

# The Impact Of The Buteyko Breathing Technique On Patients With Bronchial Asthma In Terms Of Breathing Patterns: A Systematic Review

Yofa Anggriani Utama<sup>a</sup>, Sutrisari Sabrina Nainggolan<sup>b</sup>, Aris Citra Wisuda<sup>c</sup>

<sup>1), 2), 3)</sup> Nursing Study Program, Sekolah Tinggi Ilmu Kesehatan Bina Husada, Palembang, Indonesia.  
Correspondence e-mail: [yofaanggriani@yahoo.co.id](mailto:yofaanggriani@yahoo.co.id)<sup>1)</sup>, [sutrisarisabrinanainggolan@gmail.com](mailto:sutrisarisabrinanainggolan@gmail.com)<sup>2)</sup>,  
[ariscitravisuda.edu@gmail.com](mailto:ariscitravisuda.edu@gmail.com)<sup>3)</sup>

**Keywords** Buteyko breathing, breathing patterns, bronchial asthma

**Abstract** **Background:** Leukotrienes, mast cells, eosinophils, and other inflammatory cells are among the numerous inflammatory cells involved in asthma, which is a long-term inflammatory disease of the respiratory system. The airway hyperresponsiveness linked to this chronic inflammation results in recurrent episodes and extra wheezing noises, breathing difficulties, a heaviness in the chest, and coughing, particularly in the morning and evening. **Objective:** The goal is to ascertain how patients with bronchial asthma breathe differently after using the Buteyko breathing technique. **Method:** A systematic review was the design employed. Electronic journal database, posted 2018–2023, from Pubmed, Semantic Scholar, Google Scholar, and Science Direct, utilizing PICO to create organized research questions. **Results:** Eight articles that met the inclusion criteria were found out of a total of 1841 articles. These articles underwent analysis, classification, and discovery.

## 1. INTRODUCTION

<sup>c</sup> <https://orcid.org/0000-0001-7420-1591>

Asthma is a chronic inflammatory disorder of the respiratory tract involving many inflammatory cells such as eosinophils, mast cells, leukotrienes, and others. This chronic inflammation is associated with airway hyperresponsiveness which causes repeated episodes with additional wheezing, shortness of breath, chest and coughs especially at night and in the morning (Wijaya & Toyib, 2018). Asthma is a non-communicable disease that can occur at any age and is one of the causes of high health problems throughout the world. Apart from attacking adults, Asthma is a chronic respiratory disease that occurs most often in children. This disease causes morbidity and mortality. The most numerous throughout the world (Mohammad et al., 2023).

According to the Indonesian Ministry of Health, (2018), In Indonesia, 2.4% of the population suffers from asthma. East Kalimantan Province has the highest incidence rate at 4.0%, North Sumatra Province has the lowest incidence rate at 1.0%, and South Sumatra Province has the lowest incidence rate at 1.9% of the population. In the province of South Sumatra, asthma affects 1.95% of the population. With 3.86% of the population, the Empat Lawang district had the

highest incidence rate. The South Ogan Komering Ulu area had the lowest incidence rate of asthma at 0.77%, whereas the incidence rate in the city of Palembang was 3.05% (Health Research and Development Agency, 2019).

Asthma cases could rise in the future and become a major health issue due to the huge number of people who now have the disease as well as environmental factors. In order to keep those who are predisposed to asthma from getting the disease and to keep asthmatics from having asthma episodes, education plays a critical role in raising public knowledge of asthma (Balqis & Hidayati, 2022). The high incidence of asthma can result in increased mortality and decreased quality of life in asthma patients. The risk factors for causing asthma include age, gender, history of smoking, excessive body mass index, and occupation (Wang et al., 2023).

Apart from that, asthma is influenced by age, gender, active and passive smoking, genetics, and body mass index. If the body mass index is excessive, it will result in a decrease in lung function, so there is a relationship between body mass index and the control status of asthma patients (Hamdin et al., 2021). To reduce the incidence of

<sup>a</sup> <https://orcid.org/0000-0001-5633-7444>

<sup>b</sup> <https://orcid.org/0000-0003-3443-4440>

asthma, an intervention is needed, namely the Buteyko breathing technique.

This technique can be used to control asthma symptoms and reduce the frequency of asthma recurrence. The Buteyko breathing technique can be done anywhere, anytime, and is easy to implement (Wijonarko & Jaya Putra, 2022).

