Original Article

The Relationship Between Nighttime Smartphone Use and Insomnia in Adolescents in Mataram City

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Abstract

Introduction: *Smartphone use among adolescents, particularly in Mataram City, West Nusa Tenggara, is highly prevalent. Nighttime smartphone useis associated with delayed sleep onset, as it extends the time adolescents more time to engage in various activities. Several studies have shown that smartphones use can contribute to sleep disturbances, including insomnia. This study aims to investigate the relationship between nighttime smartphone use and insomnia among adolescents in Mataram City.*
Methods: *This study employed a cross-sectional design and included 362 students from Mataram City, selected through non-probability consecutive sampling method. Participants completed questionnaires assessing nighttime smartphone use and insomnia symptoms using Insomnia Severity Index. Data were analyzed using Spearman's rank correlation test.*
Result: *Of the total sample (44.5% male), the majority were 16 years old (62.4%), enrolled in Grade 11 (82.6%), and most (66.9%) were in the natural science program. The majority of participants were classified as having subclinical insomnia (43.9%), while only 2.5% experienced severe insomnia. The findings revealed a positive correlation between the frequency of nighttime smartphone and insomnia among adolescents (r=0.104; p=0.049).*
Conclusion: *There is a significant relationship between the frequency of nighttime smartphone use and insomnia among adolescents in Mataram City.*

Keywords: *Smartphone usage, Insomnia, Adolescents.*

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Hubungan antara Penggunaan Smartphone pada Malam Hari dan Insomnia pada Remaja di Kota Mataram

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Abstrak

Pendahuluan: *Penggunaan smartphone di kalangan remaja, khususnya di Kota Mataram, Nusa Tenggara Barat, sangat tinggi. Penggunaan smartphone pada malam hari berhubungan dengan keterlambatan waktu tidur karena meningkatkan durasi keterlibatan remaja dalam berbagai aktivitas. Beberapa penelitian telah menunjukkan bahwa penggunaan smartphone dapat memicu gangguan tidur, termasuk insomnia. Penelitian ini bertujuan untuk mengetahui hubungan antara penggunaan smartphone pada malam hari dan insomnia pada remaja di Kota Mataram.*
Metode: *Penelitian ini menggunakan desain studi potong lintang dan melibatkan 362 siswa di Kota Mataram yang dipilih melalui teknik konsekutif non-probabilitas. Partisipan mengisi kuesioner yang menilai frekuensi penggunaan smartphone pada malam hari dan gejala insomnia menggunakan Insomnia Severity Index (ISI). Data dianalisis menggunakan uji korelasi Spearman.*
Hasil: *Dari total sampel (44,5% laki-laki), sebagian besar berusia 16 tahun (62,4%), berada di kelas 11 (82,6%), dan mayoritas (66,9%) berada di program studi Ilmu Pengetahuan Alam (IPA). Sebagian besar partisipan tergolong mengalami insomnia subklinis (43,9%), dan hanya 2,5% yang mengalami insomnia berat. Hasil analisis menunjukkan adanya korelasi positif antara frekuensi penggunaan smartphone pada malam hari dan insomnia pada remaja (r=0,104; p=0,049).*
Kesimpulan: *Terdapat hubungan yang signifikan antara frekuensi penggunaan smartphone pada malam hari dan insomnia pada remaja di Kota Mataram.*

Kata Kunci: *Penggunaan smartphone, Insomnia, Remaja*

Introduction

The development of smartphones has progressed rapidly alongside the advancement of time. With features like touchscreens, internet access, application installation, media playback, cameras, and GPS, they have become essential tools in daily life.[1] Surveys show that the average smartphone usage rate across 47 countries is 44.6%, and this figure is expected to increase over time.[2] In 2016, the global number of smartphone users reached 99.5 million, marking an increase of 25.8 million from the previous year.[3] According to the Indonesian Ministry of Communication and Informatics, the number of smartphone users in Indonesia has reached 167 million people, equivalent to 89% of the total population.[4] The majority of users are under the age of 30, accounting for 75.95% of the total. In the Bali and Nusa Tenggara regions, smartphone usage was recorded at 45.24%.[4]

