

Meta-analysis: Correlation between academic stress and sleep quality in urban living

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Abstract

Purpose: Sleep quality is essential because it is associated with quality of life. It plays a vital role in good health and well-being throughout life. This study aims to see whether there is a correlation between academic stress and sleep quality among urban students.

Method: This research uses a meta-analysis research method. This meta-analysis research uses 15 article of literature (2012-2024).

Result: Based on the results of the meta-analysis, it can be seen that there was an effect size correlation between academic stress and sleep quality, which was classified into a medium effect size ($r=0.454$, $p<0.001$, 95% CI=-0.288 – 0.619).

Conclusion: So it can be concluded that there is a significant relationship between academic stress and sleep quality. This research highlights the importance of managing time to minimize academic stress affecting sleep patterns.

Keywords: *academic stress; meta-analysis; sleep quality; urban living*

INTRODUCTION

Sleep is a basic human need. Abraham Maslow pointed out that sleep is part of the physiological needs in the five basic human needs hierarchy. Sleep is an indispensable human physiological need. Quality sleep is a big part of living a healthy and prosperous life. Good sleep helps us stay healthy and lower the risk of severe health problems like diabetes and heart disease. Additionally, good sleep is essential for many aspects of brain function and can improve our focus, concentration, productivity and performance in work, study and everything we do. Quality sleep also helps us achieve optimal health. Unfortunately, the nature of modern life has disrupted sleep patterns.

Nowadays, many people sleep less than they need. Sleep quality also decreases. Researchers show that more than 80% of people have had problems or been disturbed by sleep problems (Bower et al., 2010). The World Health Organization reports that one-third of adults worldwide have poor sleep quality (Chinanew.com, 2021). It is due to many reasons, such as stress, fatigue, insomnia and others. But we must remember that good sleep is essential for life, just like eating healthy and exercising. In addition, sleep inspires insight into hidden rules and facilitates the generalization of knowledge (Ellenbogen et al., 2007; Gómez et al., 2006; Wagner et al., 2004). These cognitive competencies are critical during higher education, often considered the most demanding and challenging learning period in many people's lives. Students in the early adulthood age group need 7-8 hours of sleep per night. However, in reality, not all students maintain optimal sleep due to having many activities and stressors, both academic and non-academic. This condition puts students at risk of poor sleep quality.

An independent study found that stress is one of the factors that influence sleep quality (Fortunato & Harsh, 2006; Kashani et al., 2012). People with sleep disorders often experience higher levels of stress, and frequent stressful events can cause sleep problems (Healey et al., 1981). Academic stress, the mental pressure and suffering caused by frustration in academic failure, objective learning environments and social evaluation, is a major stressor for adolescents (Liu, 1997; Verma & Gupta, 1990; Kenny et al., 2002). Studies have shown that more than 60% of students have poor sleep quality, resulting in daytime sleepiness and increased physical and psychological health problems (Lund et al., 2010; Sing and Wong, 2010).

Based on previous research, Almojali et al. showed that 76% (575 students) had poor sleep quality, and 53% (401 students) experienced symptoms of stress. This study also supports previous research by Ahrberg et al. (2012) among 144 students, showing that 59% of respondents had poor sleep quality and lower academic performance correlated with lower sleep quality and higher stress levels. Poor quality sleep causes feelings of anxiety, tension, fatigue, intellectual decline, cognitive impairment, and depression. The results of Lemma et al.'s research among 2,551 students from Haramaya showed that 55.8% (1424 students) had poor sleep quality, 50.8% (1294 students) experienced depression, and 58% (1369 students) experienced anxiety and 34.1% (864 students) experience academic stress. Beebe et al. (2010) restricted sleep in a simulated classroom, which led to lower quiz scores, more inattentive behavior, and lower arousal.

Recent studies show that intellectual abilities and psychosocial attributes contribute to academic performance. Healthy students develop a good capacity for learning based on introspection, self-observation, and practical judgment. Therefore, researchers want to know the correlation between sleep quality and academic stress levels in students using a meta-analysis that links variables between academic stress and sleep quality. The benefits of this research can be (1) valuable in research, especially in the health sector and specifically in mental health, and (2) broader public understanding of mental health awareness, especially in academic stress and sleep quality.

METHOD

Study of literature

A literature study was carried out to retrieve data that complies with the research requirements. This study uses one journal data source, namely "Google Scholar". Researchers looked for research journals that contained academic stress and sleep quality variables. The keywords used are "academic stress" AND "sleep quality". Keywords are used in combination with the two to maximize research journal search results. The research journals obtained will be inspected with the following provisions: (1) carrying out an evaluation process on the research title, which contains the two specified variables, and (2) ensuring that the research journal is a Scopus-indexed journal.