Researchers are looking for articles about the impact of the Buteyko breathing technique on patients with bronchial asthma, given the background information provided above. Thus, it was possible to determine how Buteyko breathing technique therapy affected the frequency of respiratory episodes in patients with bronchial asthma. This study aims to conduct a systematic review to examine the impact of the Buteyko breathing technique on respiratory frequency in individuals with bronchial asthma. The particular goals are to: 1) examine and evaluate research findings on the Buteyko breathing technique; and 2) examine and evaluate research

findings on the impact of therapy on respiratory frequency in patients with bronchial asthma.

## 2. METHODS

### 2.1 Search Strategy and Review Process

In this systematic review, seven studies were identified that met the criteria for research with a Quasy Experimental' design. The rules for creating this review article are based on the PRISMA checklist because it is simple and easy to use (Page & Moher, 2014). Literature search via Pubmed, Semantic Scholar, Google Scholar, dan Science Direct, published from 2018-2023. Structured research questions using the **electronic method of PICO (patient, intervention, comparison, and outcome)**. The PICO in this study is as follows: **P:** Asthma Patients, **I:** Buteyko Breathing, **C:** no comparison, **O:** Breathing Patterns.

*Table 1. An explanation of the PICO approach (patient, intervention, comparison, and outcome) keywords used in the literature search*

PICO COMPONENT	
P	Asthma Patients
I	Buteyko Breathing
C	-
O	Breathing Patterns

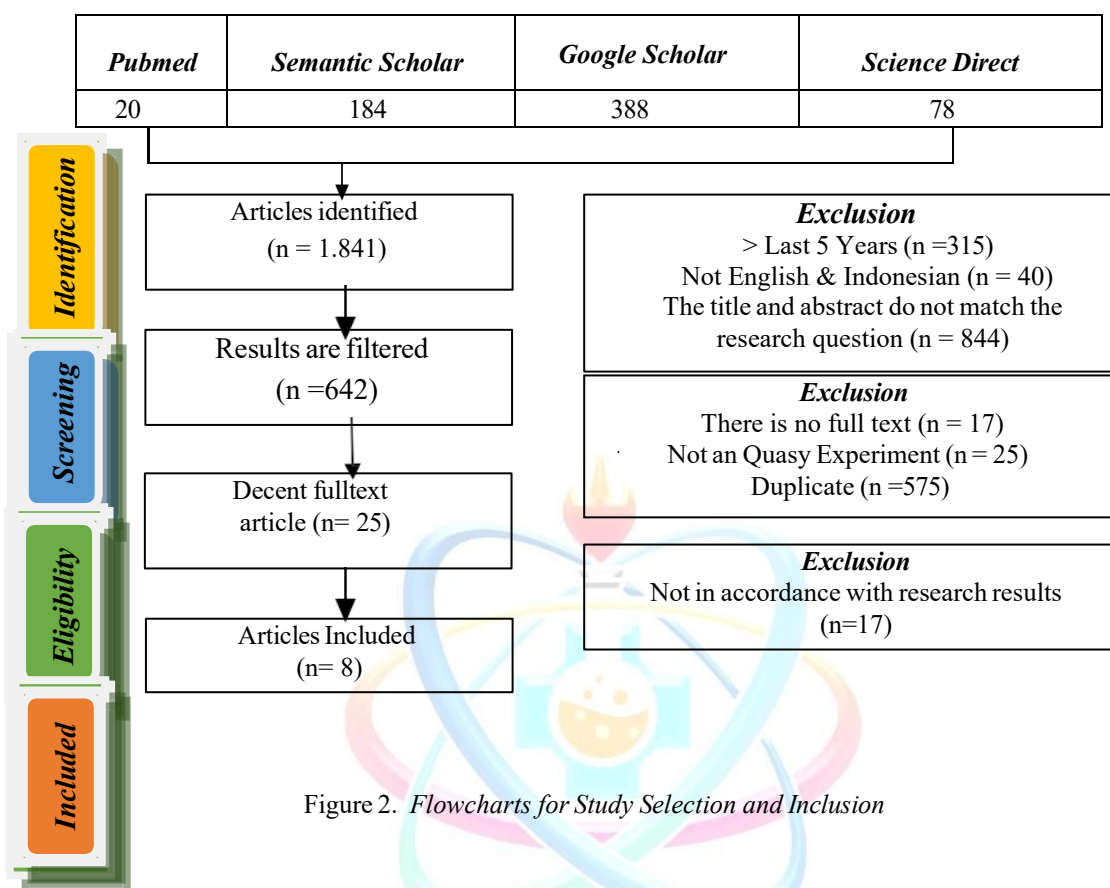
The research question formulated through the PICO strategy is as follows: is Buteyko therapy effective in reducing respiratory frequency in bronchial asthma patients? Only eight articles met the criteria after excluding articles from the 1.841 articles obtained.

