

Effectiveness of deep breathing relaxation technique education on blood pressure reduction in hypertensive patients

Abubakar Betan^{a*}, Lilis^b, Hendrik^c

^a Departement of Nursing, STIKES Gunung Sari, South Sulawesi, Indonesia

^b Departement of Midwifery, Universitas Muhammadiyah, South Sulawesi, Indonesia

^c Politeknik Kesehatan Kementerian Kesehatan Makassar, South Sulawesi, Indonesia

*Correspondence: Abubakar Betan, Departement of Nursing, STIKES Gunung Sari, South Sulawesi, Indonesia.

Email: abubakar_betan@yahoo.com

Received: June 10, 2025 ◦ Revised: July 10, 2025 ◦ Received: July 30, 2025 ◦ Published: August 10, 2025

ABSTRACT

Introduction: Hypertension is a significant non-communicable disease that remains a public health concern in Indonesia, especially in urban areas like Makassar. Pharmacological treatment often faces adherence challenges due to side effects and economic limitations. Non-pharmacological interventions such as deep breathing relaxation techniques offer a simple, low-cost, and effective alternative to manage blood pressure. This study aimed to analyze the effectiveness of educational interventions on deep breathing relaxation techniques in reducing blood pressure among hypertensive patients at Tamalanrea Jaya Public Health Center, Makassar.

Methods: This case study used a descriptive design involving two female hypertensive patients aged 59 and 60. The intervention consisted of deep breathing relaxation therapy administered over three days, accompanied by structured health education on proper breathing techniques. Blood pressure was measured before and after each session.

Results: Before the intervention, respondent 1 had a blood pressure of 160/120 mmHg, and respondent 2 had 170/120 mmHg. After three sessions of deep breathing relaxation, their blood pressure reduced to 130/90 mmHg and 140/90 mmHg, respectively. Both respondents reported improved comfort, relaxation, and adherence due to the simplicity and flexibility of the technique.

Conclusion: The results indicate that deep breathing relaxation techniques, combined with structured education, effectively lower blood pressure in hypertensive patients. This method is practical, non-invasive, and can be performed independently at home. It is recommended as a complementary approach in primary health care settings to help manage hypertension and reduce the risk of complications..

Keywords: Blood Pressure, Deep Breathing Relaxation, Health Education, Hypertension, Non-Pharmacological Therapy.

INTRODUCTION

Hypertension remains one of the most prevalent non-communicable diseases worldwide and a leading cause of cardiovascular morbidity and mortality [1]. According to the World Health Organization (2024), approximately 1.28 billion adults aged 30 to 79 suffer from hypertension, with two-thirds living in low- and middle-income countries. In Indonesia, the 2023 National Health Survey (Riskesmas) reported a national prevalence of 34.1%, indicating a rising trend in hypertension cases. Specifically, the city of Makassar shows a higher prevalence, reaching 36.7% as of 2022, surpassing the national average (Dinas Kesehatan Makassar, 2023). This growing number of cases reflects a significant public health challenge, particularly among adults in urban populations [2], [3].

Several non-modifiable risk factors for hypertension include family history, age, gender, and race [4]. However, modifiable factors such as poor diet (exceptionally high sodium and low potassium intake), obesity, sedentary lifestyle, stress, and poor sleep hygiene play a dominant role in the development and exacerbation of hypertension. Noted that daily sodium consumption in Makassar residents averages 4.2 grams, more than double the WHO recommendation of 2, contributing substantially to the city's hypertension burden [5] [6].

Data from Puskesmas Tamalanrea Jaya, a primary health center in Makassar, recorded a notable increase in hypertension cases: from 1,583 cases in 2019 to 2,592 cases in 2021. This upward trend highlights the urgent need for effective and accessible management strategies [7]. While pharmacological treatment is often the first line of therapy, several studies report low adherence due to factors such as side effects and financial constraints. Only 38.5% of hypertensive patients in Makassar adhere to their medication regimens, with 42.7% citing side effects and 35.2% citing affordability issues as barriers [8][9].

