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The relationship between sedentary behavior and physical activity with sleep quality in obese university students: a cross-sectional study

La relación entre el comportamiento sedentario y la actividad física con la calidad del sueño en estudiantes universitarios obesos: un estudio transversal

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Abstract

This study aims to determine the relationship between sedentary behavior, physical activity, and sleep quality in obese university students. This cross-sectional study involved 26 obese students (15 males, 11 females) at the State University of Malang who met specific inclusion criteria. Sedentary behavior was measured using the Sedentary Behavior Questionnaire (SBQ), physical activity with the International Physical Activity Questionnaire (IPAQ), and sleep quality using the Pittsburgh Sleep Quality Index (PSQI). Data were analyzed using Pearson's correlation and normality tests via SPSS 23.0. Results showed a strong negative correlation between sedentary behavior and sleep quality ($r = -0.916$, $p < 0.01$), and a significant positive correlation between physical activity and sleep quality ($r = 0.379$, $p < 0.05$). These findings suggest that increased screen time significantly decreases sleep quality, while physical activity helps improve it. The results highlight the importance of reducing sedentary behavior and promoting physical activity to enhance sleep quality among obese students. Practical implications include developing university-based health programs that target screen-time reduction and promote active lifestyles. Although promising, the study is limited by its small sample size and cross-sectional design, which limits causal inference. Future research should consider longitudinal designs and larger populations. This study aligns with existing literature that links lifestyle factors to sleep health and contributes new data within the context of Indonesian university students.

Keywords: obese university students, physical activity, sedentary behavior, sleep quality.

Resumen

Este estudio pretende determinar la relación entre el comportamiento sedentario, la actividad física y la calidad del sueño en estudiantes universitarios obesos. En este estudio transversal participaron 26 estudiantes obesos de la Universidad Estatal de Malang. Los datos se recogieron utilizando un cuestionario sobre el tiempo de pantalla para medir el comportamiento sedentario, el Cuestionario Internacional de Actividad Física (IPAQ) para medir el nivel de actividad física, y el Índice de Calidad del Sueño de Pittsburgh (PSQI) para medir la calidad del sueño. Los resultados mostraron una fuerte correlación negativa entre el comportamiento sedentario y la calidad del sueño ($r = -0{,}916$, $p < 0{,}01$), así como una correlación positiva significativa entre la actividad física y la calidad del sueño ($r = 0{,}379$, $p < 0{,}05$). Además, hubo una correlación negativa significativa entre el comportamiento sedentario y la actividad física ($r = -0{,}420$, $p < 0{,}05$). Las implicaciones de este estudio enfatizan la importancia de reducir el comportamiento sedentario y aumentar la actividad física para mejorar la calidad del sueño en estudiantes universitarios obesos. Es necesaria la sinergia entre los estudiantes universitarios, las familias, las instituciones educativas y los responsables políticos para crear un estilo de vida activo y saludable. Futuros estudios longitudinales deberían explorar los mecanismos causales y las intervenciones dirigidas a la reducción del tiempo frente a la pantalla en esta población.

Palabras Clave: estudiantes universitarios obesos, actividad física, comportamiento sedentario, calidad del sueño.

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Introduction

Sleep is a physiological process that regulates the brain, endocrine system, and immune system (Mukherjee et al., 2024). Poor sleep quality has been linked to a variety of disorders, including cardiovascular disease, diabetes, and mental health issues, as well as poor overall health and quality of life (Lee et al., 2017; Matsui et al., 2021). Because of the importance of sleep, several factors are being investigated for their potential impact in sleep, including environmental factors, physiological systems, and genetics (Jackson & Gaston, 2019; Madrid-Valero et al., 2022). Screen time and physical activity are two potential contributing elements, and their role in sleep is currently being investigated.

Getting enough exercise can enhance the quality of your sleep. Frequent exercise also has other general health benefits, such as lowering the risk of diabetes and heart disease and can be an effective treatment for insomnia (Riedel et al., 2024). A meta-analysis study by Riedel et al. (2024) showed that regular physical activity can improve sleep quality and reduce symptoms of depression. University students who are more physically active tend to have deeper sleep and longer sleep duration than those who are less active (Kizilkoca & Tokgöz, 2023). In contrast, sedentary habits such as watching television or using electronic devices excessively can hurt young adult development.

