



The effectiveness of physical exercise with structured light on students' sleep quality

Author Name(s): Zulkifli Keya Husain, Giofandi Samin, Gilang Ramadan

Publication details, including author guidelines

URL: <https://jurnal.iicet.org/index.php/jppi/about/submissions#authorGuidelines>

Editor: Fiky Zarya

Article History

Received: 07 Oct 2025

Revised: 19 Nov 2025

Accepted: 30 Dec 2025

How to cite this article (APA)

Husain, Z.K., Samin, G. & Ramadan, G. (2025). The effectiveness of physical exercise with structured light on students' sleep quality. *Jurnal Penelitian Pendidikan Indonesia*, 11(4), 408-416. <https://doi.org/10.29210/020256633>

The readers can link to article via <https://doi.org/10.29210/020256633>

SCROLL DOWN TO READ THIS ARTICLE



Indonesian Institute for Counseling, Education and Therapy (as publisher) makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications. However, we make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors and are not the views of or endorsed by Indonesian Institute for Counseling, Education and Therapy. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Indonesian Institute for Counseling, Education and Therapy shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever caused arising directly or indirectly in connection with, in relation to, or arising out of the use of the content.

JPPPI (Jurnal Penelitian Pendidikan Indonesia) is published by Indonesian Institute for Counseling, Education and Therapy comply with the [Principles of Transparency and Best Practice in Scholarly Publishing](#) at all stages of the publication process. JPPPI (Jurnal Penelitian Pendidikan Indonesia) also may contain links to web sites operated by other parties. These links are provided purely for educational purpose.



This work is licensed under a [Creative Commons Attribution 4.0 International License](#).

Copyright by Husain, Z.K., Samin, G. & Ramadan, G. (2025).

The author(s) whose names are listed in this manuscript declared that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript. This statement is signed by all the authors to indicate agreement that the all information in this article is true and correct.

JPPPI (Jurnal Penelitian Pendidikan Indonesia)

ISSN: 2502-8103 (Print) | ISSN: 2477-8524 (Electronic)



The effectiveness of physical exercise with structured light on students' sleep quality

Zulkifli Keya Husain^{*)}, Giofandi Samin, Gilang Ramadan

Universitas Muhammadiyah Gorontalo, Indonesia

Article Info

Article history:

Received Oct 07th, 2025

Revised Nov 19th, 2025

Accepted Dec 30th, 2025

Keyword:

Light jogging,
Physical exercise,
Students' sleep quality

ABSTRACT

This study aimed to evaluate the effectiveness of a structured light jogging program in improving sleep quality among students, as measured by the Pittsburgh Sleep Quality Index (PSQI). A qualitative approach with a pre-experimental one-group pretest-posttest design was employed. A total of 30 students with PSQI scores >5 were selected purposively. The intervention consisted of 16 jogging sessions over eight weeks at light to moderate intensity. Sleep quality was measured using the PSQI before and after the intervention, and data were analyzed using paired sample t-tests. The results showed a significant reduction in PSQI scores from a mean of 11.29 to 6.35 ($p < 0.001$). The proportion of students with poor sleep quality decreased from 83.3% to 26.7%, while those with sufficient and good sleep quality increased accordingly. The structured light jogging program effectively improved sleep quality among university students. This study contributes to the development of non-pharmacological, practical, and low-cost interventions for student health. Further research should explore other exercise types and consider lifestyle and psychological variables.



© 2025 The Authors. Published by IICET.

This is an open access article under the CC BY-NC-SA license
(<https://creativecommons.org/licenses/by-nc-sa/4.0>)

Corresponding Author:

Zulkifli Keya Husain,
Universitas Muhammadiyah Gorontalo,
Email: zeptakeiyahusain@gmail.com

Introduction

Sleep problems are among the most frequently reported health issues among university students worldwide, particularly those aged 18 to 24 years (Daud et al., 2023; Reis et al., 2021). This developmental stage represents a transitional period into adulthood, often marked by significant academic, social, and emotional pressures. The increasing number of disorders of sleep in this age group is mainly driven by sedentary behavior, excessive digital gadgets use, and the academic workload (Harrison et al., 2022). These conditions impair pupil achievement, increase the likelihood of mental health issues, and affect cognitive skills like attention and memory (Carpi et al., 2022; Reis et al., 2021). In order to improve students' sleep quality, it is imperative to create and execute interventions that are efficient, accessible, and cost-effective (Lehmann et al., 2020). Several studies investigated the relationship between physical exercise and sleep quality within the last ten years. It has been shown that low-to-moderate-intensity exercise, including light jogging, improve the state of sleep, enhance sleep duration, and lessen nocturnal incidents, particular in young adults. (Yen & Cherng, 2020).