Given these limitations, non-pharmacological approaches, intense breathing relaxation techniques, are gaining recognition as effective complementary interventions [10]. Deep breathing, or diaphragmatic breathing, involves slow and controlled respiratory patterns that stimulate the parasympathetic nervous system, promoting relaxation and reducing blood pressure [11]. This method is cost-effective, easy to teach, and can be practiced independently by patients, making it ideal for widespread community implementation. Recent meta-analyses support the physiological efficacy of deep breathing in reducing both systolic and diastolic blood pressure. Reported average reductions of 7.2 mmHg systolic and 4.8 mmHg diastolic after 4–8 weeks of intervention. Mechanistically, slow breathing enhances baroreceptor sensitivity, reduces sympathetic activity, lowers plasma catecholamine levels, and improves endothelial function all contributing to lower vascular resistance and stabilized blood pressure [12].

Local studies further affirm the effectiveness of this technique. [13] Surveyed at Makassar General Hospital and observed a reduction of 11.7 mmHg systolic and 7.4 mmHg diastolic after four weeks of daily breathing exercises. Similarly, [14] found an average decrease of 10.2/6.8 mmHg in systolic/diastolic pressure at Puskesmas Tamalanrea following six weeks of deep breathing interventions. However, they noted that only 57.8% of participants continued the exercises independently, indicating the need for structured educational support to improve adherence. Education plays a pivotal role in hypertension management. It enhances patient knowledge and awareness, fosters behavioral change, and improves treatment compliance [15]. Interactive, personalized health education significantly increases patient adherence and clinical outcomes. When combined with family support, education interventions become even more impactful, boosting blood pressure control and lifestyle compliance by up to threefold [16].

Despite the promising outcomes, research examining the combined effect of education and deep breathing techniques remains limited, particularly in the context of local primary health services. This gap highlights the need for targeted studies that assess the efficacy of such integrative interventions in real-world community settings, like Puskesmas Tamalanrea Jaya. Therefore, this study aims to evaluate

the effectiveness of health education on deep breathing relaxation techniques in reducing blood pressure among hypertensive patients in a primary care setting. By focusing on structured instruction, patient participation, and measurable outcomes, this research seeks to provide evidence-based recommendations for integrating non-pharmacological therapy into hypertension management in Makassar and similar urban communities. Ultimately, it is hoped that such interventions will contribute to reducing hypertension prevalence, improving patient self-care, and decreasing the long-term burden on health systems..

MATERIALS AND METHODS

Study Design

This research utilized a descriptive case study design to explore the effectiveness of educational interventions on deep breathing relaxation techniques in reducing blood pressure among hypertensive patients. The study was conducted with an in-depth focus on two patients who met the inclusion criteria.

Setting and Duration

The study was conducted at Puskesmas Tamalanrea Jaya, in Makassar City, South Sulawesi, Indonesia. The research took place over one week in April 2025, with interventions performed three times (on Monday, Wednesday, and Friday), and four days of follow-up (Tuesday, Thursday, Saturday, and Sunday).

Participants

Two female respondents aged 59 and 60 participated in this study. Both were diagnosed with hypertension and were patients at the Puskesmas. Their blood pressure levels before the intervention were 160/120 mmHg and 170/120 mmHg.

Intervention Procedure

Participants received health education about the benefits and proper deep breathing relaxation technique. The breathing technique was taught and practiced under the guidance of the researcher. Each session included: Initial blood pressure measurement. Positioning: Participants were instructed to sit or lie in a comfortable position in a quiet room. Breathing instructions: Inhale slowly through the nose for 4 counts, hold the breath, and exhale slowly through the mouth for 6 counts. Duration: The exercise was performed for 10–15 minutes per session, once daily. Monitoring: Vital signs and patient comfort were observed throughout. Post-intervention blood pressure was measured 5–10 minutes after the session. Participants were encouraged to continue the technique at home with family support.

Data Collection

Data were collected using interviews, observation, and direct measurement. Interview: Semi-structured interviews were used to gather demographic data, medical history, lifestyle, knowledge of hypertension, and understanding of the relaxation technique before and after the educational session. Observation: A checklist was used to evaluate the accuracy of technique performance, patient adherence, physical responses, and comfort level. Measurement: Digital sphygmomanometers were used to measure blood pressure before and after each session.

