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Effect of the 4-7-8 Breathing Technique on Sleep Quality in University Students: A Quasi-Experimental Controlled Study

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Abstract

Background: University students are at high risk of poor sleep quality due to academic demands, psychological stress, and irregular sleep schedules. Non-pharmacological relaxation strategies, such as the 4-7-8 breathing technique, have been proposed to improve sleep quality by promoting autonomic regulation and relaxation.

Objective: This study aimed to examine the effect of the 4-7-8 breathing technique on sleep quality among university students.

Methods: A quasi-experimental pretest–posttest controlled study was conducted involving 110 undergraduate physiotherapy students. Participants were allocated into an intervention group (n = 55) and a control group (n = 55). The intervention group performed the 4-7-8 breathing technique twice daily for 14 consecutive days, while the control group received no intervention. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). Within-group changes were analyzed using paired t-tests, and between-group differences were evaluated using independent t-tests, with a significance level of $\alpha = 0.05$.

Results: The intervention group demonstrated a significant reduction in PSQI scores from 9.5 ± 3.5 at baseline to 5.7 ± 2.9 post-intervention ($t = 7.108$, $p < 0.001$; 95% CI: 4.9–6.5), with a large effect size (Cohen's $d = 0.95$). No significant change was observed in the control group. Post-intervention comparisons showed significantly better sleep quality in the intervention group compared with the control group ($t = 3.910$, $p < 0.001$; Cohen's $d = 0.75$).

Conclusion: The 4-7-8 breathing technique significantly improves sleep quality among university students and may serve as an effective, safe, and accessible non-pharmacological intervention.

Keywords
Breathing Exercises; Sleep Quality; Students; Pittsburgh Sleep Quality Index

Introduction

Sleep is a fundamental physiological requirement essential for maintaining physical health, cognitive function, emotional regulation, and overall well-being. Adequate sleep allows the body to restore energy balance, regulate metabolic and immune processes, and consolidate memory and learning. Conversely, insufficient or poor-quality sleep disrupts these restorative processes, leading to fatigue, impaired concentration, mood disturbances, and reduced academic and occupational performance. In the long term, chronic sleep disturbances are associated with an increased risk of cardiovascular disease, metabolic disorders, and mental health problems.[1]

Globally, sleep disturbances represent a growing public health concern. The prevalence of chronic insomnia has been reported to range from 31% to 75%, with particularly high rates among adolescents and young adults.[2] In Indonesia, epidemiological data indicate that approximately 64.7% of adolescents and young adults sleep for less than seven hours per night, which is below the recommended duration for optimal health.[2] University students constitute a high-risk population due to the convergence of academic pressure, irregular schedules, psychological stress, excessive screen exposure, and unhealthy lifestyle behaviors. A recent cross-sectional study reported that more than 70% of university students experienced sleep disturbances, largely influenced by academic demands, psychological stress, and maladaptive sleep habits.[3]

Sleep quality is a multidimensional construct that encompasses not only sleep duration but also subjective sleep satisfaction, sleep latency, sleep efficiency, nocturnal disturbances, and daytime functioning.[4] Poor sleep quality has been shown to negatively affect daily functioning, emotional stability, and decision-making ability, while prolonged sleep impairment may contribute to the development of hypertension, cardiovascular disease, and type 2 diabetes mellitus.[5] Therefore, improving sleep quality among university students is essential not only for academic success but also for long-term health outcomes.

University students frequently experience sleep deprivation as a result of poor time management and increasing academic workload. In early adulthood, the recommended sleep duration is approximately seven to eight hours per night; however, many students fail to meet this recommendation.[6,7]Academic obligations, practical coursework, examinations, and thesis preparation often lead students to sacrifice sleep, resulting in cumulative sleep debt and impaired sleep quality. This pattern is particularly evident among health science students, including physiotherapy students, whose curricula involve both theoretical and practical demands.