Several studies have indicated that teenagers tend to use smartphones more frequently than other age groups. This is largely due to their lower self-regulation in managing their enthusiasm for engaging activities, making them more prone to improper smartphone use compared to adults.[3] Teenagers around the world have integrated smartphones into nearly every aspect of their lives. With their comprehensive and user-friendly features,

smartphones support daily activities such as completing assignments or communicating with friends. Social media applications also play a major role in teenagers' social interactions.[5] In Indonesia, teen smartphone usage has become a significant phenomenon in recent years, with approximately 30 million users, representing 80% of total respondents.[6]

Statistics show a 39% increase in the number of hours people spend using their smartphones in 2020. Indonesia is one of the countries with the highest smartphone usage rates globally.[6] In Indonesia, the number of smartphone users rose significantly from 150.5 million in 2018 to 171.2 million in 2019. Projections estimate that by 2025 256.1 million Indonesians will own smartphones.[3]

The use of electronic media among teenagers has been associated with delayed sleep onset, giving them with more opportunities to engage in various activities late into the night. This behavior contributes to a progressive shift in their circadian rhythm.[7] Excessive smartphone use can also result in health problems. Several studies have shown that smartphone radiation may contribute to sleep disorders, one of which is insomnia.[7,8]

Insomnia can be defined as dissatisfaction with sleep quality, including difficulty initiating sleep, maintaining sleep, frequent awakenings, having trouble returning to sleep after waking up, and early morning awakenings without the ability to fall back assleep.[9] Using smartphones or other electronic devices for more than 35 minutes before bedtime is considered pathological. According to a survey, 57% of teenagers who use smartphones in bed reported experiencing sleep difficulties.[10] A previous study conducted by Al Battashi, et al.[9] (2021) found that smartphone use can contribute to insomnia among teenagers. According to Indonesia's Central Bureau of Statistics (BPS) in 2020, the number of students enrolled in both public and private high schools in Mataram City, West Nusa Tenggara, was 11,973. A study conducted in 2019 revealed that 51.3% of school-aged teenagers in Mataram City were at high risk of smartphone addiction.[11] Given this background and the limited research on the relationship between nighttime smartphone usage frequency and insomnia among teenagers in Mataram City, further investigation is warranted to explore this relationship.

Method

This study is a type of observational, analytical, quantitative research using a cross-sectional design. The research was conducted from January 2024 to September 2024. The study population comprised high school (SMA) students currently enrolled in schools in Mataram City, West Nusa Tenggara Province . A total of 284 students were included as the sample, calculated using Lemeshow's formula. Participants were selected based on predefined inclusion and exclusion criteria.

The inclusion criteria for this study were: student who were actively participating in learning activities, actively using smartphones, and willing to participate in the study. Exclusion criteria included the presence of medical conditions or other disorders that could affect sleep patterns independent of smartphone use, as well as the used of medications known to influence sleep. Ethical approval for this research was obtained from the of Mataram University under the approval number 069/UN18.F8/ETIK/2024.

Data on insomnia symptoms and the frequency of nighttime smartphone use were collected using a nighttime smartphone usage questionnaire and the Insomnia Severity Index (ISI). Questionnaires were distributed to high school students in Mataram City. Prior to data collection, informed consent was obtained to ensure that participants understood the purpose and contents of the questionnaire, were informed about how to complete it, and voluntary agreed to participate in this study.

After data collection, the responses were reviewed for completeness, tabulated, and statistically analyzed using SPSS software. This study employed the Spearman statistical test to analyze the correlation, using categorical (ordinal) data scales. A p-value of less than 0.05 was considered statistically significant.

Result

This study was conducted in Mataram City from May to September 2024, involving six schools with a total of 365 students: SMAN 1 Mataram (17.4%), SMAN 2 Mataram (17.1%), SMAN 6 Mataram (17.1%), SMAN 7 Mataram (15.5%), SMAN 11 Mataram (12.7%), and SMAK Kesuma Mataram (20.2%). After excluding three respondents, the final sample consisted of 362 students, comprising 161 male (44.5%) and 201 female (55.5%), aged 15-19 years old.

Demographic Characteristics

The demographic characteristics of respondents included gender, age, grade level,

and study program (Table 1). Female students (n=201) outnumbered males (n=161). The largest age group was 16 years with a mean age of 16.2 years. Respondents were drawn from all grade levels, with the highest proportion in grade 11. Most student (n=242) were enrolled in the Mathematics and Natural Sciences (MIPA/Natural Science) program.

