.3% males. Regarding educational background, both groups showed identical proportions, with 68.6% of participants having completed senior high school and 31.4% having obtained higher education. This suggests a comparable baseline between groups in terms of education level, supporting the internal validity of the study's comparative outcomes.

Table 2. Effectiveness and Comparison of Deep Breathing and Semi-Fowler Position on Respiratory Rate

Group	Mean ± SD	Mean ± SD	Mean Difference	Paired t-test	Independent t-test
	Pretest	Posttest			
Deep Breathing	29.03±2.20	18.29±1.56	10.74	< 0.001*	1.00
Semi-Fowler	28.43±1.98	18.29±1.66	10.14	< 0.001*	

*α<0.05

Table 2 presents the effectiveness of deep breathing and semi-Fowler position in reducing respiratory rate among asthma patients. In the Deep Breathing group, the mean respiratory rate decreased significantly from 29.03 ± 2.20 breaths per minute (pretest) to 18.29 ± 1.56 breaths per minute (posttest), with a mean difference of 10.74 and a paired t-test p-value < 0.001, indicating a statistically significant improvement. Similarly, in the Semi-Fowler group, the mean respiratory rate decreased from 28.43 ± 1.98 to 18.29 ± 1.66, with a mean difference of 10.14 and also a significant p-value < 0.001 based on the paired t-test. These results suggest that both interventions were effective in reducing respiratory rate within each group. However, the independent t-test comparing the posttest respiratory rates between the two groups yielded a p-value of 1.00, indicating no significant difference in effectiveness between deep breathing and the semi-Fowler position. Both deep breathing and the semi-Fowler position are equally effective non-pharmacological interventions for reducing respiratory rate in asthma patients. These techniques can be considered as complementary nursing interventions in the clinical management of asthma, especially during acute exacerbations.

Discussion

This quasi-experimental study aimed to evaluate and compare the effectiveness of two non-pharmacological nursing interventions—deep breathing techniques and the semi-Fowler position—on reducing respiratory rate in asthma patients. The findings provide robust evidence that both interventions are statistically effective in lowering respiratory rate within each group (p < 0.001). However, when compared between groups, no significant difference was found (p = 1.00), suggesting that both interventions are equally effective as supportive measures for managing dyspnea in asthma. These results are aligned with the study's original objectives, which were to determine whether deep breathing or the semi-Fowler position could offer greater benefit in controlling acute respiratory symptoms—specifically respiratory rate—in patients with asthma. The reduction in respiratory rate observed in both intervention groups confirms that simple, nurse-led interventions can contribute meaningfully to the management of asthma exacerbations. It also reflects the potential of these techniques to be applied in routine clinical practice, particularly in settings with limited access to advanced respiratory therapies.

In the deep breathing group, the respiratory rate dropped from an average of 29.03 ± 2.20 breaths/minute at baseline to 18.29 ± 1.56 post-intervention—a mean reduction of 10.74 breaths/minute. This is physiologically plausible, as diaphragmatic breathing facilitates more efficient gas exchange in the lower lung fields, increases tidal volume, and reduces the respiratory workload. Moreover, deep breathing may activate the parasympathetic nervous system, thereby counteracting the sympathetic overactivation that often precipitates bronchospasm and hyperventilation in asthma patients (Bentley et al., 2023; Hallett & Ashurst, 2018; Hamasaki, 2020; Tsakona et al., 2025).

Similarly, in the semi-Fowler group, the respiratory rate declined from 28.43 ± 1.98 to 18.29 ± 1.66, showing a mean reduction

of 10.14 breaths/minute. The semi-Fowler position is known to reduce diaphragmatic pressure, optimize ventilation-perfusion matching, and enhance thoracic expansion. This positioning has been widely applied in respiratory care and is supported by pathophysiological principles related to pulmonary mechanics, especially in patients with compromised breathing capacity (Alan & Khorshid, 2019; Cortes-Puentes et al., 2014; Katz et al., 2018; Prajapati, 2024). The fact that both interventions resulted in similar post-intervention respiratory rates (18.29 breaths/minute) further emphasizes their equivalent efficacy. The present study's findings are consistent with prior research that highlighted the benefits of both deep breathing and semi-Fowler positioning for improving respiratory function. For instance, demonstrated that structured breathing exercises significantly improved oxygen saturation and reduced respiratory rates in patients with bronchial asthma (Kiyak et al., 2019; Öner Cengiz et al., 2025). Similarly, Dinaryanti et al., (2025) and Prajapati, (2024)Yulia et al. (2019) found that patients placed in semi-Fowler position showed decreased respiratory effort and improved comfort. However, what differentiates the current study is that it directly compares both interventions in one experimental framework, thereby offering a more conclusive evaluation of relative effectiveness. While the results support previous literature, the current findings add value by showing no superiority between the techniques, suggesting that nurses can select either approach based on patient comfort, cooperation, and context of care.