Given the limitations and potential adverse effects of pharmacological sleep interventions, non-pharmacological strategies have gained increasing attention as first-line approaches for managing sleep disturbances. Among these strategies, breathing-based relaxation techniques are widely recognized for their simplicity, safety, and effectiveness. The 4-7-8 breathing technique is a structured breathing exercise that involves inhaling for four seconds, holding the breath for seven seconds, and exhaling slowly for eight seconds, repeated across several cycles. This technique is designed to induce relaxation by modulating respiratory patterns and autonomic nervous system activity.[8]

The 4-7-8 breathing technique was popularized by Dr. Andrew Weil and is rooted in principles of controlled breathing and mindfulness-based relaxation. Physiologically, slow and prolonged exhalation enhances parasympathetic nervous system activation while suppressing sympathetic activity, resulting in reduced heart rate, lower blood pressure, and increased heart rate variability.[9,10] Previous studies have demonstrated that the 4-7-8 breathing technique is more effective than conventional deep breathing in reducing insomnia symptoms, pain, and anxiety in various clinical populations.[8,11]

Despite growing evidence supporting the benefits of the 4-7-8 breathing technique, existing studies remain limited in several respects. Most investigations have focused on clinical populations or older adults, while empirical evidence among university students—particularly physiotherapy students in Indonesia—is scarce.[12] Furthermore, controlled studies examining short-term, structured implementation of the 4-7-8 breathing technique and its effect on sleep quality in academic settings are still limited.

Addressing this research gap is important, given the high prevalence of sleep disturbances among university students and the need for accessible, low-cost, and safe interventions. Therefore, this study aimed to examine the effect of the 4-7-8 breathing technique on sleep quality among undergraduate physiotherapy students at Universitas Muhammadiyah Surakarta using a quasi-experimental controlled design. It was hypothesized that students who performed the 4-7-8 breathing technique would demonstrate a significant improvement in sleep quality compared with those who did not receive the intervention.

Methods

Study Design

This study employed a quantitative quasi-experimental design using a pretest–posttest controlled approach. This design was selected to evaluate changes in sleep quality attributable to the 4-7-8 breathing intervention by comparing outcomes within and between groups over time. The study was conducted from October to November 2025 at the Undergraduate Physiotherapy Program, Faculty of Health Sciences, Universitas Muhammadiyah Surakarta, Indonesia.

Participants and Recruitment

The target population consisted of all undergraduate physiotherapy students enrolled in the 2022, 2023, and 2024 academic cohorts at Universitas Muhammadiyah Surakarta (N = 516). Participant recruitment was carried out through announcements distributed via official student WhatsApp groups. Students who expressed interest were provided with detailed information regarding the study objectives, procedures, potential benefits, and risks. Written informed consent was obtained from all participants prior to enrollment.

A total of 110 students met the eligibility criteria and agreed to participate in the study. Participants were allocated into an intervention group (n = 55) and a control group (n = 55). Group allocation was performed using a non-random method based on participant availability and willingness to adhere to the intervention schedule.

Inclusion and Exclusion Criteria

Inclusion criteria were: (1) active undergraduate physiotherapy students from the 2022–2024 cohorts, (2) poor sleep quality as indicated by a Pittsburgh Sleep Quality Index (PSQI) score greater than 5, and (3) willingness to participate throughout the entire study period. Exclusion criteria included: (1) medically diagnosed chronic sleep disorders, (2) comorbid medical conditions known to affect sleep quality, and (3) current use of pharmacological treatment for sleep disturbances.

Academic Context of Participants

The academic structure of the physiotherapy program was considered in participant selection. Practical coursework begins in the third semester (2024 cohort), increasing academic workload and adjustment demands. Students in the fifth semester (2023 cohort) experience a higher intensity of coursework and assignments, while seventh-semester students (2022 cohort) are required to begin thesis preparation. These academic demands contribute to increased vulnerability to sleep disturbances, supporting the relevance of the selected population.

Intervention Procedure

Participants in the intervention group received the 4-7-8 breathing technique intervention. Prior to the intervention period, participants attended an educational session conducted by the researcher, which included an explanation of the purpose, benefits, and procedures of the 4-7-8 breathing technique. The researcher provided a live demonstration and supervised practice to ensure correct execution. The 4-7-8 breathing technique involved inhaling through the nose for four seconds, holding the breath for seven seconds, and exhaling slowly through the mouth for eight seconds. This cycle was repeated continuously for approximately two minutes per session. Participants were instructed to perform the exercise twice daily (morning and evening) for 14 consecutive days.[13]

Adherence to the intervention was monitored through daily reminders sent via WhatsApp. Participants were asked to confirm completion of each session as a form of self-report compliance. In addition, the researcher conducted informal monitoring during in-person class meetings to reinforce proper technique execution and maintain participant consistency. Due to the educational and behavioral nature of the intervention, participant blinding was not feasible. Participants in the control group did not receive any breathing intervention and continued their usual daily activities throughout the study period.