There is a consensus among health authorities that excessive sedentary behavior adversely affects the development of children and university students (Domingues-Montanari, 2017). Screen media use among university students is highly prevalent and is exceptionally high among university students from low-income families and racial/ethnic minorities, and may adversely affect obesity risk (Domingues-Montanari, 2017). Several studies revealed a dose-response relationship between average hours of TV viewing in children and the prevalence of obesity (Hobbs et al., 2021; Hu et al., 2019; Tahir et al., 2019). Although some cited studies focus on adolescents, the physiological mechanisms linking screen time to obesity and sleep disruption are equally relevant to university students, particularly given their prolonged exposure to digital devices.

Smartphone use disrupts sleep through blue light-mediated melatonin suppression (Christensen et al., 2016; George et al., 2019). In obese individuals, this effect is intensified by metabolic dysregulation. Leptin resistance—a hallmark of obesity—blunts melatonin secretion (Guan et al., 2021).

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The association between physical exercise, sedentary behavior, and sleep quality has been well researched, revealing complicated relationships. Physical activity generally improves sleep quality, however excessive sedentary behavior might decrease it, especially among teens and young adults. Increased physical activity is consistently linked to better sleep quality. For instance, a study found that physically active college students reported better sleep quality during the COVID-19 pandemic (Garcia et al., 2024). Young athletes also demonstrated that higher physical activity levels correlated with better sleep quality, but this relationship weakened with increased sedentary behavior (Turpin et al., 2024). High sedentary behavior is linked to poorer sleep outcomes. A study indicated that 75% of college students reported over 8 hours of sedentary behavior daily, correlating with sleep deterioration (Garcia et al., 2024). Specific screen activities, particularly during nighttime, negatively impacted sleep quality, while some daytime activities had a positive effect (Chen et al., 2024). Despite these findings, some studies suggest that not all sedentary behavior is detrimental, as certain activities may not significantly affect sleep quality. This emphasizes the importance of nuanced ways to regulating sedentary behavior and encouraging physical exercise for better sleep outcomes.

However, there is a significant gap in the literature regarding how these factors - screen time and physical activity - interact specifically in obese college students. Most previous studies have focused on the general population, adolescents, or athletes, and not many have specifically examined obese college students (Hale & Guan, 2015; Garcia et al., 2024). Obese college students may experience more severe sleep disturbances due to the presence of distinctive metabolic dysfunctions, such as leptin resistance and systemic inflammation, that can exacerbate melatonin suppression and disrupt sleep architecture (Cipolla-Neto et al., 2022; Khandelwal et al., 2024). These unique physiological interactions could potentially increase the susceptibility of obese individuals to sleep disturbances due to excessive screen exposure. In addition, most existing studies are still centered on populations of Western countries (Nagata et al., 2023), while research in the Indonesian context is minimal.

In the Indonesian context, university students face high academic pressure and near-constant exposure to digital technology. This combination contributes to an

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increased risk of physical inactivity and its associated health consequences. Supporting this, Gençoğlu et al. (2019) observed that physical education students experienced a decline in aerobic capacity during their university years despite maintaining similar physical activity levels between genders. Their study also revealed a significant correlation between reduced VO_2max and lower academic performance, highlighting the importance of sustaining physical fitness throughout higher education.

Similarly, Bennàsser Torrandell and Vidal-Conti (2021), in a study involving 2,399 adolescents, found that students who perceived themselves as active during school recess had healthier BMI, higher VO_2max, less screen time, greater weekly physical activity, and better academic outcomes. These findings emphasize the critical role of structured opportunities for physical activity—such as recess—in supporting health and learning.

In Indonesia, an intensive academic culture, low awareness of the value of physical activity, and urban lifestyles that promote sedentary behavior may further worsen sleep quality problems, particularly among obese university students. It is, therefore, essential to explore how these sociocultural factors interact with physiological health indicators. Research in this context can offer valuable insights into the lived experiences of Indonesian university students and contribute underrepresented perspectives to the global literature. Recent evidence also emphasizes the broader role of physical fitness and activity in shaping not only health but also cognitive and academic performance. Previous studies also confirm the importance of physical activity from an early age. Anjelina, Supriatna, & Fadhli (2022) found that even at the early childhood stage, adequate levels of physical activity are essential for supporting optimal growth and health outcomes. Adi, Hanief, Widiawati, Panganiban, & Muslim (2024) reported that among Indonesian elementary school students, physical fitness was significantly associated with learning outcomes in physical education, while body fat, BMI, and general activity levels showed weaker effects. These findings highlight that maintaining adequate physical fitness can provide multidimensional benefits, ranging from improved sleep quality to better academic performance, reinforcing the importance of integrating active lifestyles into educational settings.