Selection of Literature

Selection of research journals uses the following conditions: (1) be in a specific year range between 2012 - 2024, (2) include citations to both variables, (3) be indexed by Scopus using the website <https://www.scimagojr.com/>, (4) ensure research journals use quantitative methods, (5) ensure there are measuring instruments for academic stress and sleep quality variables, (6) the literature has the required statistical data, namely the number of research subjects and the correlation coefficient (r).

Data Process

Data will be processed using meta-analysis methods. Gene Glass introduced the term meta-analysis in his 1967 presidential speech to the American Educational Research Association, defined as an analysis of the results of statistical analysis that aims to draw general conclusions (Hedges, 1992). The current meta-analysis research involves funnel plots of the Fisher r-to-z transformation correlation coefficient as a result of measurements, estimated values on the intercept, I² on heterogeneity statistics, forest plots as a result of the magnitude of the correlation values, p values on Egger's regressions to see publication bias. The literature that has been obtained is summarized in a table containing sequence number, country, quality of life measuring instrument, depression measuring instrument, correlation value and number of participants. Data processing was carried out using the Jamovi software application in version 1.8. The data entered into the software application is the name of the researcher (author), number of respondents (n), and correlation value (r) between academic stress variables and sleep quality. The percentage of a random-effect model obtained 95% CI in this study. The effect size in this study can be seen through the random correlation coefficient of the Fisher r-to-z transformation. The correlation that can be identified is small when the r value is smaller than 0.3, medium when it is 0.3 or greater than the r value or below 0.49, and high when the r value is above 0.5 (Sari et al., 2021).

RESULT

From the results of the literature selection, the researchers found that 17 article of literature met the criteria and could be used in this research with a combined sample size of as many participants. The countries that dominate the most are Indonesia, India and several other countries such as Hungary and Poland. In addition, several journals use the same measuring tool for the academic stress variable, namely the Perceived Stress Scale (PSS). In contrast, several journals use the same measuring tool for the sleep quality variable, namely the Pittsburgh Sleep Quality Index (PSQI).

The initial research process involves recapitulating the literature by looking at the correlation coefficient value, number of participants, research location, and measuring instruments used for these two variables. In the literature selection process, 10,000 results were found during specific years ranging from 2012 to 2024. Literature that includes citations was found to be 71,100. At the end of the selection of research literature using quantitative methods, there are two measuring instruments between academic stress and sleep quality variables. There is a correlation value (r) indexed by Scopus for 15 article of literature. This research uses meta-analysis writing guidelines from Reporting Systematic Reviews and Meta-Analyses.

The results of the statistical tests show that academic stress can affect sleep quality but not as significantly because the effect size value obtained from the random effect is a medium effect size of 0.454 (95% CI: 0.288 to 0.619). Based on one another's literature, it was also found that research from one to another was heterogeneous with an inconsistency (I²) value of 93.14%, and bias was found in publication because Egger's Regression value was below 0.005, namely 0.001. The highest standardized effect value can be seen in literature number 13, from Maisa et al., 2021 [Figure 1 Forest Plot].

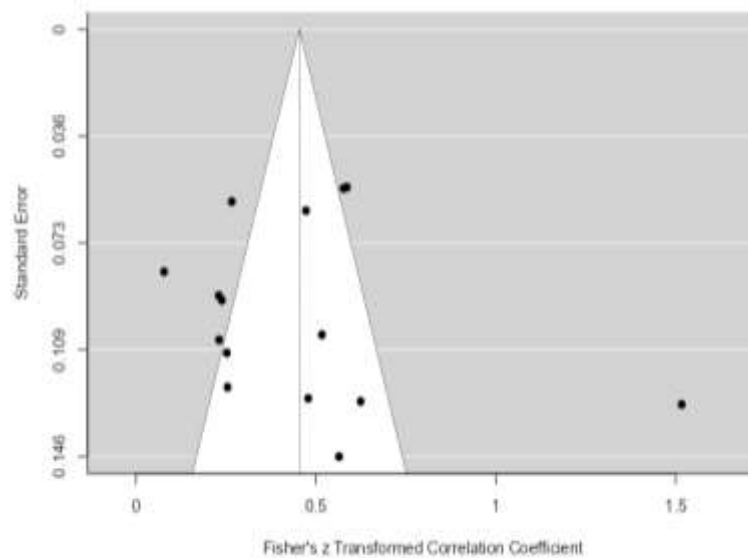


Figure 1. Forest plot.