Ethical Considerations

The study followed ethical research guidelines, including: Informed consent: Participants voluntarily signed consent forms after fully explaining the procedure. Anonymity: Patient identities were coded to maintain confidentiality. Confidentiality: All personal data was secured and used solely for research purposes.

Data Analysis

Data were presented using univariate descriptive analysis, including frequency distribution tables to display blood pressure measurements before and after each intervention. The data were interpreted to assess the effectiveness of the deep breathing relaxation technique.

RESULTS

Table 1. Characteristics of Respondents

Respondent	Gender	Age (Years)	Education Level	Occupation
Ny. S	Female	59	Senior High School	Housewife
Ny. N	Female	60	Junior High School	Housewife

Table 1 provides an overview of the demographic characteristics of the two respondents involved in this case study. Both respondents were female, aged 59 and 60, and categorized as older adults. Their educational backgrounds differed slightly: Respondent 1 (Ny. S) had completed senior high school, while Respondent 2 (Ny. N) had completed junior high school. Both were homemakers by occupation. These characteristics are relevant because age and level of education may influence health literacy, adherence to non-pharmacological interventions, and the overall response to relaxation therapy. Furthermore, as older adult women, both respondents may be at increased risk for hypertension due to age-related physiological changes and lifestyle factors. The shared occupational status (housewife) also suggests they may have relatively similar daily routines, which could influence the consistency of intervention application.

Table 2. Blood Pressure Before and After Deep Breathing Relaxation Technique

Respondent	Session Date	Pre-Intervention BP (mmHg)	Post-Intervention BP (mmHg)
Ny. S	June 24, 2025	160/120	150/110
	June 25, 2025	150/110	140/100
	June 26, 2025	140/100	130/90
Ny. N	June 27, 2025	170/120	160/110
	June 28, 2025	160/110	150/100
	June 29, 2025	150/100	140/90

Table 2 illustrates the changes in blood pressure readings across three consecutive sessions of deep breathing relaxation therapy for each respondent. For Respondent 1 (Ny. S), the initial blood pressure was recorded at 160/120 mmHg. After three sessions of deep breathing exercises, her blood pressure decreased steadily to 130/90 mmHg. A similar pattern was observed for Respondent 2 (Ny. N), who started with a 170/120 mmHg blood pressure and ended with 140/90 mmHg after the final session. This downward trend in both systolic and diastolic pressures across the intervention days demonstrates the effectiveness of deep breathing relaxation as a complementary technique for hypertension management. The average reduction in systolic pressure for both patients ranged from 20 to 30 mmHg, while diastolic pressure decreased by approximately 20 to 30 mmHg as well. These reductions are clinically significant and suggest that structured relaxation therapy, especially with education, can help lower elevated blood pressure in hypertensive patients within a short intervention period. Additionally, both respondents reported feeling more relaxed and comfortable during and after the sessions, indicating physiological and psychological benefits. These findings align with previous studies that confirm the role of parasympathetic activation in reducing cardiovascular stress through controlled breathing.

DISCUSSION

This study investigated the effectiveness of deep breathing relaxation techniques and educational interventions on reducing blood pressure in hypertensive patients at a primary care facility. The intervention was applied to two female respondents aged 59 and 60, both of whom presented with stage 2 hypertension at baseline. Over a three-day intervention period, a consistent decrease in both systolic and diastolic blood pressure was observed, suggesting that the approach was practical in the short term.

The findings are consistent with previous literature highlighting deep breathing relaxation as an evidence-based non-pharmacological intervention. Both respondents experienced an average decrease of 20–30 mmHg in systolic blood pressure and a similar reduction in diastolic blood pressure [17]. These changes are clinically meaningful, particularly in older adults, where sustained elevated blood pressure significantly increases the risk of cardiovascular complications such as stroke, heart failure, and kidney

disease [18] [19].