Furthermore, regular aerobic exercise several times a week significantly enhances various sleep parameters (Cornelissen & Smart, 2021; Mashfufa et al., 2022). Among university students, structured activities like jogging not only offer physical benefits but also support mental health, reduce stress, and improve emotional stability (Fontefrancesco, 2021). Therefore, regular light exercise can serve as an effective strategy to enhance students' sleep patterns (Bodnar et al., 2020; Oral, 2021).

However, existing research still reveals gaps, especially in the context of student populations. Most studies have focused on older adults or clinical patients, while university students who are highly vulnerable to sleep problems remain underrepresented in the literature (Farooqi et al., 2022; Vargas et al., 2024; Xie et al., 2021). Moreover, previous research rarely specifies the type and intensity of physical activity, making it difficult to determine the specific effectiveness of light jogging (Wang & Boros, 2020; Xu et al., 2025). This study aims to address these gaps by focusing on students aged 18–24 years with poor to moderate sleep quality, as measured by the Pittsburgh Sleep Quality Index (PSQI).

A number of techniques, such as melatonin supplements, cognitive-behavioral therapy, relaxation techniques, and sleep hygiene instructions, are often employed to tackle students' sleep problems (Griffiths et al., 2024; Hagedorn et al., 2021; Icenhower et al., 2025). While the promise of these interventions, their effectiveness often relies on individual adherence, which may prove difficult to keep up with rigorous academic schedules (Sexton Radek, 2020). Physical therapy, such as light jogging, on the other hand, offer greater flexibility, require less equipment, and are simple to incorporate into regular daily activities. In addition, it has been shown that a little jogging improves mood and reduces anxiety, both of which improve sleep quality (Heryanto & Sholehudin, 2023; Kaneko et al., 2023).

Low-intensity aerobic exercise, such as light jogging, has a number of psychological, bodily, and social advantages. According to Arkhypov, (2024), structured jogging programs can be adjusted to suit participants' varying levels of fitness, ensuring access and durability. These programs boost interaction with others and resilience, both of which have been shown to improve sleep quality (Bodnar et al., 2020; Dakanalis et al., 2024). Therefore, physical exercise programs that also address psychological and social elements are particularly relevant in higher education settings.

The primary instrument used in this study to contrast the quality of students' sleep prior to and after the intervention is the Pittsburgh Sleep Quality Index, or PSQI (Buysse et al., 1989), in Fauzi et al., (2024), Icenhower et al., (2025), the PSQI is a widely employed and validated instrument it assesses seven aspects of sleep over the last month: duration, latency, efficiency, delays, use of sleep aids, dysfunction during the day, and overall quality of sleep.

This study is unique in it involves a simple, cost-effective physical intervention that students could easily adopt. By providing real-world evidence on the effect of light jogging on students' sleep quality, it fills the gap in the studies and lays a basis for university-based health promotion initiatives (Malik et al., 2024). The main research question examines whether university students' sleep quality, measured by the PSQI, can be significantly better by a structured light jogging program.

The purpose of the study is to see if an organized light jogging program improves students' quality of sleep. Using a one-group pretest-posttest design, the intervention included 16 sessions spread over several weeks. To assess changes in PSQI scores, statistical analysis was done using paired sample t-tests (Griffiths et al., 2024). In accordance to the main idea, structured light jogging greatly improves the quality of sleep.

The experimental pretest-posttest look at used in this study differs it from earlier research by allowing for a causal evaluation of the impact of the intervention. The program's relevance in the context and scalability increase if it is in line with students' academic timetables and physical activity preferences. This study takes a more solid and reliable quantitative method, while much previous research is observational.

The study provides a multifaceted framework that takes social, psychological, and physiologic factors to heart from the perspective of method. Other than to boosting physical fitness, the running program was designed to boost social interaction and mental wellness (Garber et al., 2011). The study offers an important step to the development of feasible, affordable, and sustainable means of enhancing sleep quality by addressing all of these variables, particularly in the context of academic institutions.