### 2.2 Inclusion and Exclusion Criteria

Studies that satisfied the following inclusion  
**Study Selection**

requirements were chosen: Buteyko therapy intervention studies, full text in English, quasi-experimental research type, published within the previous eight years (2018–2023), studies published both domestically and worldwide, Interventions with one or more components, interim standards, and exclusion standards: Research conducted as a protocol, review, or pilot research; the publication just contains the title and abstract; adult asthma patients are the target group

Table. 2. An overview of the inclusion process carried out can be seen in the PRISMA flow diagram below:



The study selection is depicted in Figure 2. A total of 1.841 articles were identified from the four literature data searches after the assignment was carried out in 2018-2023, namely the results of search screening in PubMed totaling 20 articles, Semantic Scholar 184 articles, Google Scholar 1.590 articles, and Science Direct 47 articles. The authors independently assessed all identified articles for inclusion in the systematic review. Of the 1.841 potential articles, these were excluded articles. The results of exclusion were publications from more than the last five years (n= 315), not in English or Indonesian (n = 40), and titles and abstracts that did not match the research question (n= 844), resulting

in 642 articles. Then, those that did not have full text (n= 17) and duplicates (n= 575) that were not Quasy Experiment (25) were excluded from obtaining 25 eligible full-text articles. After that, we excluded 17 articles that did not match the research results. Currently, eight articles are worthy of review.

### 2.3 Extracting Data and Evaluating Quality

Table 3 provides a summary of Data Extraction and the evaluation of the quality of Information Extraction by identifying the author, the year of publication, the location, the type of study, the aims, the interventions, and the research findings

Tabel 3. Data Extraction And Quality Assessment

Author Name	Title	Country	Method	Research Result
Elsaid & Zahran (2023)	Comparison of the Effects of Buteyko and Diaphragmatic Breathing Tecnique on Improving Pulmonary Fuctions and	Egypt	D (Design): A quasi Experimental (pretest – post test design)  S (Sample): 60 bronchial asthma patients consisting of	With a p-value of 0.000, it was demonstrated that buteyko breathing method therapy was more successful in enhancing lung

	Asthma Control among Patients with Bronchial Asthma		30 Buteyko Technique therapy intervention groups and 30 control intervention groups	function and managing symptoms of asthma
			V (Variable): Buteyko Technique therapy, diaphragmatic breathing, and bronchial asthma patients	
			I (Instrument): observation sheet	
Ramadhona et al (2023)	The Effect of Buteyko Breathing Technique on Ineffective Breathing Patterns in Clients with Bronchial Asthma	Indonesian	<p>D (Design): Quasy experiments</p> <p>S (Sample): 34 bronchial asthma respondents consisting of 17 control groups and 17 intervention groups</p> <p>V (Variable): Buteyko breathing technique, and breathing pattern are not effective in patients with bronchial asthma</p> <p>I (Instruments): stopwatch, research observation sheet, and Buteyko breathing technique video</p>	Following the implementation of the Buteyko breathing technique therapy in bronchial asthma patients, the dyspnea value was found to be $0.033 < \alpha$ (0.05) and the respiratory frequency value to be $0.001 < \alpha$ (0.05). These findings indicate a significant relationship between the breathing pattern of patients with bronchial asthma and the Buteyko breathing technique intervention. Therefore, those with bronchial asthma can benefit from improved breathing patterns with the Buteyko breathing technique..
Fitriani & Silaen, (2023)	The Effect of Buteyko Breathing on Dyspnea Levels in Asthma Patients in Outpatient Services at Aminah Hospital, Tangerang City	Indonesian	<p>D (Design): Quasy Experiment</p> <p>S (Sample): 23 people in the control group and 23 people in the intervention group</p> <p>V (Variable): Asthma, Buteyko Breathing Technique, Level of Dyspnea</p> <p>I (Instrument): observation sheet</p>	The Wilcoxon test findings showed a p-value of $0.000 < 0.05$ , indicating that the Buteyko breathing technique had an impact on the severity of asthma dyspnea at Tangerang City Hospital outpatient care.
Mohamed et al., (2019)	The Effect of Buteyko Breathing Technique among patients with bronchial asthma :	Egypt	<p>D (Design): Quasy Experiment</p> <p>S (Sample): 100 bronchial asthma</p>	With a p-value of 0.000, Buteyko breathing exercises had a significant impact on asthma patients'