Outcome Measure

Sleep quality was assessed using the Indonesian version of the Pittsburgh Sleep Quality Index (PSQI), which has demonstrated adequate validity and reliability in cross-cultural settings. The PSQI consists of 19 self-rated items grouped into seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each component is scored on a scale from 0 to 3, resulting in a global PSQI score ranging from 0 to 21. A global score of ≤5 indicates good sleep quality, whereas a score >5 indicates poor sleep quality.

Participants completed the PSQI questionnaire at baseline (pretest) and after completion of the 14-day intervention period (posttest). At baseline, sleep quality was comparable between the intervention and control groups, supporting internal validity for subsequent comparisons.

Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) software. Descriptive statistics were calculated for participant characteristics and PSQI scores. The Kolmogorov–Smirnov test was used to assess data normality due to the sample size exceeding 50 participants. Homogeneity of variance was evaluated using Levene's test.

For inferential analysis, paired sample t-tests were conducted to assess within-group differences in PSQI scores between pretest and posttest measurements in both the intervention and control groups. Independent sample t-tests were applied to compare posttest PSQI scores between groups. Effect sizes were calculated using Cohen's d to quantify the magnitude of the intervention effect. Statistical significance was set at $\alpha = 0.05$.

Results

Participant Flow and Baseline Characteristics

A total of 516 undergraduate physiotherapy students were assessed for eligibility. Of these, 110 students met the inclusion criteria and consented to participate in the study. Participants were allocated into an intervention group (n = 55) and a control group (n = 55). All participants completed the study, and no dropouts were recorded during the intervention period. The participant recruitment and inclusion process is illustrated in Figure 1.

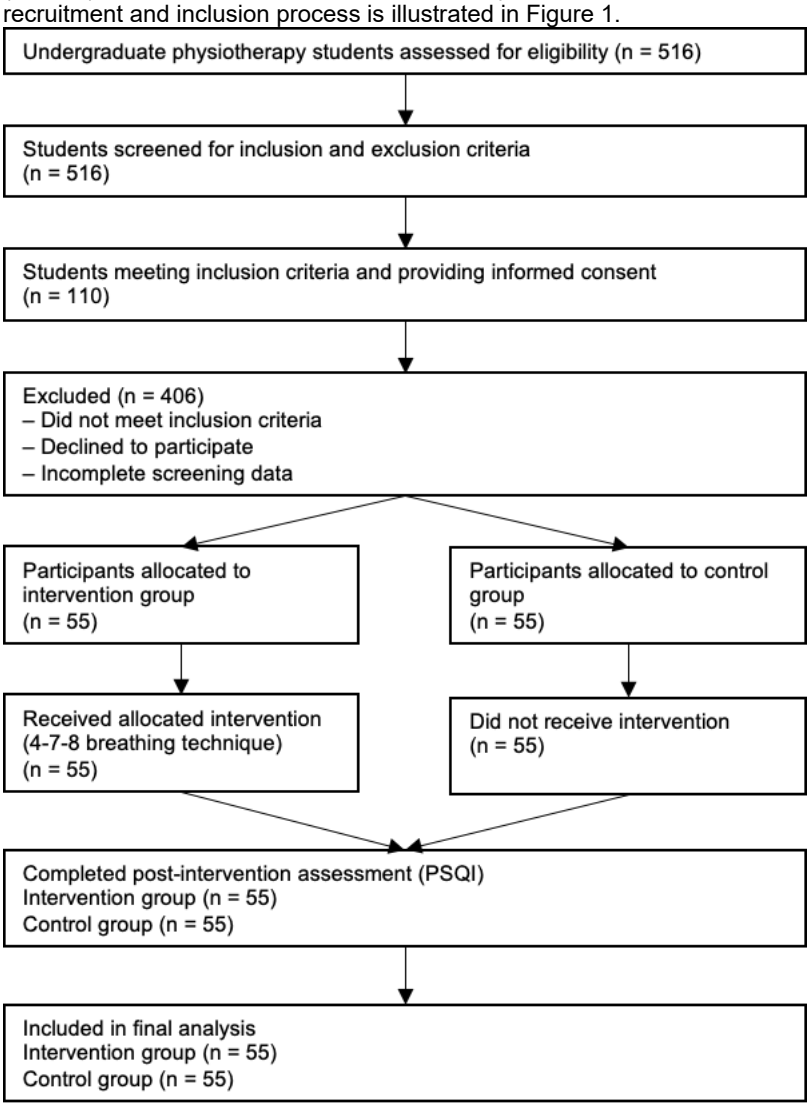

Figure 1. STROBE Flow Diagram of Participant Recruitment and Study Inclusion

Baseline sleep quality was comparable between the intervention and control groups prior to the intervention, with the majority of participants in both groups classified as having poor sleep quality based on PSQI scores.