The findings up, this research enhances our knowledge of the connection between sleep and physical activity while offering an effective approach that educational institutions may use to improve the wellbeing of the pupils they serve.

Method

Using qualitative methods and a pre-experimental design, this study examined why a structured light jogging program improve the quality of sleep in college learners (Rahmadani, 2022). This technique was used because of the contextual nature of the problem, which required an in-depth understanding of the subjective changes users experienced after some physical intervention. One participant group was examined twice, once after the intervention (O1) and once at the endpoint (O2), with no control group available for comparison. A one-group pretest-posttest method was used for this (Nasution, 2023). A 16-session structured light jogging program began over a period of eight days. This design aims to look at changes in sleep quality measured by the Pittsburgh Sleep Quality Index (PSQI) and directly assess the efficacy of the program.

Table 1. One Group Pretest-Posttest Design

Pre-Experimental Design	Design	Information
Test one group design, earlier and post.	O1 X O2	O1 : Pretest scores X : Treatment O2 : Posttest scores

Research Subjects

Participants in this study include 30 undergraduate sports science students, ages 18 to 24, who were found to have poor sleep quality (PSQI score > 5). Participants were chosen via purposive sampling in accordance with predetermined standards pertinent to the study's goals and their willingness to participate in each intervention session (Soesana et al., 2023).

Research Procedure

Table 2. Components of the Pittsburgh Sleep Quality Index (PSQI)

No.	PSQI Component	Component Description	Score (0–3)
1	Subjective Sleep Quality	Individual's overall self-assessment of their sleep quality	0 = Very good, 1 = Fairly good, 2 = Poor, 3 = Very poor
2	Sleep Latency	Time required to fall asleep and frequency of difficulty falling asleep	0 = <15 minutes, 1 = 16–30 minutes, 2 = 31–60 minutes, 3 = >60 minutes or often asleep
3	Sleep Duration	Total actual sleep time per night	0 = >7 hours, 1 = 6–7 hours, 2 = 5–6 hours, 3 = <5 hours
4	Sleep Efficiency	The proportion of actual sleep duration relative to the total time spent in bed	0 = >85%, 1 = 75–84%, 2 = 65–74%, 3 = <65%
5	Sleep Disturbances	Frequency of nighttime awakenings or disturbances due to physical/environmental factors	0 = Never, 1 = <1×/week, 2 = 1–2×/week, 3 = ≥3×/week
6	Use of Sleep Medication	Frequency of using medication to aid sleep	0 = Never, 1 = <1×/week, 2 = 1–2×/week, 3 = ≥3×/week
7	Daytime Dysfunction	Difficulty staying awake or enthusiastic during the day	0 = No problem, 1 = Mild, 2 = Moderate, 3 = Severe

The two primary stages of the research method were the evaluation of sleep quality and the execution of the intervention. The Pittsburgh Sleep Quality Index (PSQI), created by (Buysse et al., 1989). With a reported Cronbach's Alpha of 0.83, the PSQI is a well-known and trustworthy instrument

for assessing subjective sleep quality. It has been culturally modified and approved for use in Indonesia (Setyowati & Chung, 2020). Subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disruptions, usage of sleep aids, and daytime dysfunction are its seven constituent parts. Overall sleep quality is evaluated using the PSQI score, where a score of 5 or more denotes poor sleep quality. Numerous populations have used this questionnaire extensively in sleep studies.

The light jogging program was conducted over eight weeks, comprising 16 sessions, with two sessions held each week. The program was designed based on the guidelines of the American College of Sports Medicine (ACSM) (Garber et al., 2011), which recommend engaging in low-intensity aerobic activity for at least 30 minutes on 3 to 5 days per week to support general health and improve sleep quality. The intervention sessions were conducted under the supervision of nationally certified physical trainers to ensure safety, consistency, and adherence to the training protocol.