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Based on various gaps in previous research, this study aims to investigate the relationship between sedentary behavior and physical activity with sleep quality, specifically in obese students. This study used a cross-sectional design and involved obese students from one of the universities in Indonesia. The findings of this study are expected to provide significant benefits, both in increasing public awareness about the impact of technology on health and reducing the risk of chronic diseases through lifestyle changes. In addition, the results of this study can be used as a basis for designing interventions that aim to reduce sedentary behavior, increase physical activity, and educate students about healthier sleep habits. The findings can also serve as a reference for physicians, psychologists, and public health professionals in addressing common sleep disorders in college students and provide hope for improved quality of life and long-term health outcomes.

Methodology

Research Design

This research is quantitative descriptive research with a cross-sectional study approach.

Participants

The population in this study comprised students of Universitas Negeri Malang, Indonesia. The sampling technique used was purposive sampling, with the inclusion criteria being: 1) willingness to participate in the research until completion, and 2) being classified as obese based on BMI. The exclusion criteria were: 1) having a history of diseases such as asthma and vertigo, as these conditions could interfere with the ability to perform physical activity tests and might independently affect sleep quality, thereby confounding the results. The final sample consisted of 26 university students who met the criteria and completed all assessments (15 males, 11 females). The characteristics of the study participants are presented in Table 1. This study was approved by the Research Ethics Committee of Universitas Negeri Malang (approval number: 29.11.8/UN32.14/PB/2024) and conducted by the Declaration of Helsinki on the ethical conduct of human subject research. All participants, exercising autonomy, provided written informed consent before data collection. To ensure confidentiality, participant

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data were anonymized, securely stored in encrypted digital files, and only accessible to the research team.

Table no. 1 Characteristics of Participants

Variable	n = 26			
	Minimum	Maximum	Mean	Std. Deviation
Age	19	21	20.23	.815
Weight (kg)	62	85	74.19	7.043
Height (cm)	155	178	166.96	7.544
Body Mass Index (kg/m^2)	25.3	28.7	26.519	.9867

Research Instrument

The Sedentary Behavior Questionnaire (SBQ) by Wagner et al. (2010), International Physical Activity Questionnaire – Long Form (IPAQ-LF) (Vasheghani-Farahani et al., 2011), and Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989) were used in this study. All three instruments have been widely validated in various populations, including university students. The SBQ has demonstrated good test-retest reliability (ICC > 0.70) and acceptable construct validity. The IPAQ-LF has been validated in multiple countries with reliability coefficients ranging from 0.76 to 0.88 and moderate concurrent validity with accelerometer data. The PSQI has shown high internal consistency (Cronbach's alpha > 0.80) and strong validity for assessing subjective sleep quality.

Data analysis

Data analysis was conducted using Pearson correlation tests to examine the relationships between physical activity level (measured via IPAQ-LF), sedentary behavior (SBQ), and sleep quality (PSQI global score). Before correlation analysis, assumptions of normality and linearity were tested using the Shapiro–Wilk test and scatterplot visualization, respectively. The variables met the necessary assumptions for parametric testing.

Results

A total of 26 subjects completed the form. The data was then analyzed to determine whether there was a relationship. Table 2 presents exciting results regarding

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the level of sedentary behavior in obese university students. Of the 26 university students, none had sedentary behavior activities in the low category (<10 hours/week). Most of them did sedentary behavior activities in the high category (>20 hours/week). Furthermore, the physical activity level data showed that five university students performed activities in the low category (<600 minutes/week), nine university students performed activities in the medium category (600-3000 minutes/week), and 12 university students performed activities in the high category (>3000 minutes/week) (table 3). Meanwhile, table 4 shows the results of poor sleep quality (n=17), which is higher than good sleep quality (n=9).