Participant Characteristics

Demographic characteristics of the participants are presented in Table 1**.** The majority of participants were female (80.0%) and aged 21–23 years (61.8%).

Table 1. Participant Characteristics (n = 110)

Characteristic	n	%
Sex		
Male	22	20.0
Female	88	80.0
Age (years)		
18–20	42	38.2
21–23	68	61.8

Sleep Quality Distribution Within Groups

The distribution of sleep quality categories before and after the intervention is shown in Tables 2 and 3.

Table 2. Sleep Quality Distribution in the Intervention Group (n = 55)

Sleep Quality	Pretest n (%)	Posttest n (%)
Good (PSQI ≤5)	7 (12.7)	26 (47.3)
Poor (PSQI >5)	48 (87.3)	29 52.7)

Table 3. Sleep Quality Distribution in the Control Group (n = 55)

Sleep Quality	Pretest n (%)	Posttest n (%)
Good (PSQI ≤5)	13 (23.6)	13 (23.6)
Poor (PSQI >5)	42 (76.4)	42 (76.4)

Within-Group Comparisons of Sleep Quality

Within-group analysis demonstrated a significant improvement in sleep quality in the intervention group following the 14-day breathing intervention, whereas no change was observed in the control group.

Table 4. Within-Group Comparison of PSQI Scores in the Intervention Group (Paired t-test)

Measurement	Mean ± SD	t	p-value	95% CI	Effect Size (Cohen's d)
Pretest	9.5 ± 3.5			9.5–10.4	
Posttest	5.7 ± 2.9	7.108	<0.001	4.9–6.5	0.95

Table 5. Within-Group Comparison of PSQI Scores in the Control Group

Measurement	Mean ± SD	Mean Difference	95% CI	Effect Size (Cohen's d)
Pretest	7.9 ± 3.02			
Posttest	7.9 ± 3.02	0.00	0.00–0.00	0.00

Between-Group Comparison

Post-intervention PSQI scores were compared between the intervention and control groups using an independent sample t-test. The intervention group demonstrated significantly better sleep quality than the control group.

Table 6. Between-Group Comparison of Posttest PSQI Scores

Group	Mean ± SD	t	p-value	95% CI	Effect Size (Cohen's d)
Control	7.9 ± 3.02			7.1–8.7	
Intervention	5.7 ± 2.9	3.910	<0.001	4.9–6.5	0.75

Summary of Results

The intervention group exhibited a statistically significant reduction in PSQI scores following the 4-7-8 breathing intervention, with large effect sizes observed in both within-group and between-group analyses. No improvement in sleep quality was observed in the control group.

Discussion

This study demonstrated that the 4-7-8 breathing technique significantly improved sleep quality among undergraduate physiotherapy students after a 14-day intervention period. Participants who practiced the breathing technique twice daily showed a meaningful reduction in PSQI scores compared with baseline and with the control group, supporting the effectiveness of structured breathing-based relaxation as a non-pharmacological intervention for sleep disturbances in young adults.

The magnitude of improvement observed in the intervention group was clinically relevant, as indicated by large within-group and moderate-to-large between-group effect sizes. These findings are consistent with previous studies reporting that the 4-7-8 breathing technique is effective in improving sleep quality and reducing insomnia-related symptoms across different populations. Abdelfatah et al. demonstrated that the 4-7-8 breathing technique produced greater improvements in insomnia severity, pain, and anxiety compared with conventional deep breathing exercises, highlighting the superiority of structured breathing patterns that emphasize prolonged exhalation.[8] Similarly, Eskici İlgin and Yayla reported significant improvements in sleep quality among postoperative patients who practiced the 4-7-8 breathing technique, further supporting its effectiveness across clinical contexts.[11]

The physiological mechanisms underlying these improvements are likely related to autonomic nervous system modulation. Controlled slow breathing with extended exhalation enhances parasympathetic nervous system activity while suppressing sympathetic arousal, leading to reduced physiological stress and improved relaxation. Vierra et al. reported that the 4-7-8 breathing technique improved heart rate variability and reduced blood pressure, particularly in individuals experiencing sleep deprivation, indicating improved autonomic balance.[10] Enhanced parasympathetic activation facilitates sleep initiation and maintenance by reducing cortical arousal and promoting a calm physiological state conducive to sleep.