Table 1. Demographic Characteristics

Charateristics	N(%)
Gender	
Male	141 (44.5)
Female	201 (55.5)
Age	
15	35 (9.7)
16	226 (62.4)
17	94 (26.0)
18	6 (1.7)
19	1 (0.3)
Grade Level	
10	35 (9.7)
11	299 (82.6)
12	28 (7.7)
Study Program	
MIPA (Natural Science)	242 (66.9)
IPS (Social Science)	85 (23.5)
Other	35 (9.7)

Nighttime Smartphone Usage

Based on the questionnaire results, 70.7% of respondents were categorized as excessive smartphone users, 25.4% as moderate users, and 3.9% as low users. Questionnaire results showed that 41.4% of respondents placed their smartphones in the bedroom but not on the bed, while 34.8% placed them on the bed (see Table 2). According to the questionnaire results, the three most frequently used applications at night were Instagram®, WhatsApp®, and TikTok® as shown in Table 3.

Table 2. Nighttime Smartphone Placement

Placement	N(%)
Does not use a smartphone at night	74 (20.4)
In another room	12 (3.3)
In the bedroom, but not on the bed	150 (41.4)
In the bedroom, on the bed	126 (34.8)

Table 3. Applications Used at Night (N=362)

Applications	N(%)
Instagram®	255 (70.4)
WhatsApp®	255 (70.4)
TikTok®	229 (63.2)
Online Game	50 (13.8)
YouTube®	75 (20.0)
Holy Book Application	3 (0.8)

Insomnia Severity Index (ISI)

Based on the questionnaire results, 43.9% of respondents were classified as having subclinical insomnia, 34.3% had no insomnia, 19.3% had moderate insomnia, and 2.5% experience severe insomnia. The mean insomnia symptom score was 10.09, indicating that adolescents in Mataram City, on average, fall into the subclinical insomnia category.

The Relationship Between Nighttime Smartphone Use and Insomnia

The Spearman correlation test was used to examine the relationship between the frequency of nighttime smartphone use and insomnia, as the data were ordinal and not normally distributed ($p<0.05$). A significant positive correlation was found ($r=0.104$; $p=0.049$), indicating a relationship between nighttime smartphone use and insomnia symptoms.

Discussion

The respondents in this study were adolescents aged 15-19 years, with the majority aged 16, corresponding to the late adolescence category. These findings are consistent with studies conducted in Western countries, which report that nearly all adolescents aged 12-19 years (98%) own a mobile phone, with 97% owning a smartphone.[11]

A study found that 16-year-old adolescents who use social media for a moderate duration, approximately 3 to 4 hours per day, tend to experience mild insomnia on average.[12] This may be attributed to the underdeveloped self-regulatory capacities in adolescents, making them more vulnerable to excessive smartphone use, which in turn increases the risk of sleep disturbances. In the current study, the majority of respondents were female, aligning with previous research indicating that females are at greater risk of

excessive smartphone use and addiction. Furthermore, a study by the Centers for Disease Control and Prevention (CDC) reported that adolescent girls have a higher prevalence of insufficient sleep compared to boys (71.3% vs. 66.4%).[13]

Excessive smartphone use has emerged as a significant concern among adolescents. Smartphones has evolved beyond their original function as communication tools to become primary sources of entertainment, information, and social interaction. However, uncontrolled usage has been associated with adverse outcomes, including sleep disturbances, reduced academic performance, and behavioral changes. Previous studies have identified adolescents as particularly vulnerable to these effects, given that smartphones often serve as their primary medium for social connection and self-expression.[5]

Research findings indicate that the majority of respondents exhibit excessive smartphone use Specifically 70.7% respondents (70.7%) were classified as excessive users.. Supporting these findings, a separate study reported that 97% of adolescents use technology, including smartphones, within one hour before bedtime, with 74% specifically using smartphones.[14] Additionally, a study conducted at SMAN 2 Surabaya found that 51.5% of adolescents engage in excessive smartphone use.[5]

The study also found that 34.8% of adolescents use their smartphones while in bed, 41.4% use them in their bedrooms but not in bed, and 20.4% do not use their smartphones at night. Notably, only 3.3% place their smartphones in a different room at night. These findings are consistent with those of Lemola, et al. (2014), who reported that 57.6% of adolescents sleep with their smartphones turned on in bed, 21.2% keep their smartphones on but outside their beds, and 21.2% turn their smartphones off while sleeping.[15]

Social media applications such as Instagram® and WhatsApp® are the most frequently used at night, with 70.4% of adolescents using them, followed by TikTok® at 63.2%. Other applications, such as YouTube®, are used by 20% of adolescents, while only 0.8% use religious scripture apps at night. Excessive smartphone use is more prevalent among adolescent girls. While boys tend to use smartphones for playing video games or watching videos, girls are more engaged in social media, phone calls, and messaging. Girls also appear more susceptible to excessive use, possibly due a greater tendency to express emotions, stay current with trends, and share personal experiences.[5] Excessive smartphone use significantly affects adolescents' daily functioning. A preference for virtual interactions often diminishes interest in face-to-face social engagement.[3] Additionally, poor self-regulation of smartphone use adversely affects productivity, behavior, and academic performance.