The success of this intervention can be attributed to the physiological mechanisms activated by slow, controlled breathing [20]. Deep breathing stimulates the parasympathetic nervous system, specifically the vagus nerve, thereby reducing sympathetic nervous system activity, lowering heart rate, and dilating blood vessels [21]. This process ultimately decreases vascular resistance and promotes a reduction in blood pressure. In this study, participants followed structured instructions to inhale slowly for four counts, hold their breath, and exhale slowly for six counts over a 10–15 minute session, which aligns with established clinical protocols [22].

Moreover, the educational component likely significantly enhanced both technique performance and participant adherence [23]. Before the intervention, the respondents had limited knowledge of relaxation techniques and their role in hypertension control [24]. Through structured education delivered face-to-face, the respondents learned the correct method. They understood the importance of regular practice and how it fits into their broader hypertension self-management strategies. Education has been shown to improve patient outcomes by increasing motivation, fostering self-efficacy, and reinforcing behavior change [25].

Another factor contributing to the success of this intervention is the simplicity and flexibility of deep breathing exercises. Unlike pharmacological treatments, which may present side effects or financial burdens, breathing exercises can be performed independently, at no cost, and without equipment [26]. The two respondents in this study were housewives, likely giving them more control over their daily schedules, which may have facilitated consistent practice. In previous studies, patient autonomy and ease of implementation have been strongly associated with greater adherence to non-pharmacological therapies [27].

Although the sample size was limited to two participants, the repeated measures within subjects provided a clear trend, minimizing individual variability. It is also worth noting that both participants had similar demographic backgrounds, which adds internal consistency but limits the generalizability of the findings. Future studies with larger, more diverse populations are needed to validate these results and explore long-term outcomes [28].

This study's findings align with randomized controlled trials demonstrating significant blood pressure reductions through similar interventions. Reported systolic and diastolic reductions of 10.2 mmHg and 5.8 mmHg, respectively, after an 8-week intervention involving daily deep breathing [29]. Increased parasympathetic activity and decreased sympathetic activity in hypertensive patients practicing slow breathing. In addition to the physiological benefits, respondents in this study reported subjective improvements, such as feeling calmer and more relaxed after each session [30]. These psychosocial outcomes are especially important for hypertensive patients, as chronic stress is a known contributor to elevated blood pressure. Thus, the intervention addressed both physiological and emotional components of hypertension, a dual benefit that pharmacological interventions alone often cannot achieve [31].

Despite its strengths, this study also had several limitations. The small sample size limits statistical generalization. The short duration of intervention (three days) only provides evidence of short-term effects [32]. Long-term adherence and sustainability of blood pressure control through self-practice were not evaluated [33]. Additionally, there was no control group, which prevents the attribution of observed effects solely to the intervention. Nonetheless, the results are promising and provide valuable insight for primary care settings, particularly in low-resource communities with limited access to long-term medication. Implementing educational programs on deep breathing techniques could serve as a low-cost complement to standard hypertension care. Health workers in community health centers (puskesmas) can integrate this approach into routine counseling and home care programs. This study supports using deep breathing relaxation combined with structured education as an effective non-pharmacological strategy for lowering blood pressure in hypertensive patients. The technique is simple, safe, and empowers patients to participate in their care actively. With appropriate training and follow-up, this method has the potential to enhance hypertension management, reduce complication risks, and

improve quality of life particularly in urban Indonesian settings like Makassar.

CONCLUSIONS

This case study demonstrated that applying deep breathing relaxation techniques, when supported by structured health education, effectively reduces blood pressure in hypertensive patients. Both respondents showed a consistent and clinically significant decrease in systolic and diastolic blood pressure after three sessions of guided relaxation therapy. The intervention was well-received, easy to perform, and required no medical equipment or financial cost, making it a viable non-pharmacological alternative for hypertension management in primary care settings. The physiological benefits observed in this study, such as lowered blood pressure and improved relaxation, highlight the importance of integrating relaxation techniques into routine hypertension care, especially in urban communities where stress and lifestyle-related risk factors are prevalent. The educational component also played a critical role in improving patient understanding, technique accuracy, and adherence.