Table no. 2 Sedentary behavior Data

	Frequency	Percentage (%)
Low	0	0
Moderate	8	30.8
High	18	69.2
Total	26	100

Table no. 3 Data on Physical Activity Level

	Frequency	Percentage (%)
Low	5	19.2
Moderate	9	34.6
High	12	46.2
Total	26	100

Table no. 4 Data on Sleep Quality

	Frequency	Percentage (%)
Poor	17	65.4
Good	9	34.6
Total	26	100

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Table no. 5 Correlation Test Results between Screen time, Physical Activity with Sleep Quality

		Sedentary behavior	Physical Activity	Sleep Quality
Sedentary behavior	Pearson Correlation	1	-.420*	-.916**
	Sig. (1-tailed)		.016	.000
	N	26	26	26
Physical Activity	Pearson Correlation	-.420*	1	.379*
	Sig. (1-tailed)	.016		.028
	N	26	26	26
Sleep Quality	Pearson Correlation	-.916**	.379*	1
	Sig. (1-tailed)	.000	.028	
	N	26	26	26

*. *Correlation is significant at the 0.05 level (1-tailed).*
**. *Correlation is significant at the 0.01 level (1-tailed).*

Table 5 shows a significant negative correlation ($r = -0.916$, $p < 0.01$) between sedentary behavior and sleep quality. This link is extremely significant, indicating that increasing sedentary behavior is substantially associated with poorer sleep quality. This suggests that obese university students who spend more time in front of screens have poorer sleep quality. The correlation coefficient between physical activity and sleep quality was 0.379, with a significance level of 0.028 ($p < 0.05$). Although not as strong as the correlation between sedentary behavior and sleep quality, this finding nevertheless indicates a significant beneficial relationship. This suggests that the individual's sleep quality improves as their amount of physical activity increases. The correlation between sedentary behavior and physical activity was -0.420, with a significance level of 0.016 ($p < 0.05$). This suggests a considerable unfavorable association. That is, the more time an individual spends on screens, the lower their level of physical activity.

Discussion

This study aims to determine the association between sedentary behavior and physical activity with sleep quality in obese university students. The findings showed that sedentary behavior (particularly screen time) significantly reduced sleep quality ($r = -0.916$, $p < 0.01$), while physical activity had a weaker positive effect. Overexposure to screens harms sleep patterns and memory performance (Han et al., 2024) and is linked to reduced academic achievement due to sleep deprivation (Putri et al., 2021). These results align with Domingues-Montanari (2017), who reported similar adolescent patterns. Our

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study extends these findings to young adults, suggesting that the mechanisms linking screen time to poor sleep—such as blue light exposure and mental stimulation—persist across age groups. Academic stressors and irregular schedules may exacerbate these effects in university students, warranting targeted interventions. One of the primary mechanisms by which increased screen time impairs sleep is exposure to blue light emitted by digital devices. Blue light suppresses melatonin secretion, a hormone that regulates circadian rhythms and promotes sleep onset (Chang et al., 2015). Furthermore, engaging with stimulating content on screens, such as social media, video games, or academic material, increases cognitive arousal and mental alertness, making it more challenging to transition into restful sleep (Hale & Guan, 2015).

Academic stress is also critical in disrupting sleep patterns and reducing physical activity levels. During exam periods or under heavy academic workloads, students often experience heightened anxiety and irregular schedules, contributing to delayed sleep onset, poor sleep quality, and reduced motivation for physical exercise (Beattie et al., 2015; Lund et al., 2010). Sleep deprivation during these periods may further impair cognitive function and academic performance, creating a cyclical problem.

The current study found that higher physical activity levels were associated with better sleep quality and lower sedentary behavior. A recent Mendizabal (2024) study also supports the relevance of subjective physical activity assessments in predicting specific components of health-related physical fitness. Involving 362 university students, the study utilized the International Physical Activity Questionnaire (IPAQ) and several standardized fitness tests, including sit-and-reach, push-up, plank, wall sit, and three-minute step test. The findings demonstrated that subjective physical activity levels significantly predict muscular endurance and flexibility. Furthermore, sex-specific differences were noted, with subjective activity levels influencing both upper body and core endurance in males, while only muscular endurance was affected in females. These findings reinforce the potential utility of self-reported physical activity measures like the IPAQ while highlighting the need for diverse fitness assessment methods in future studies.