	Comparative studi		patients, consisting of 50 control group patients and 50 intervention group patients	capacity to control their breathing and on how severe their symptoms are.
			V (Variable): Buteyko breathing technique and Asthma patients	
			I (Instrument): observation sheet	
Sutrisna (2019)	Effect of Buteyko Breathing Technique on Control of Bronchial Asthma	Indonesian	D (Design): Quasy Experimental  S (Sample): 14 asthma patients  V (Variable): Buteyko breathing technique and Bronchial asthma Patients  I (Instrument): observation sheet	The study's findings indicate that there was a significant difference ( $p=0.00$ ) between the FEV1 values obtained before and after the buteyko breathing technique ( $37.43 \pm 6.513$ vs. $69.57 \pm 6.836$ ). An ANOVA test conducted again revealed a significant difference ( $p=0.00$ ).
Juwita & Sary (2019)	Buteyko breathing is useful in controlling asthma	Indonesian	D (Design): Quasy Experimental  S (Sample): 15 people  V (Variable): Buteyko breathing and Asthma Control  I (Instrument): observation sheet	The study's p-value of 0.000 indicated that there was a difference in asthma control between the pre- and post-implementation periods for Buteyko breathing. Using Buteyko breathing to manage asthma is beneficial.
Mufarika et al., (2019)	Effect of Buteyko Methods Breathing Exercise on Moderate Persistent Asthma Patients' Forced Expiratory Volume in One Second (FEV1) Score Improvement	Indonesian	D (Design): Quasy Experimental  S (Sample): 30 control groups and 30 intervention groups  V (Variable): Asthma, Buteyko FEV1 breathing exercises  I (Instrument): observation sheet	Based on the study's findings, which showed a p-value of 0.001 difference between the intervention and control groups, it was determined that the Buteyko breathing technique had an impact on asthma patients' FEV1.
E. Mohamed et al. (2018)	Buteyko Breathing Technique : A Golden Cure for Asthma	Egypt	D (Design): A Quasi Experimental  S (Sample): 50 asthma patients before intervention and 50 asthma patients after intervention	Based on the research results, it was found that all respondents with asthma who experienced severity and asthma control experienced a significant improvement after



V (Variable): Buteyko breathing technique and Asthma patients

I (Instrument): observation sheet for asthma severity and asthma control

applying the Buteyko breathing technique with a p value <0.000, with a significant increase in function-forced expiratory volume in 1s (FEV1) after applying the Buteyko breathing technique, which can be seen from intermittent increases in lung function: 64% and mild increases in lung function: 36%.

**Table 4: Critical Appraisal JBI**

Appraisal Checklist	Elsaid & Zahran, (2023)	Ramadhona et al., (2023)	Fitriani & Silaen, (2023)	Mohamed et al., (2019)	Sutrisna, (2019)	Juwita & Sary, (2019)	Mufarik a et al., (2019)	E. Mohamed et al., (2018)
Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were the participants included in any comparisons similar?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Was there a control group?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were there multiple measurements of the outcome both pre and post the intervention/exposure?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were the outcomes of participants included in any comparisons measured in the same way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were outcomes measured in a reliable way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Overall appraisal:	Include	Include	Include	Include	Include	Include	Include	Include

### 3. RESULTS

For this study, eight papers were reviewed, three from Egypt and five from Indonesia, two different countries. The eight publications show how the Buteyko breathing technique significantly alters the breathing patterns of those who have bronchial asthma. These are the results that:

#### 3.1 Research design

The research objective of this type of systematic review identified eight articles. The article discusses the influence of the Buteyko breathing technique on breathing patterns in patients with bronchial asthma. There are eight intervention studies with a Quasi-Experimental design, namely Elsaid & Zahran, (2023), Ramadhona et al., (2023), Fitriani & Silaen, (2023), Mohamed et al., (2019), Sutrisna, (2019), Juwita & Sary, (2019), Mufarika et al., (2019), E. Mohamed et al., (2018).