University students represent a population that is particularly vulnerable to sleep disturbances due to academic pressure, irregular schedules, and psychological stress. Previous studies have consistently reported high prevalence rates of poor sleep quality among students, including those in health science programs.[3] In the present study, most participants exhibited poor sleep quality at baseline, underscoring the relevance of targeted interventions within academic settings. The findings suggest that the 4-7-8 breathing technique may serve as a practical strategy to mitigate sleep disturbances associated with academic stress and workload.

The advantages of the 4-7-8 breathing technique include its simplicity, minimal time requirement, low cost, and absence of adverse effects. Unlike pharmacological sleep aids, which may be associated with dependency, tolerance, and side effects, breathing-based interventions are safe and easily self-administered.[14] This makes the 4-7-8 breathing technique particularly suitable for student populations who may be reluctant to use medication for sleep problems. Moreover, the technique can be integrated into daily routines without disrupting academic activities, increasing the likelihood of adherence.

The present findings also align with broader evidence supporting mind–body and breathing-based interventions for sleep improvement. Breathing exercises have been shown to reduce cognitive hyperarousal, emotional tension, and anxiety, which are key

contributors to poor sleep quality. By directing attention to rhythmic breathing and controlled breath retention, the 4-7-8 technique may reduce pre-sleep rumination and facilitate the transition from wakefulness to sleep. These psychological and physiological effects jointly contribute to improved subjective sleep quality, as reflected in PSQI scores.[8-10]

Despite its strengths, this study has several limitations that should be considered when interpreting the results. Sleep quality was assessed using the Pittsburgh Sleep Quality Index, a subjective self-report instrument that may be influenced by recall bias and individual perception. Although the PSQI is a validated and widely used tool, the absence of objective sleep measurements such as actigraphy, polysomnography, or physiological indicators limits the ability to confirm objective sleep improvements.[15,16] In addition, the intervention period was relatively short, and the long-term sustainability of the observed effects remains unclear.

Another limitation is that the study was conducted at a single institution with a specific academic context, which may limit the generalizability of the findings to other student populations or educational settings. Furthermore, the non-randomized allocation of participants may introduce selection bias, although baseline equivalence between groups supports the internal validity of the findings.

Future research should incorporate objective sleep measurements, such as heart rate variability, oxygen saturation, or actigraphy, to complement subjective assessments and provide a more comprehensive evaluation of sleep quality. Longer follow-up periods are also recommended to assess the durability of the intervention effects. Additionally, randomized controlled trials involving multiple institutions and diverse student populations would strengthen the evidence base for the 4-7-8 breathing technique as a sleep intervention.

In conclusion, the findings of this study provide evidence that the 4-7-8 breathing technique is an effective, safe, and accessible non-pharmacological intervention for improving sleep quality among university students. Given the high prevalence of sleep disturbances in this population, incorporating breathing-based relaxation techniques into student health promotion programs may offer meaningful benefits for both academic performance and overall well-being.

Conclusion

This study demonstrated that the 4-7-8 breathing technique is effective in improving sleep quality among undergraduate physiotherapy students. After a 14-day intervention period, students who practiced the 4-7-8 breathing technique twice daily experienced a meaningful improvement in subjective sleep quality, whereas no improvement was observed in the control group. These findings indicate that structured breathing-based relaxation can serve as a viable non-pharmacological approach to managing sleep disturbances in young adult populations exposed to academic stress.

The clinical relevance of these findings is underscored by the magnitude of the observed effects, suggesting that the intervention not only achieved statistical significance but also produced practical benefits for daily sleep functioning. Given the simplicity, safety, and low cost of the 4-7-8 breathing technique, it may be feasibly implemented as part of student health promotion and wellness programs, particularly in academic environments characterized by high cognitive and psychological demands.