Furthermore, a systematic literature review by Hale & Guan (2015) showed that most studies reported that university students exposed to electronic media, such as TV, computers, smartphones, and tablets, have shorter sleep duration and a higher risk of

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insomnia. The leading causes are exposure to blue light from screens and mental stimulation, leading to delayed bedtime and decreased sleep efficiency. This makes them more likely to experience sleep deprivation and other sleep disturbances, such as midnight waking and poorer sleep quality (Twenge et al., 2019). This not only disrupts sleep quality but also increases the risk of depressive symptoms in university students (Lemola et al., 2015).

Therefore, it is essential to engage in regular physical activity. University students who engage in physical activity for at least 30 minutes daily have been shown to improve sleep quality and reduce the time needed to fall asleep (Dewi et al., 2024). In addition, it can improve mood and decrease anxiety levels in physically active university students. Research conducted by Baso et al. (2018) found that university students who regularly engage in intense physical exercise have better sleep quality. The timing of exercise is also essential, as exercise or physical activity too close to bedtime can disrupt sleep. However, moderate-intensity exercise during the day can improve sleep quality and duration (Amzajerdi et al., 2020).

The findings also highlight that excessive screen time negatively impacts university students' physical activity levels. This is in line with research conducted by Priftis & Panagiotakos (2023) that excessive sedentary behavior adversely affects the physical and mental health of children and university students, including decreased physical activity, sleep disturbances, and increased risk of obesity and cardiometabolic problems. Research using data from the Adolescent Brain Cognitive Development (ABCD) Study showed that university students with more than 8 hours of sedentary behavior per day had a higher BMI and lower daily steps associated with decreased physical activity (Nagata et al., 2023). A study conducted by Bakour et al. (2022) on university students in the United States revealed that university students who spent more than 4 hours a day in front of a screen significantly increased BMI, which was also associated with lower levels of physical activity. This study underscores the importance of managing sedentary behavior and encouraging physical activity to support better sleep quality.

To improve sleep quality in obese teenagers, several strategies have been identified through recent research. These include dietary adjustments, exercise programs,

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and structured eating patterns. Implementing an 8-hour time-limited eating (TLE) schedule can enhance sleep quality without negatively affecting sleep duration. A study conducted by Jayakumar et al. (2023) showed a marginal improvement in sleep quality scores after 12 weeks of TLE among university students with obesity, suggesting that this dietary approach may serve as a practical lifestyle intervention. In addition to dietary timing, structured physical activity programs have also shown positive effects on sleep and body composition. One such intervention is the Ampe exercise program, a traditional Ghanaian high-intensity game predominantly played by females. This culturally rooted activity involves rhythmic jumping, clapping, and projecting one leg forward in synchronization with a partner, aiming to predict and counter the opponent's movement. The game requires coordination, aerobic endurance, and agility, making it physically engaging. More importantly, it fosters social interaction, making it a holistic experience. Afrifa et al. (2023) found that implementing the Ampe program in a structured format for six weeks led to significant improvements in sleep quality and notable reductions in body weight among obese female university students. These findings indicate that culturally relevant and enjoyable physical activity programs, alongside dietary interventions such as TLE, can provide practical strategies for improving sleep quality and overall health in the obese student population.

The timing of physical activity also plays a role in sleep regulation. While regular exercise generally improves sleep quality, engaging in high-intensity workouts too close to bedtime—particularly within two hours—can increase core body temperature and sympathetic nervous system activity, thereby delaying sleep onset. Exercise performed earlier, particularly before 6:00 p.m., is generally considered optimal for promoting better sleep (Kredlow et al., 2015).

Although the results of this study show that sedentary behavior and physical activity are closely related to sleep quality, the relatively small sample size may affect the generalizability of the results. This is a limitation of this study; with a larger sample, it will be more representative and allow for more in-depth analysis and higher reliability. Therefore, further research with a more significant number of participants is needed to confirm these findings.

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Conclusion

These findings highlight the importance of managing sedentary behavior and increasing physical activity to support better sleep quality in obese university students. A significant challenge is to change sedentary lifestyles and establish a physically active lifestyle in obese university students. The implications of this study suggest the need for interventions that focus on reducing sedentary behavior and increasing physical activity as strategies to improve the sleep quality and health of obese university students. There is a need for collaboration involving university students, families, educational institutions, and policymakers to effectively address these challenges and create an environment that supports a balance between sedentary behavior use, physical activity, and healthy sleep patterns.

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