#### 3.2 Sample Characteristics

The total sample data is  $n = 429$  from eight studies, there is research using one group pre-test post-test, namely Juwita & Sary (2019)  $n = 15$  respondents and Sutrisna, (2019)  $n = 14$  respondents while six studies use different respondents for the control group and intervention; Elsaid & Zahran, (2023)  $n = 30$  control group and 30 intervention group, Ramadhona et al., (2023)  $n = 17$  control group and 17 intervention group, Fitriani & Silaen, (2023)  $n = 23$  control group and 23 intervention groups, Mohamed et al., (2019)  $n = 50$  control groups and 50 intervention groups, Mufarika et al., (2019)  $n = 30$  control groups and 30 intervention groups, E. Mohamed et al., (2018)  $n = 50$  control group and 50 intervention group.

#### 3.3 Types of Interventions and Instruments

Based on this review, it was found that the eight studies used the Buteyko breathing technique intervention, the instrument used was an observation sheet checking the severity of asthma and asthma control.

#### 3.4 Effect of Buteyko Breathing Technique on Breathing Patterns in Bronchial Asthma Patients

All eight of the examined research demonstrated that the Buteyko breathing technique had a substantial impact on patients with bronchial asthma's breathing patterns. These investigations included the findings of Elsaid & Zahran, (2023), stating that following the Buteyko breathing method therapy, the  $p$ -value was 0.000. When treating patients with bronchial asthma, the Buteyko breathing technique Ramadhona et al., (2023) revealed that the respiratory frequency value was  $0.001 < \alpha (0.05)$  and the dyspnea value was  $0.033 < \alpha (0.05)$ , indicating a significant relationship between the Buteyko breathing method intervention and breathing patterns in bronchial asthma patients Fitriani & Silaen (2023)

declared that the Buteyko breathing technique had an impact on the severity of asthma dyspnea because the  $p$ -value was  $0.000 < 0.05$ ., Mohamed et al., (2019) claimed that after using the Buteyko breathing technique, asthma patients in the intervention group had a decrease in the severity of their symptoms, a decrease in the requirement for medicine, and an improvement in their ability to manage their breathing ( $p$ -value of 0.000), Sutrisna, (2019) indicated that the FEV1 values before and after the Buteyko breathing technique ( $37.43 \pm 6.513$ ) differed significantly ( $p=0.00$ ). The FEV1 values after the technique was administered were 69.57. The results of the Repeated ANOVA test indicated a significant difference ( $p=0.00$ ); Juwita & Sary, (2019) claimed that a  $p$ -value of 0.000 indicated a difference in asthma control between the use of Buteyko breathing apparatus and, Mufarika et al., (2019) determined that the Buteyko breathing technique had an impact on asthma patients' FEV1 since there is a difference between the control group and the intervention group with a  $p$ -value of 0.001., E. Mohamed et al., (2018) stated that all respondents with asthma experienced severity and control asthma experienced a significant improvement after applying the Buteyko breathing technique with a  $p$ -value  $< 0.000$ .

### 4. DISCUSSION

The death rate in patients who experience disorders of the respiratory system can be reduced by providing primary assistance to patients experiencing hypoxia by regulating breathing patterns using complementary therapy. The Buteyko breathing technique is useful for maintaining or increasing oxygen saturation values (Endiyono et al., 2022). Asthma is one of the most common chronic diseases in the world. Hyperventilation is the main cause of hypoxemia in asthma patients. To overcome this, Buteyko therapy is needed to increase the peak flow rate by reducing dyspnea (John David & R Patil, 2022). Apart from that, respiratory system disorders can result in a decrease in lung function, which can cause a decrease in peak expiratory flow rate. Using Buteyko breathing exercises can increase the peak expiratory flow rate (Mistry et al., 2021).

Limited airflow is a common symptom of asthma, a persistent inflammation of the respiratory system. The Buteyko breathing technique is one of the many breathing exercises that may be used to increase ventilation. It can assist improve lung health and lessen the intensity of asthma attacks. (Jagtap & Vardhan, 2020). To overcome the frequency of relapses in asthma patients, it is necessary to apply respiratory technique therapy, namely the Buteyko breathing technique. This is included in non-pharmacological therapy, so it is very easy to do and is also more cost-effective (Indrawati & Anggiarti, 2021).