Although the results are promising, further research is warranted to confirm the long-term effectiveness of the 4-7-8 breathing technique and to explore its impact using objective sleep measures. Future studies employing randomized controlled designs, longer follow-up periods, and diverse student populations are recommended to strengthen the evidence base and enhance generalizability. Overall, the 4-7-8 breathing technique represents a practical and accessible strategy for improving sleep quality and supporting overall well-being among university students.

Author Contribution

Dinda Mualifah: Conceptualization, Methodology, Data curation, Formal analysis, Writing—original draft.
Isnaini Herawati: Methodology, Writing—review & editing, Supervision.

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Conflict of Interest Statement

The authors declare no conflict of interest.

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Ethics Statement

This study was approved by the Ethics Committee of the Faculty of Health Sciences, Universitas Muhammadiyah Surakarta (Ethical Approval No. 013622331121113225091700023/2025). All participants provided written informed consent prior to participation and were informed of their right to withdraw from the study at any time without consequences.

References

1. Hutasoit DM, Mendrofa IJ, Arkianti MMY, Diannita CG. Sleep quality of second-year nursing students. J Keperawatan Malang. 2024;9(1):58–66.
2. Abidin I, Nurlianawati L, Puspitasari S. Effectiveness of Buteyko breathing intervention on sleep quality among nursing students. J Keperawatan Florence Nightingale. 2024;7(2):428–433.
3. Rajinikanth SB, Priya GV, Raj RDS, Arulselvan D, Rekha UV. Prevalence and factors influencing insomnia among college students in a private university in Chennai. J Pioneer Med Sci. 2024;13(7):131–134.
4. Saputri J, Nela AS, Rahman A. Association between stage II stress level and sleep quality among final-year nursing students. J Ment Health Concerns. 2024;3(2):59–64.
5. Bianca N, Budiarsa IGN, Samatra DPGP. Sleep quality among medical students during preclinical and clinical phases. E-J Med Udayana. 2021;10(12):1–6.
6. Manoppo MW, Pitoy FF, Abigael T. Sleep quality among professional nursing students at Universitas Klabat. Mahesa Malahayati Health Stud J. 2023;3(7):2095–2102.

7. Kamila F, Dainy NC. Factors associated with sleep quality among medical and health science students at Universitas Muhammadiyah Jakarta. J Ilm Gizi dan Diet. 2023;2(3):168–174.
8. Abdelfatah DAA, Ahmed DAAS, Amer MAM, Harby SSE, Abdelaty HIM. Effect of deep breathing exercise versus 4-7-8 breathing technique on insomnia, pain, and anxiety among patients with burn injuries. Egypt J Nurs Health Sci. 2024;5(3):51–71.
9. Aromaterapi P, Atsiri M, Bergamot J, et al. Effect of combined deep breathing relaxation using the 4-7-8 method on stress reduction. J Ilm Ilmu Cendekia. 2025;2(2):4137–4150.
10. Vierra J, Boonla O, Prasertsri P. Effects of sleep deprivation and 4-7-8 breathing control on heart rate variability, blood pressure, blood glucose, and endothelial function in healthy young adults. Physiol Rep. 2022;10(13):e15389.
11. Eskici Ilgin V, Yayla A. Effect of the 4-7-8 breathing technique on pain level and sleep quality of patients after laparoscopic bariatric surgery: a randomized controlled study. Bariatr Surg Pract Patient Care. 2023;18(4):225–232.
12. Nirangjhana S. News and views. Int J Clin Exp Physiol. 2024;10(4):134–135.
13. Zahra RC, Dewi E, Marumpy N. Effect of anxiety reduction interventions on vital signs in intensive care unit patients. J Ber Ilmu Keperawatan. 2023;16(2):320–328.
14. Satria O, Nasution N, Apriani F, Andriani R, Damayanti S, Tarigan AP. Effectiveness of the 4-7-8 breathing technique in enhancing sleep quality among patients with chronic obstructive pulmonary disease. J Respirologi Indones. 2025;45(4):267–271.
15. Permata A. Effect of aerobic exercise on sleep quality among adolescents with chronic insomnia: a case report. Physiother Health Sci. 2025;7(2):109–114.
16. Sutiyo TAW, Yuliadarwati NM, Mufakhiroh M. Physiotherapy assessment of sleep quality in older adults using the Pittsburgh Sleep Quality Index. J Abdi Masy Indones. 2024;4(2):449–454.