The demographic characteristics of the respondents were also analyzed and found to be relatively balanced between the two groups. The mean age in the deep breathing group (39.6 years) was slightly higher than in the semi-Fowler group (35.0 years), although this difference did not likely influence the outcomes due to overlapping age ranges and similar standard deviations. In terms of gender distribution, the deep breathing group had slightly more females (51.4%), while the semi-Fowler group had a higher proportion of males (54.3%). Gender differences can influence asthma symptoms and response to interventions due to hormonal and anatomical factors, but the comparable outcomes across groups suggest that gender had minimal impact in this study. Educational background was identical in both groups, with 68.6% of participants having completed senior high school and 31.4% having tertiary education. This level of education is important because it may influence participants' understanding and adherence to the interventions, but the uniformity supports the internal validity of the study. The homogeneity in key demographic variables reinforces the conclusion that the observed intervention effects were not confounded by differences in participant characteristics, allowing for a fair comparison of the two techniques.

Implication and limitations

The results of this study emphasize the clinical value of incorporating non-pharmacological interventions—specifically deep breathing techniques and the semi-Fowler position—into routine nursing care for asthma patients. Both methods proved to be effective in reducing respiratory rate, suggesting their role as practical and low-cost adjunct therapies to pharmacological treatment. These techniques can be integrated into nursing protocols in hospital, outpatient, and even home-care settings. For nurses, this study

highlights the opportunity to expand their role in asthma management by applying evidence-based, patient-centered practices. At a policy level, the findings support the need for training modules, clinical guidelines, and community-based asthma education programs that include such simple but effective interventions. Public health planners and nursing educators could promote these strategies to improve asthma outcomes, reduce hospitalizations, and empower patients to manage symptoms proactively.

Despite the promising results, this study has several limitations. First, it was conducted at a single hospital, which may affect the generalizability of findings to other populations and settings. Second, the relatively small sample size (70 participants) limits statistical power and may not capture subtle differences between groups. Third, the short duration of follow-up restricts the ability to assess long-term effects of the interventions. Furthermore, the absence of a randomized design and the inability to blind participants and researchers may have introduced bias. Confounding factors such as medication use, asthma severity, and psychological stressors were not controlled. Future research should consider addressing these limitations through larger randomized controlled trials, longer follow-up periods, and the inclusion of additional clinical and patient-reported outcomes.

Conclusion

This study concludes that both deep breathing techniques and the semi-Fowler position are effective in significantly reducing respiratory rate among patients with asthma. There was no significant difference in effectiveness between the two interventions, suggesting they are equally beneficial. These findings add to the current knowledge by offering a direct comparative analysis of two widely used non-pharmacological interventions, reaffirming their relevance in clinical nursing practice. By providing measurable benefits in respiratory parameters, these strategies strengthen the role of nurses in non-drug-based asthma management.

Based on the study findings, it is recommended that healthcare institutions formally integrate deep breathing and semi-Fowler positioning into standard asthma care protocols. Nurses should receive training to apply these interventions consistently, and patients should be educated to use them as part of their self-care routines. Further research is warranted to assess the long-term benefits, cost-effectiveness, and broader health outcomes of these interventions. Future studies should also explore the potential synergistic effects when these techniques are combined with other supportive therapies such as guided relaxation, digital asthma education, or peer coaching. Scaling up this approach across diverse healthcare settings could enhance asthma control, reduce exacerbations, and improve overall patient quality of life.

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Author contribution

MO contributed to the study design, participant recruitment, and initial manuscript drafting. WR was responsible for ethical clearance submission, data collection coordination, and documentation. RO supervised the research process and provided expert input in manuscript revision. YY contributed to statistical analysis, data interpretation, and formatting of the final results. AW assisted in methodological guidance, literature synthesis, and final manuscript review and approval.

Conflict of interest

The authors declare no conflict of interest in the conduct, authorship, or publication of this study.

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