Patients with asthma need to be given nursing care management to fulfill oxygenation needs with ineffective airway clearance nursing problems, given the Buteyko breathing exercise nursing action in 1 meeting for 3 days with a time of 15 minutes and the results show that the respiration rate has decreased, from 26 x/minute to 22 x / minute, SpO2 increases from 94% to 98, respiratory muscles from present to

no muscles assisting breathing (Yosifine et al., 2022)

Applying Buteyko breathing exercises can help nurses deal with respiratory difficulties such as inadequate breathing patterns with a respiratory rate (RR) > 26 x/minute and mild hypoxia with a SpO<sub>2</sub> < 95%. Patients with asthma who have poor breathing patterns see improvements in their diseases, with SPO<sub>2</sub> > 98% and RR 18–20 X/Minute (Mursjid Djiwandono et al., 2023).

## 5. CONCLUSION

Health professionals should implement Buteyko breathing therapy, which has advantages such as helping asthmatics breathe better by balancing CO<sub>2</sub> levels and cellular oxygenation values, which ultimately helps lessen asthma symptoms. The main purpose of the Buteyko approach is to lessen the severity and symptoms of asthma naturally. Future studies on the connection between bronchial asthma patients' quality of life and Buteyko respiratory therapy are being planned; these studies should help patients live better lives.

## REFERENCES

- Badan Penelitian dan Pengembangan Kesehatan, & L. (2019). *Laporan Provinsi Sumatera Selatan. Lembaga Penerbit Badan Penelitian Dan Pengembangan Kesehatan*, 19(9), 1–7.  
<http://ejournal2.litbang.kemkes.go.id/index.php/lpb/article/view/3665>
- Balqis, D., & Hidayati, I. (2022). *Penatalaksanaan Asma Persisten Ringan Melalui Pendekatan Dokter Keluarga*. 12(April), 79–87.
- Elsaid, A. A., & Zahran, W. E. (2023). *Comparison of the Effects of Buteyko and Diaphragmatic Breathing Technique on Improving Pulmonary Functions and Asthma Control among Patients with Bronchial Asthma*. 4(2), 58–76.
- Endiyono, E., Adhi, M. H. P., & Muslim, A. H. (2022). The Effect of Buteyko Method on Oxygen Saturation Values in Covid-19 Patients. *Jurnal Aisyah : Jurnal Ilmu Kesehatan*, 7(S2), 125–128.  
<https://doi.org/10.30604/jika.v7is2.1419>
- Fitriani, R., & Silaen, H. (2023). *Pengaruh pernafasan buteyko terhadap tingkat dispnea pada penyakit asma di pelayanan rawat jalan rumah sakit aminah kota tangerang*. 1(3), 76–81.
- Hamdin\*, T. W. J. K., Risky Irawan\*\*, D. R., & Pramana, K. D. (2021). *Hubungan Indeks Massa Tubuh Dengan Status Kontrol Pasien Asma Di Rsud Kota Mataram Tahun 2019*. 06(02), 188–198.
- Indrawati, L., & Anggiarti, G. (2021). *Pengaruh Teknik Pernapasan Buteyko terhadap Frekuensi Kekambuhan Asma Bronkial*. *Jurnal Ilmu Kesehatan*, 9(2), 103.
- Jagtap, N. R., & Vardhan, G. D. V. (2020). *International Journal Of Scientific Research Effect Of Buteyko Breathing Technique On Peak Expiratory Physiotherapy Nikita Rajendra G . D . Vishnu*. 3, 51–52.
- John David, J., & R Patil, H. (2022). *Immediate Effect of Buteyko Breathing Technique Versus Stacked Breathing Technique in Asthma Patients*. *International Journal of Health Sciences and Research*, 12(6), 158–167.  
<https://doi.org/10.52403/ijhsr.20220621>
- Juwita, L., & Sary, I. P. (2019). *Pernafasan Buteyko Bermanfaat Dalam Pengontrolan Asma*. *REAL in Nursing Journal*, 2(1), 10.  
<https://doi.org/10.32883/rnj.v2i1.476>
- Kementerian Kesehatan RI. (2018). *Laporan Riskesdas 2018 Nasional.pdf*. In *Lembara Penerbit Balitbangkes*.
- Mistry, P. B., Palkar, A., & Kumar, A. (2021). *The Effect of Buteyko Breathing Exercise on Peak Expiratory Flow Rate in Carpenters*. *International Journal of Health Sciences and Research*, 11(6), 47–51.  
<https://doi.org/10.52403/ijhsr.20210608>
- Mohamed, E., Elmetwaly, A., & Ibrahim, A. (2018). *Buteyko Breathing Technique: A Golden Cure for Asthma*. *American Journal of Nursing Research*, 6(6), 616–624.  
<https://doi.org/10.12691/ajnr-6-6-32>
- Mohamed, Y., Elderiny, S., & Ibrahim, D. L. (2019). The effect of Buteyko breathing technique among patients with bronchial asthma: Comparative study. *International Journal of Midwifery and Nursing Practice*, 2(2), 01–10.  
<https://doi.org/10.33545/26630427.2019.v2.i2a.36>
- Mohammad, Y., Rafea, S., Latifeh, Y., Haydar, T., Jamal, H., Alkhayer, G., Dib, G., AL-Massalmeh, M. S., AL-Lahham, A., Fawaz, Y., Nahas, L. D., Sony, A. El, & Ellwood, P. (2023). Global Asthma Network Phase I Syria asthma surveillance and the impact of the war. *Journal of Thoracic Disease*, 15(5), 2873–2881.  
<https://doi.org/10.21037/jtd-23-251>
- Mufarika, M., Mayangsari, M., Haris, M., & Andrian, W. (2019). Effect of Breathing Exercise With Buteyko Methods Improveing Forced Expiratory Volume In One Second (Fev1) Score With Moderate Persistent Asthma. *Jurnal Keperawatan Muhammadiyah*, 4(2), 163–168.  
<https://doi.org/10.30651/jkm.v4i2.2591>
- Mursjid Djiwandono, S., Trisnaningtyas, W., Utami Dwiningsih, S., Dafid Zakaria, E., & Nisa, R. (2023). Analysis of the application of buteyko breathing exercise to improvement of respiratory rate (RR) and oxygen saturation (SpO<sub>2</sub>) in asthma patients in the emergency room RSUP Dr. Kariadi. *Jurnal Keperawatan*, 14(02), 149–155. <https://doi.org/10.22219/jk.v14i02.27251>
- Ramadhona, S., Wasisto Utomo, & Yulia Rizka. (2023). *Pengaruh Teknik Pernapasan Buteyko Terhadap Pola Napas Tidak Efektif Pada Klien Asma Bronkial*. *Jurnal*