Research indicates that excessive nighttime smartphone use is associated insomnia, reduced sleep duration, increased daytime drowsiness, and disruptions to school-related activities. When sustained over time, this behavior can significantly impair adolescent' academic performance.[5] Adequate sleep is essential for brain development, and sleep disturbances can have long-term consequences for adolescents' health and growth. However, when used responsibly, smartphones can offer notable benefits. They serve as a source of up-to-date information, facilitate the expansion of social networks, and support learning activities. Therefore, addressing excessive smartphone use among adolescents is a critical concern. The adverse effects—such as sleep disturbances and reduced academic achievement—can be mitigated through education and effective time management. At the same time, responsible smartphone use can enhance both social interaction and educational engagement.

The majority of respondents (43.9%) experienced subclinical insomnia, while 34.3% reported no symptoms of insomnia. The average Insomnia Severity Index (ISI) score was 10.09, indicating that most adolescents fell within the subclinical category. These findings are consistent with previous studies. At SMA Negeri 9 Manado, 71.0% of students had mild insomnia and 29.0% had severe insomnia. Similarly, at SMA Negeri 1 Sentolo, Kulon Progo, Yogyakarta, 50.0% of students reported mild insomnia, 29.3% moderate insomnia, and 20.7% severe insomnia.[12] According to the DSM-IV, the lifetime prevalence of insomnia in adolescents is 10.7%, with a current prevalence of 9.4%, and it is more common among females, especially after puberty.[16]

Adolescence is marked by significant changes in sleep patterns driven by shifts in biological rhythms and homeostatic processes. Alterations in the circadian system often delay sleep and wake times, largely due to central nervous system (CNS) reorganization, which regulates sleep and other vital functions.[16] External factors—such as academ-

ic demands, extracurricular activities, and nighttime technology use—further disrupt sleep quality and duration. Early school start times compound these effects, contributing to chronic sleep deprivation.[16] Insomnia is common among adolescents, primarily resulting from circadian rhythm shifts and social pressures. Its consequences can be severe, affecting physical health, brain development, and academic performance.

This study found a significant association between the frequency of nighttime smartphone use and insomnia symptoms in adolescents (r=0.104, p=0.049), suggesting that even low levels of nighttime smartphone use may increase the risk of insomnia. A study at SMA Negeri 3 Gorontalo found a positive correlation between the duration of smartphone use before bedtime and insomnia symptoms, reinforcing the link between extended nighttime smartphone use and sleep disturbances. Similarly, research at SMA Negeri 1 Tibawa demonstrated a significant relationship between smartphone use intensity and sleep quality.[17]

One key factor contributing to these disturbances is exposure to blue light from screens, which suppresses melatonin production, disrupts circadian rhythms, and delays sleep onset.[18] Additionally, mentally stimulating activities such as gaming or social media use can increase emotional arousal and anxiety—particularly due to phenomena like Fear of Missing Out (FOMO)—further impairing sleep.[14] Excessive smartphone use also leads to irregular sleep schedules, prolonged sleep latency, and reduced total sleep time, increasing the risk of chronic insomnia.[16]

A key strength of this study is its examination of variables previously investigated in Mataram City, reinforcing the relevance and contextual validity of its findings. Moreover, the results provide a basis for future research exploring additional factors that may influence the relationship between nighttime smartphone use and insomnia. However, the study has several limitations. It does not account for other potential contributors to insomnia in adolescents, such as smoking, caffeine or drug use, and anxiety-related factors. Additionally, the cross-sectional design limits the ability to establish causal relationships between the variables examined.

Conclusion

This study found a statistically positive correlation, but very weak, between the frequency of nighttime smartphone use and insomnia among adolescents in Mataram City, West Nusa Tenggara. These findings may highlight the need to educate adolescents and parents about the potential risks of excessive smartphone use before bedtime.

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