DISCUSSION

Based on the findings in this meta-analysis research, the correlation effect size results are medium to large. This follows a previous study that found a medium correlation indicating a strong correlation between academic stress and sleep quality. The medium value in the effect size of the correlation between academic stress and sleep quality can be explained by the fact that the two variables have an indirect effect, namely an indirect relationship.

The meta-analysis results are medium to large, with an effect size of 0.454 (95% CI: 0.288 to 0.619), and the correlation between the two is medium to large. This could mean that if there is an indirect relationship (indirect effect), what is happening is that poor sleep quality is not always caused by academic stress; likewise, academic stress does not always cause people not to be able to sleep. However, difficulty sleeping can be caused by other factors, such as hormones, drugs and psychology. It could also be due to external factors such as mental pressure, an uncomfortable bedroom atmosphere, noise or a change in time due to having to work at night. Apart from that, coffee and tea, which contain central nervous system stimulants; tobacco, which contains nicotine; and body control drugs, which include amphetamines, are examples of substances that can cause difficulty sleeping.

Morin (in Espie, 2002) states that the leading causes of decreased sleep quality are emotional, cognitive and physiological problems. All three play a role in cognitive dysfunction, unhealthy habits, and the consequences of insomnia. Apart from that, excess or deficiency of the hormone melatonin can result in several changes in the body. Because it is produced naturally in the body, harmful consequences can occur when there is an excess or deficiency of the melatonin hormone. Excess melatonin hormone can cause liver problems, fatigue, disorientation, psychotic thoughts and behavior, drowsiness, speech disorders, tremors, headaches and dizziness. Meanwhile, when there is a lack of the hormone melatonin, you can experience insomnia, restless sleep, enlarged prostate, depression, fatigue, irregular menstrual cycles, anxiety, high cholesterol, hypertension, and heart rhythm disorders. Also, according to the findings of a new study published by the

Journal of the American Medical Association, a lack of the hormone melatonin can increase the risk of diabetes.

The etiology of depression that can be linked to sleep disorders is disruption of the neurotransmitter serotonin. Serotonin plays a role in controlling affect, aggressiveness, sleep and appetite. Serotonergic neurons project from the dorsal raphe nucleus of the brainstem to the cerebral cortex, hypothalamus, basal ganglia, septum, and hippocampus. Its projections to these places underlie its involvement in psychiatric disorders. There are about 14 serotonin receptors, but just one transmitter can have effects throughout the brain. Experiments conducted on mice show that disruption of 5-HT₇ can reduce depressive behavior and decrease REM duration.

Hormonal regulation disorders can cause depression, namely the Cortical Hypothalamic-Pituitary-Adrenal Cortical Axis (CHPA). The normal mechanism is that daily bad experiences will be recorded in the cerebral cortex and limbic system as stressors. This part of the brain will send messages to the body to prepare for the stressor. The target organ is the adrenal glands. This gland will secrete cortisol to maintain life. Cortisol regulates sleep, appetite, kidney function, the immune system, and all critical factors in life. Cortisol levels decrease at night before bed, while when we wake up in the morning, they increase so that we can wake up refreshed. An increase in cortisol will cause a feedback mechanism to the hypothalamus to reduce the secretion of Corticotrophin Releasing Hormone (CRH) and to the anterior pituitary gland to reduce the secretion of Adrenocorticotrophin Hormone (ACTH). The CRH system is the system most affected by stressors experienced by a person early in life. Repeated stressors will cause increased CRH secretion and decreased sensitivity of adenohipophyseal CRH receptors. So, in the end, cortisol secretion is also disrupted. Stressors in early life can cause permanent changes in the neurobiological system or leave an imprint on the nervous system that responds to the stressor.

On the other hand, according to Sadoso Sumosardjuno (1988), some food ingredients such as salt and sugar (refined sugar), as well as drinks such as coffee, cola, tea and alcohol, can cause difficulty sleeping or even not being able to sleep, apart from that, some medicines contain substances. Chemicals, namely sodium chloride, can cause a person to have difficulty sleeping. Therefore, academic stress is not directly related to someone having trouble sleeping; many factors influence it, and further research is needed.

CONCLUSION

An important implication of the meta-analysis study is the large effect-size correlation value between academic stress variables and sleep quality. The relationship between these two variables can be caused by other factors, such as too much sleep hormone, use of gadgets, and parental pressure. Future research that uses academic stress and sleep quality variables can use more literature sources and conduct further studies that are more heterogeneous.

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