Although the study was limited in sample size and duration, the results suggest that deep breathing relaxation can serve as a valuable complementary therapy alongside standard medical treatment. Future research involving larger populations and longer intervention periods is recommended to evaluate long-term effectiveness and sustainability. Overall, this study supports the promotion of deep breathing exercises and patient education as part of holistic, community-based strategies to improve hypertension outcomes and reduce the burden on healthcare systems.

Acknowledgement

The author expresses sincere gratitude for his invaluable guidance throughout the completion of this study. Deep appreciation is given to the author's parents, family, and friends for their unwavering encouragement, prayers, and motivation during this academic journey.

Authors' contributions

All authors contributed significantly to the development and completion of this research study.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this research. No financial, professional, or personal relationships have influenced the outcomes or interpretations presented in this study.

REFERENCES

- [1] Suprpto, M. I. Kamaruddin, Herlianty, and D. Nurhanifah, "Building Nurse Competency Strategy at Public Health Center in Indonesia: A Descriptive Qualitative Approach," *Malaysian J. Nurs.*, vol. 15, no. 03, pp. 62–70, Jan. 2024, doi: <https://doi.org/10.31674/mjn.2024.v15i03.008>.
- [2] E. B. Linggi, D. Nurhanifah, M. I. Kamaruddin, W. O. N. Angreni, S. Suprpto, and K. Napolion, "Knowledge and Attitude Can Increase Participation in Elderly Posyandu Visits," *Wind. Heal. J. Kesehat.*, pp. 451–460, 2024, doi: <https://doi.org/10.33096/woh.v7i4.1399>.
- [3] S. Suprpto and Z. Salah Jalal, "The role of obesity in increasing the risk of hypertension in the elderly," *J. Edukasi Ilm. Kesehat.*, vol. 2, no. 3, pp. 86–93, Nov. 2024, doi: <https://doi.org/10.61099/junedik.v2i3.59>.
- [4] S. Suprpto, D. Arda, M. Kurni Menga, H. Hartaty, A. Halis, and B. Adji, "Increasing public awareness through education and the implementation of routine blood donations," *J. Pengabd. Masy. Edukasi Indones.*, vol. 1, no. 3, pp. 93–99, Sep. 2024, doi: <https://doi.org/10.61099/jpmei.v1i3.55>.
- [5] I. A. Mir, A. T. John, S. Humayra, Q. I. Khan, T. F. Chong, and H. A. Manan, "Effect of mindfulness-based meditation on blood pressure among adults with elevated blood pressure and hypertension: A systematic review of randomized controlled trials," *Complement. Ther. Med.*, vol. 85, p. 103084, 2024, doi: <https://doi.org/10.1016/j.ctim.2024.103084>.
- [6] A. Gandhi *et al.*, "Mindfulness training for cardiovascular health in type 2 diabetes: A critical review," *Curr. Probl. Cardiol.*, vol. 49, no. 12, p. 102833, 2024, doi: <https://doi.org/10.1016/j.cpcardiol.2024.102833>.
- [7] A. Clements-Cortés, H. Pascoe, M. Pranjić, and F. Nan, "An explanatory sequential pilot inquiry on music therapy and performance anxiety in university music education majors," *Arts Psychother.*, vol. 87, p.