Table 3. Sequence of the Structured Light Jogging Exercise Program

Week	Phase	Duration	Intensity (HRmax / RPE)	Activity Description
1–2	Warm-up	10 minutes	Light ($\leq 50\%$ HRmax / RPE 9–10)	Brisk walking, joint mobilization, and dynamic stretching (e.g., arm swings, leg swings)
	Main Exercise	20 minutes	Light (50–60% HRmax / RPE 10–11)	Light jogging for 2 minutes alternated with 1-minute brisk walking, repeated 6 times. Focus on comfort and breathing rhythm.
	Cool-down	10 minutes	Very light (RPE 8–9)	Slow walking and static stretching (quadriceps, calves, shoulders, lower back)
3–4	Warm-up	10 minutes	Light	Brisk walking, joint rotations (shoulders, hips, knees), and deep breathing
	Main Exercise	25 minutes	Light to moderate (60–65% HRmax / RPE 11–12)	Steady jogging for 3–4 minutes alternated with 1-minute brisk walking, repeated 5–6 times
	Cool-down	10 minutes	Very light	Slow walking, major muscle group stretching, diaphragmatic breathing (inhale 4s, hold 4s, exhale 6s)
5–6	Warm-up	10 minutes	Light	Brisk walking and full-body active mobilization
	Main Exercise	30 minutes	Moderate (65–70% HRmax / RPE 12–13)	Continuous light jogging at a steady rhythm. Focus on breathing control and running comfort
	Cool-down	10 minutes	Very light	Slow walking, full-body stretching, and simple body scan relaxation technique
7–8	Warm-up	10 minutes	Light	Brisk walking, rhythmic breathing exercises, and light dynamic stretching
	Main Exercise	30–35 minutes	Moderate (65–70% HRmax / RPE 12–13)	Free jogging in a comfortable environment (e.g., park or campus). Emphasis on mindfulness and psychological comfort
	Cool-down	10 minutes	Very light	Relaxed walking, full-body stretching, post-session body reflection and journaling

Data Analysis

The data analysis technique employed a paired sample t-test to examine the differences in Pittsburgh Sleep Quality Index (PSQI) scores between the pretest and posttest measurements. Prior to conducting the main analysis, prerequisite tests were performed, including the Shapiro-Wilk normality test and

Levene's test for homogeneity, to ensure the appropriateness of using parametric statistical procedures. All statistical analyses were conducted using SPSS version 26 (Umi, 2023).

Results and Discussions

Descriptive analysis was conducted to evaluate the effectiveness of the structured light jogging intervention on improving sleep quality, as measured by the Pittsburgh Sleep Quality Index (PSQI). The descriptive statistics for both pretest and posttest PSQI scores are presented in Table 4.

Table 4. of Descriptive Statistics for Pre-Test and Post-Test

Statistik	Pretest PSQI	Posttest PSQI
N (Valid)	30	30
N (Missing)	0	0
Mean	11.29	6.35
Std. Error of Mean	0.26	0.25
Median	11.20	6.30
Mode	11.0	6.0
Std. Deviation	1.50	1.37
Variance	2.25	1.89
Range	6.6	6.8
Minimum	8.9	3.4
Maximum	15.5	10.2
Sum	338.7	190.6
25th Percentile	10.2	5.5
50th Percentile (Median)	11.2	6.3
75th Percentile	12.4	7.1

Based on the data above, there was a significant decrease in PSQI scores from pretest to posttest, with the mean score dropping from 11.29 to 6.35. This indicates a measurable improvement in participants' sleep quality following the structured light jogging program. The minimum score decreased from 8.9 to 3.4, while the maximum score fell from 15.5 to 10.2, reflecting an overall reduction in the severity of sleep disturbances. Furthermore, the frequency distribution of sleep quality categories based on PSQI scores also showed a positive shift. The detailed distribution is presented in Table 5 and visually illustrated in Figure 2.

Tabel 5. Frequency Distribution of Sleep Quality Improvement via PSQI

Pre-Test Category	Frequency	Percentage (%)	Post-Test Category	Frequency	Percentage (%)
Good (0-5)	0	0.0%	Good (0-5)	3	10.0%
Enough (6-10)	5	16.7%	Enough (6-10)	19	63.3%
Lacking (>10)	25	83.3%	Lacking (>10)	8	26.7%

These results reflect the effectiveness of the light jogging program in addressing sleep disturbances. Before conducting the paired t-test, the data were first analyzed to ensure that the assumptions of normality and homogeneity were met. The results of the normality and homogeneity tests are presented in Table 6.