*Vokasi Keperawatan (JVK)*, 6(1), 18–27.  
<https://doi.org/10.33369/jvk.v6i1.26180>

Sutrisna, M. (2019). Pengaruh Teknik Pernapasan Buteyko Terhadap Kontrol Asma Bronkial. *Jurnal Riset Media Keperawatan*, 2(1), 15–26.  
<https://doi.org/10.51851/jrmk.v2i1.18>

Wang, Z., Li, Y., Gao, Y., Fu, Y., Lin, J., Lei, X., Zheng, J., & Jiang, M. (2023). Global, regional, and national burden of asthma and its attributable risk factors from 1990 to 2019: a systematic analysis for the Global Burden of Disease Study 2019. *Respiratory Research*, 24(1), 1–13.  
<https://doi.org/10.1186/s12931-023-02475-6>

Wijaya, A., & Toyib, R. (2018). Sistem Pakar Diagnosis Penyakit Asma Dengan Menggunakan Algoritme Genetik (Studi Kasus RSUD Kabupaten Kepahiang). *Pseudocode*, 5(2), 1–11.  
<https://doi.org/10.33369/pseudocode.5.2.1-11>

Wijonarko, & Jaya Putra, H. (2022). Pengaruh Terapi Teknik Pernapasan Buteyko Terhadap Penurunan Frekuensi Kekambuhan Pada Pasien Asma. *Jurnal Keperawatan Bunda Delima*, 4(1), 24–31.  
<https://doi.org/10.59030/jkbd.v4i1.30>

Yosifine, Y., Margaretha, M., Fatik, R., Saputra, R., Naning, D., Meiliana, R., Lestari, S., Septiana, R., Octaviana, W., Nurjanah, S., & Rokhmiati, E. (2022). Intervensi Teknik Pernafasan Buteyko terhadap Penurunan Respirasi Rate dan Saturasi Oksigen pada Pasien Asma Bronchial. *Open Access Jakarta Journal of Health Sciences*, 1(9), 318–322. <https://doi.org/10.53801/oajjhs.v1i9.70>