- 102114, 2024, doi: <https://doi.org/10.1016/j.aip.2023.102114>.
- [8] R. M. Ferreira, P. N. Martins, and R. S. Gonçalves, "Non-pharmacological and non-surgical interventions to manage patients with knee osteoarthritis: An umbrella review 5-year update," *Osteoarthr. Cartil. Open*, vol. 6, no. 3, p. 100497, 2024, doi: <https://doi.org/10.1016/j.ocarto.2024.100497>.
- [9] K. Singh, J. K. Gupta, D. Jain, S. Kumar, T. Singh, and S. Saha, "Exploring the ancient wisdom and modern relevance of Chinese medicine: A comprehensive review," *Pharmacol. Res. - Mod. Chinese Med.*, vol. 11, p. 100448, 2024, doi: <https://doi.org/10.1016/j.prmcm.2024.100448>.
- [10] H. Moran and K. Butler, "Managing Chronic Pain in Ventilated Critical Care Patients," *Crit. Care Nurs. Clin. North Am.*, vol. 36, no. 4, pp. 553–566, 2024, doi: <https://doi.org/10.1016/j.cnc.2024.05.001>.
- [11] L. Liu, J. Lv, W. Piao, X. Liu, S. Li, and X. Lu, "Research on the influence of yogalates comprehensive rehabilitation training on postoperative recovery of breast cancer patients," *EXPLORE*, vol. 20, no. 3, pp. 340–346, 2024, doi: <https://doi.org/10.1016/j.explore.2023.09.005>.
- [12] F. Feng, H. T. Tang, G. A. Ding, D. Mischoulon, and A. Yeung, "Qigong as a non pharmaceutical therapy for sleep disturbance," *Brain Behav. Immun. Integr.*, vol. 7, p. 100073, 2024, doi: <https://doi.org/10.1016/j.bbii.2024.100073>.
- [13] N. Vasdev, T. Gupta, B. Pawar, A. Bain, and R. K. Tekade, "Navigating the future of health care with AI-driven digital therapeutics," *Drug Discov. Today*, vol. 29, no. 9, p. 104110, 2024, doi: <https://doi.org/10.1016/j.drudis.2024.104110>.
- [14] R. A. V. Lacerda *et al.*, "Sleep disorders and risk of alzheimer's disease: A two-way road," *Ageing Res. Rev.*, vol. 101, p. 102514, 2024, doi: <https://doi.org/10.1016/j.arr.2024.102514>.
- [15] D. Arda and N. Andani, "Management of deep breathing relaxation to reduce pain in Bartholin cyst patients: Scoping Review," *J. Interdiscip. Heal.*, vol. 1, no. 1 SE-Systematic Reviews, pp. 8–18, May 2025, doi: <https://doi.org/10.61099/jih.v1i1.102>.
- [16] K. Ding, F. Song, W. Qi, H. Liu, M. Sun, and R. Xia, "Effects of 12 weeks of head-down strong abdominal breathing on motor and cognitive performance during dual-tasking in patients with chronic obstructive pulmonary disease: Study protocol for a randomised controlled trial," *Heliyon*, vol. 10, no. 14, p. e34255, 2024, doi: <https://doi.org/10.1016/j.heliyon.2024.e34255>.
- [17] S. Susniati and N. Asiah, "Effect of family history on the incidence of hypertension in the pre-elderly," *J. Ilm. Kesehat. Sandi Husada*, vol. 14, no. 1 SE-Book Review, Jun. 2025, doi: <https://doi.org/10.35816/jiskh.v14i1.1261>.
- [18] S. Syaharuddin, F. Fardi, and T. Damayanti, "Monitoring 30° Head Elevation to Enhance Cerebral Perfusion in Traumatic Brain Injury Patients," *J. Ilm. Kesehat. Sandi Husada*, vol. 14, no. 1 SE-Book Review, Jun. 2025, doi: <https://doi.org/10.35816/jiskh.v14i1.1247>.
- [19] W. O. N. Angraeni, S. Suprpto, and S. Alshammari, "Workload, job satisfaction, and salary satisfaction with turnover intention of health workers," *J. Edukasi Ilm. Kesehat.*, vol. 3, no. 2, pp. 63–69, 2025.
- [20] M. Muhaimin, U. Lestari, R. Hirzan, and A. Y. Chaerunisaa, "The potential of medicinal plants in tuberculosis treatment: Indigenous plants used by the Anak Dalam tribe of Jambi, Indonesia," *South African J. Bot.*, vol. 180, pp. 688–709, 2025, doi: <https://doi.org/10.1016/j.sajb.2025.03.046>.
- [21] M. Amer, H. O. AlMubayedh, S. Bolesta, and C. Gélinas, "Analgesia First in Critically Ill Adults: Current Practices and Future Directions," *Crit. Care Clin.*, 2025, doi: <https://doi.org/10.1016/j.ccc.2025.05.002>.
- [22] A. Pannu and R. K. Goyal, "From Evidence to Practice: A Comprehensive Analysis of Side Effects in Synthetic Anti-Depressant Therapy," *Curr. Drug Saf.*, vol. 20, no. 2, pp. 120–147, 2025, doi: <https://doi.org/10.2174/0115748863301630240417071353>.
- [23] H. Aslan, A. Akçin, and H. Çelik, "The effect of laughter yoga's on perceived stress and anxiety levels in nursing students: Randomized controlled trial," *Adv. Integr. Med.*, vol. 12, no. 1, pp. 49–56, 2025, doi: <https://doi.org/10.1016/j.aimed.2024.10.007>.
- [24] N. A. Allameen *et al.*, "Physiotherapy and occupational therapy in rheumatoid arthritis: Bridging functional and comorbidity gaps," *Best Pract. Res. Clin. Rheumatol.*, vol. 39, no. 1, p. 102032, 2025, doi: <https://doi.org/10.1016/j.berh.2024.102032>.
- [25] H. Mo and Y. Li, "Effects and comparisons of a 16-week resistance training vs. yoga intervention on psychological distress in older adults," *Acta Psychol. (Amst.)*, vol. 258, p. 105207, 2025, doi: <https://doi.org/10.1016/j.actpsy.2025.105207>.
- [26] T. Cai, J. Ma, and S. Ge-Zhang, "Smart cities and smart health: Innovations in home medical devices for efficient healthcare delivery," *Results Eng.*, vol. 27, p. 105739, 2025, doi: <https://doi.org/10.1016/j.rineng.2025.105739>.
- [27] C. C. Ee *et al.*, "Mindfulness-based interventions for adults with type 2 diabetes mellitus: A systematic review and meta-analysis," *Integr. Med. Res.*, vol. 14, no. 2, p. 101138, 2025, doi: <https://doi.org/10.1016/j.imr.2025.101138>.