Table 6. Results of the Normality and Homogeneity Tests

Test	Pretest PSQI	Posttest PSQI	Homogeneity Test
Shapiro-Wilk Significance Value	0.758 (Normal)	0.254 (Normal)	0.264 (Homogeneous)

The Shapiro-Wilk test of normality yielded significance values of 0.758 for the pretest and 0.254 for the posttest PSQI scores. As both values exceed 0.05, the data can be considered normally distributed. Additionally, the Levene's test for homogeneity produced a significance value of 0.264, also above 0.05,

indicating that the variance between groups is homogeneous. These results confirm that the data fulfill the assumptions for parametric testing, and thus a paired sample t-test was conducted.

Table 7. Paired Sample t-test Results

Variable	t	df	Significance (2-tailed)
Pretest vs Posttest PSQI Scores	38.047	29	0.000

The t-test result of 38.047 with a p-value of 0.000 ($p < 0.05$) indicates a highly significant difference between the pretest and posttest PSQI scores. This strongly supports the conclusion that the structured light jogging program had a positive and substantial impact on students' sleep quality. Specifically, the mean PSQI score decreased from 11.29 to 6.35, demonstrating a clear quantitative improvement in sleep quality following the intervention.

This significant reduction in PSQI scores is also reflected in the categorical classification of sleep quality. Before the intervention, 83.3% of respondents were categorized as having poor sleep quality (PSQI >10). After completing the jogging program, only 26.7% remained in this category. In contrast, the proportion of students in the fair sleep quality range (scores 6–10) rose to 63.3%, and 10% of participants achieved good sleep quality (PSQI ≤ 5). These findings are consistent with those of (Qiu et al., 2022), who reported that aerobic exercise significantly reduces sleep disturbances among university students.

These results are further backed by studies by by Brandão et al., (2020), Elgayar et al., (2024), that show that aerobic has such as running not only enhance overall sleep architecture but also lessen daytime drowsiness. The psychological effects of physical activity further amplify these physiological benefits. It has been demonstrated that mild exercise can improve mood and decrease anxiety, as well as affecting the quality of sleep. According to research by (Dodange et al., 2024).

Physical activity increases awareness and serves as a mediator between psychological stress and sleep performance. Getting enough sleep is crucial for academic success, according to (Shehata et al., 2022). In order to improve students' overall welfare, an organized light jogging program could be a practical and cost-effective solution. The strong correlation between mental health, sleep quality, and academic success was also highlighted by (Altaf et al., 2024). suggesting that physical exercise interventions can benefit students' academic performance as well as their psychological well-being.

The study's addition of new empirical data to the growing body of research on physical activity and sleep quality is also essential. The findings pave the way for long-term research on exercise's effects on kids. Resistance and interval training should be studied to see how they effect sleep. Consider lifestyle, psychiatric illnesses, and diet because these variables may alter how well such interventions perform. This is consistent with (Gururaj et al., 2024; Kong et al., 2024), who found that genetic traits, training commitment, and baseline fitness levels affect physical exercise response.

In conclusion, the study suggests that well-planned mild exercise routines like jogging may improve university students' sleep quality. These activities improve physiological results and social and psychological balance, which are essential to student health. Thus, higher education institutions should incorporate physical activity programs as part of a comprehensive student health plan.

Conclusions

Studies demonstrate that structured light exercise improves university students' sleep. Sleep interruptions decreased and efficiency, latency, and duration improved with the treatment. When practiced regularly and appropriately, light jogging can address student sleep disorders without medication. This study suggests developing student-specific exercise-based strategies and improves understanding of how physical interventions improve sleep quality. Physical exercise frequency, intensity, and duration can maximize program benefits. The findings also apply to campus wellness programs that improve students' mental and physical health. Future studies should examine light exercise that fits students' daily routines and academic plans. Investigating other factors including

dietary habits, stress levels, and psychological disorders that could impact sleep quality is also crucial. A multifaceted approach might offer a greater awareness of the ways in which active lives enhance overall student wellness and sleep quality in higher education settings.