- [28] D. Solé *et al.*, “V Brazilian Consensus on Rhinitis – 2024,” *Braz. J. Otorhinolaryngol.*, vol. 91, no. 1, p. 101500, 2025, doi: <https://doi.org/10.1016/j.bjorl.2024.101500>.
- [29] Z. Eskimez, A. Keskin, E. Kurt, H. S. Özbarlas, M. Tekin, and B. Kundakçı, “4-7-8 Breathing Techniques Make It Possible to Reduce Pain Associated With Total Knee Arthroplasty: A New Technique in Respiratory Exercises,” *J. PeriAnesthesia Nurs.*, 2025, doi: <https://doi.org/10.1016/j.jopan.2025.04.009>.
- [30] D. A. Kalmbach *et al.*, “A randomized controlled trial of telemedicine CBTI and PUMAS for prenatal insomnia: Reducing nocturnal cognitive arousal is a treatment mechanism for alleviating insomnia and depression during pregnancy,” *Sleep Med.*, vol. 133, p. 106570, 2025, doi: <https://doi.org/10.1016/j.sleep.2025.106570>.
- [31] F. Bano *et al.*, “Recent Development of Zolmitriptan Formulation in Migraine Therapy: Production, Metabolism and Pharmaceutical Aspects,” *CNS Neurol. Disord. - Drug Targets*, vol. 24, no. 3, pp. 219–233, 2025, doi: <https://doi.org/10.2174/0118715273306929240820071521>.
- [32] J. Kumawat and K. G. Metri, “Effects of an eight-week yoga intervention on cognitive, mental, and autonomic function in female students with elevated stress: A randomized controlled trial protocol,” *Ment. Health Phys. Act.*, vol. 29, p. 100709, 2025, doi: <https://doi.org/10.1016/j.mhpa.2025.100709>.
- [33] R. Shishira, H. C. Shashikiran, K. J. Sujatha, and P. Shetty, “Vitality and metabolic responses to integrated naturopathy and yogic interventions among metabolic syndrome – A protocol for randomized controlled trial,” *Adv. Integr. Med.*, vol. 12, no. 1, pp. 67–74, 2025, doi: <https://doi.org/10.1016/j.aimed.2024.10.010>.