References

- Altaf, S., Malmir, K., Mir, S. M., Olyaei, G. R., Omar, A., & Syed, J. (2024). Associations Between Mental Health, Academic Performance, and Sleep Quality in Physical Therapy Students: A Cross-Sectional Study. *JHRR*, 4(1), 1291–1295. <https://doi.org/10.61919/jhrr.v4i1.615>
- Arkhyrov, O. (2024). Recreational Running as a Means of Training for the Development of Strength Endurance for Children and Adolescents. *Scientific Journal of National Pedagogical Dragomanov University Series 15 Scientific and Pedagogical Problems of Physical Culture (Physical Culture and Sports)*, 9(182), 9–13. [https://doi.org/10.31392/udu-nc.series15.2024.9\(182\).01](https://doi.org/10.31392/udu-nc.series15.2024.9(182).01)
- Bodnar, I., Pavlova, Y., & Hamade, A. (2020). Physical Education of Children With Autism Spectrum Disorders: A Systematic Review of Structure and Effects of Interventional Programs. *Physiotherapy Quarterly*, 28(4), 61–70. <https://doi.org/10.5114/pq.2020.96232>
- Brandão, G. S., Callou, A. A., Brandão, G. S., Silva, A. S. d., Urbano, J. J., Faria, N. S. d., Oliveira, L. V. F. de, & Camelier, A. A. (2020). The Effect of Home-Based Exercise in Sleep Quality and Excessive Daytime Sleepiness in Elderly People: A Protocol of Randomized Controlled Clinical Trial. *Manual Therapy Posturology & Rehabilitation Journal*, 1–6. <https://doi.org/10.17784/mtprehabjournal.2018.16.577>
- Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research*, 28(2), 193–213. [https://doi.org/10.1016/0165-1781\(89\)90047-4](https://doi.org/10.1016/0165-1781(89)90047-4)
- Carpi, M., Cianfarani, C., & Vestri, A. (2022). Sleep Quality and Its Associations With Physical and Mental Health-Related Quality of Life Among University Students: A Cross-Sectional Study. *International Journal of Environmental Research and Public Health*, 19(5), 2874. <https://doi.org/10.3390/ijerph19052874>
- Cornelissen, V. A., & Smart, N. A. (2021). Exercise Training for Blood Pressure: A Systematic Review and Meta-analysis. *Journal of the American Heart Association*, 2(1). <https://doi.org/10.1161/JAHA.112.004473>
- Dakanalis, A., Voulgaridou, G., Alexatou, O., Papadopoulou, S. K., Jacovides, C., Pritsa, A., Chrysafi, M., Papacosta, E., Kapetanou, M. G., Tsourouflis, G., Antonopoulou, M., Mitsiou, M., Antasouras, G., & Giaginis, C. (2024). Overweight and Obesity Is Associated With Higher Risk of Perceived Stress and Poor Sleep Quality in Young Adults. *Medicina*, 60(6), 983. <https://doi.org/10.3390/medicina60060983>
- Daud, A., Hasmat, N. E. A., & Othman, H. (2023). Association Between Sleep Quality and Mental Illness Among Undergraduate Students. *International Journal of Care Scholars*, 6(3), 7–14. <https://doi.org/10.31436/ijcs.v6i3.335>
- Dodange, Z., Darvishpour, A., Ershad, M. J., & Chaboki, B. G. (2024). Comparison of the Effects of Diaphragmatic Breathing and Pursed-Lip Breathing Exercises on the Sleep Quality of Elderly Patients With Chronic Obstructive Pulmonary Disease (COPD): A Clinical Trial Study. *Therapeutic Advances in Pulmonary and Critical Care Medicine*, 19. <https://doi.org/10.1177/29768675241302901>
- Elgayar, S. L., El-Gendy, S. M., & Youssef, T. M. (2024). Comparative Effects of Aerobic, Resistance, and Combined Exercises on Depression and Sleep Quality in Women With Controlled Hypothyroidism. A Randomized Controlled Trial. *Advances in Rehabilitation*, 38(1), 9–19. <https://doi.org/10.5114/areh.2024.136292>
- Farooqi, M., Rehman, S. J., Ahsan, N. Z., Malik, M. F., Ashraf, H., & Mirza, J. M. (2022). Sleep Quality in Relation With Perceived Stress and Physical Activity in the Students of Pakistani Medical Colleges. *Journal of Shalamar Medical & Dental College - JSHMDC*, 3(1), 4–9. <https://doi.org/10.53685/jshmdc.v3i1.90>
- Fauzi, A., Ahmedy, F., & Rosidah, R. (2024). Cross-Culture Adaptation and Validation of Indonesian Language Version of Pittsburgh Sleep Quality Index. *International Journal of Public Health Science (Ijphs)*, 13(4), 1672. <https://doi.org/10.11591/ijphs.v13i4.23439>

- Fontefrancesco, M. F. (2021). Jogging During the Lockdown: Changes in the Regimes of Kinesthetic Morality and Urban Emotional Geography in NW Italy. *Societies*, 11(4), 124. <https://doi.org/10.3390/soc11040124>
- Garber, C. E., Blissmer, B., Deschenes, M. R., Franklin, B. A., Lamonte, M. J., Lee, I.-M., Nieman, D. C., & Swain, D. P. (2011). Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory, Musculoskeletal, and Neuromotor Fitness in Apparently Healthy Adults. *Medicine & Science in Sports & Exercise*, 43(7), 1334–1359. <https://doi.org/10.1249/MSS.0b013e318213fefb>
- Griffiths, C., Silva, K. da, Sheldon, A., & Smith, G. (2024). Physical Activity, Sleep Hygiene, Diet, Wearable Activity Tracker Coaching in Severe Mental Illness (SMI). *Psychology*, 15(07), 1208–1220. <https://doi.org/10.4236/psych.2024.157071>
- Gururaj, R., Samuel, S. R., Kumar, V., Ravishankar, N., & Keogh, J. (2024). Effect of Exercise Based Interventions on Sleep and Circadian Rhythm in Cancer Survivors—a Systematic Review and Meta-Analysis. *Peerj*, 12, e17053. <https://doi.org/10.7717/peerj.17053>
- Hagedorn, R. L., Olfert, M. D., MacNeill, L., Houghtaling, B., Hood, L., Roskos, M. R. S., Goetz, J., Kern-Lyons, V., Knol, L. L., Mann, G., Esquivel, M., Hege, A., Walsh, J., Pearson, K., Berner, M., Soldavini, J., Steeves, E. A., Spence, M., Paul, C., ... Fontenot, M. (2021). College Student Sleep Quality and Mental and Physical Health Are Associated With Food Insecurity in a Multi-Campus Study. *Public Health Nutrition*, 24(13), 4305–4312. <https://doi.org/10.1017/s1368980021001191>
- Harrison, E., Schmied, E. A., Hurtado, S. L., Easterling, A. P., & Glickman, G. (2022). The Development, Implementation, and Feasibility of a Circadian, Light, and Sleep Skills Program for Shipboard Military Personnel (CLASS-SM). *International Journal of Environmental Research and Public Health*, 19(5), 3093. <https://doi.org/10.3390/ijerph19053093>
- Heryanto, M., & Sholehudin, I. (2023). The Effect of Brain Jogging Exercise on the Attention Ability of Students in Class VIII of SMP Negeri 9 Bandung. *Journal of Physical and Outdoor Education*, 5(1), 49–54. <https://doi.org/10.37742/jpoe.v5i1.193>
- Icenhower, A. L., Murphy, C., Brooks, A. K., Irby, M. B., N'dah, K. W., Robison, J., & Fanning, J. (2025). Investigating the Accuracy of Garmin PPG Sensors on Differing Skin Types Based on the Fitzpatrick Scale: Cross-Sectional Comparison Study. *Frontiers in Digital Health*, 7. <https://doi.org/10.3389/fdgth.2025.1553565>
- Kaneko, T., Kumagai, H., Yoshikawa, T., Tsujimoto, T., Miyauchi, T., Tanaka, K., & Maeda, S. (2023). Regular Aerobic Exercise Decreases Circulating Estradiol/Testosterone Ratio in Overweight and Obese Men. *The Journal of Physical Fitness and Sports Medicine*, 12(4), 101–106. <https://doi.org/10.7600/jpfs.12.101>
- Kong, Z., Wei, X., Shen, M., Cheng, Y., & Feng, J. (2024). Interval Training Has More Negative Effects on Sleep in Adolescent Speed Skaters: A Randomized Cross Controlled Trial. *Frontiers in Sports and Active Living*, 6. <https://doi.org/10.3389/fspor.2024.1367190>
- Lehmann, S., Askeland, K. G., & Hysing, M. (2020). Sleep Among Youths in Foster Care: Associations With Potentially Traumatic Events, PTSD and Mental Health. *Child & Family Social Work*, 26(1), 111–121. <https://doi.org/10.1111/cfs.12794>
- Malik, N., Ashiq, I., & Khan, R. M. (2024). Sleep Quality and Sleep Hygiene as Predictors of Mental Health Among University Students. *J. Asian Dev. Studies*, 13(1), 675–685. <https://doi.org/10.62345/jads.2024.13.1.560>
- Mashfufa, E. W., Marina, N. S. A. P., Sari, R. K., Marta, O. F. D., Setyowati, L., Aini, N., & Alifatin, A. (2022). Interaction Between Exercise and Sleep Quality Through Melatonin Synthesis: A Literature Review. *Kne Medicine*. <https://doi.org/10.18502/kme.v2i3.11874>
- Nasution, A. F. (2023). Metode Penelitian Kualitatif. Harfa Creative.
- Oral, O. (2021). A Narrative Review of the Impact of Aerobic Training on the Prevention and Treatment of Obesity-Related Hypertension. *Orthopedic Research Online Journal*, 8(3). <https://doi.org/10.31031/oproj.2021.08.000689>
- Qiu, L., Gong, F., Wu, J., You, D., Zhao, Y., Xu, L., Cao, X., & Bao, F. (2022). Exercise Interventions Improved Sleep Quality Through Regulating Intestinal Microbiota Composition. *International Journal of Environmental Research and Public Health*, 19(19), 12385. <https://doi.org/10.3390/ijerph191912385>
- Rahmadani, A. (2022). Metodologi Penelitian Olahraga. Media Sains Indonesia.
- Reis, M., Ramiro, L., Paiva, T., & Matos, M. G. d. (2021). National Survey on the Importance of Sleep in

-
- the Quality of Academic Life and Mental Health of College Students in Portugal. *Sleep Science*, 14(S 02), 125–132. <https://doi.org/10.5935/1984-0063.20200090>
- Setyowati, A., & Chung, M. (2020). Validity and Reliability of the Indonesian Version of the Pittsburgh Sleep Quality Index in Adolescents. *International Journal of Nursing Practice*, 27(5). <https://doi.org/10.1111/ijn.12856>
- Shehata, Y. A., Sharfeldin, A. Y., & Sheikh, G. M. E. (2022). Sleep Quality as a Predictor for Academic Performance in Menoufia University Medical Students. *The Egyptian Journal of Hospital Medicine*, 89(1), 5101–5105. <https://doi.org/10.21608/ejhm.2022.261794>
- Soesana, A., Subakti, H., Salamun, S., Tasrim, I. W., Karwanto, K., Falani, I., Bukidz, D. P., & Pasaribu, A. N. (2023). *Metodologi Penelitian Kuantitatif*. Penerbit Yayasan Kita Menulis.
- Umi, Y. (2023). Analisis Data Menggunakan SPSS. In *Analisis Data Menggunakan SPSS Versi IBM SPSS Statistics 26*. Tahta Media Grup.
- Vargas, G. O., Neaves, S., Pham, T. N., Huang, M., Turki, A. F., Wang, C., Bell, K. R., Juengst, S. B., Zhang, R., Li, M., Driver, S., Behbehani, K., Hynan, L. S., & Ding, K. (2024). Community-Based Exercise Program, Self-Reported Health-Related Symptoms, and Quality of Life in Persons With Traumatic Brain Injury 45+years Old. *Neurorehabilitation*, 54(3), 373–381. <https://doi.org/10.3233/nre-230223>
- Wang, F., & Boros, S. (2020). The Effect of Daily Walking Exercise on Sleep Quality in Healthy Young Adults. *Sport Sciences for Health*, 17(2), 393–401. <https://doi.org/10.1007/s11332-020-00702-x>
- Xie, Y., Liu, S., Chen, X., Yu, H., Yang, Y., & Wang, W. (2021). Effects of Exercise on Sleep Quality and Insomnia in Adults: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Frontiers in Psychiatry*, 12. <https://doi.org/10.3389/fpsy.2021.664499>
- Xu, Z., Niu, M., Du, W., & Dang, T. (2025). The Effect of Sleep Quality on Learning Engagement of Junior High School Students: The Moderating Role of Mental Health. *Frontiers in Psychology*, 16. <https://doi.org/10.3389/fpsyg.2025.1476840>
- Yen, K. T., & Cherng, S. (2020). Secondary Prevention of Depressive Prodrome in Adolescents: Before and After Attending a Jogging Program on Campus. *International Journal of Environmental Research and Public Health*, 17(21), 7705. <https://doi.org/10.3390/ijerph17217705>