

The Relationship Between Social Media Use and Sleep Quality Among Adolescents at SMAN 1, Kota Ternate

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Abstract

Social media has become an integral part of adolescents' daily lives, with increasing engagement through digital devices, particularly during nighttime hours, potentially affecting sleep quality. This study aimed to examine the association between social media use and sleep quality among adolescents at Sekolah Menengah Atas Negeri (SMAN) 1 Kota Ternate, Indonesia. A quantitative analytical observational study with a cross-sectional design was conducted involving 289 students selected through proportional cluster sampling. Data were collected using the Social Media Use Scale and the Pittsburgh Sleep Quality Index (PSQI). Descriptive and bivariate analyses were performed using SPSS statistical software, with the chi-square test employed to assess the association between social media use and sleep quality. Of the 289 respondents, 229 (79.2%) demonstrated moderate social media use, 49 (17.0%) demonstrated high social media use, and 11 (3.8%) demonstrated low social media use. Regarding sleep quality, 204 respondents (70.6%) were classified as having poor sleep quality, while 85 (29.4%) were classified as having good sleep quality. The chi-square test revealed a statistically significant association between social media use and sleep quality ($p = 0.022$). These findings indicated that social media use was significantly associated with sleep quality among adolescents at SMAN 1 Kota Ternate. However, the cross-sectional design did not establish a causal relationship between these variables. The results highlighted the importance of promoting responsible social media use, particularly before bedtime, and encouraging healthy sleep practices among adolescents.



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INTRODUCTION

(MacKenzie et al., 2022) Social media has become deeply integrated into adolescents' daily lives, transforming how young people communicate, access information, establish social relationships, and spend their leisure time. Although this development has created substantial opportunities for communication and learning, it has also raised concerns about excessive and poorly regulated social media use, particularly during the evening and before bedtime (Suyatno et al., 2022). Adolescence is a developmental period characterized by significant biological, psychological, and social changes, making adequate sleep essential for cognitive functioning, emotional regulation, physical development, and academic performance (Amir, 2021). At the same time, adolescents are among the most frequent users of digital and social media platforms, creating potential conflicts between online engagement and healthy sleep habits. Consequently,

the association between social media use and adolescent sleep quality has become an increasingly important public health and educational concern rather than merely an issue of technology use (Sennock, 2024) .

(Fathadhika & Afriani, 2018) The magnitude of this issue is reflected in recent global digital statistics. DataReportal's Digital 2026 report, based primarily on data available in late 2025, estimated approximately 5.66 billion active social media user identities worldwide, equivalent to 68.7% of the global population, with individuals aged 16–24 years among the most frequent users of social media platforms. Similarly, Indonesia has experienced substantial growth in digital engagement. The Digital 2026: Indonesia report estimated that approximately 230 million people used the internet in Indonesia, representing 80.5% of the population, while approximately 180 million social media user identities were recorded, equivalent to 62.9% of the national population. These figures demonstrate the widespread integration of social media into everyday life, particularly among younger populations. However, social media user identities do not necessarily represent unique individuals. Nevertheless, the scale of digital engagement underscores the importance of investigating its potential implications for adolescent health behaviors, particularly sleep quality.

Sleep is a fundamental component of adolescent health, as insufficient sleep duration and poor sleep quality may negatively affect attention, learning, memory, emotional regulation, and overall well-being (Siallagan et al., 2023; Pagano et al., 2023) . The American Academy of Sleep Medicine recommends that adolescents aged 13–18 years regularly obtain 8–10 hours of sleep per 24-hour period to support optimal health and daytime functioning. Sleep duration below the recommended range has been associated with difficulties in concentration, learning, and emotional regulation, as well as broader physical and psychological health concerns. Social media engagement may interfere with healthy sleep through several potential mechanisms, including sleep displacement, prolonged interaction with digital content, cognitive and emotional arousal, fear of missing out (FoMO), and exposure to light emitted by electronic screens before bedtime (Suhartati, 2021). Recent literature has also identified bedtime social media engagement, psychological stimulation, delayed sleep onset, and screen-related light exposure as plausible pathways linking digital media use to sleep disturbances among adolescents. However, the relative contribution of these mechanisms may vary according to individual characteristics, patterns of use, and environmental circumstances (Mohammadbeigi, 2016).

Within Indonesia, adolescent exposure to the internet and social media has become increasingly relevant as digital connectivity has expanded across metropolitan areas and regional cities. This development is particularly important in North Maluku Province, including Ternate, where internet access has become an increasingly prominent component of daily activities. Internet penetration in North Maluku reportedly reached 68.6% in 2022, while social media access was identified as a major reason for internet use. Furthermore, 79.51% of internet users in Ternate reportedly accessed the internet for social media activities (APJII, 2022; Maluku Utara Province Welfare Statistics 2022). Among secondary school students, prolonged social media engagement, particularly during nighttime hours, may compete with sleep, academic responsibilities, and other daily activities. Previous studies have associated poor sleep quality with daytime sleepiness, reduced concentration during learning activities, fatigue, and

difficulties maintaining effective participation in school activities (Woran et al., 2021; Siallagan et al., 2023). These regional conditions highlight the relevance of examining whether differences in social media use are associated with variations in sleep quality among adolescents in Ternate (Boniel-Nissim et al., 2023; Doni, 2017; Evers et al., 2020).

Previous international research has provided substantial evidence concerning the association between social media use and adolescent sleep outcomes. Khan et al. (2024) analyzed data from 212,613 adolescents aged 11–15 years across 40 countries and reported that problematic social media use was strongly associated with difficulties initiating sleep among both male and female adolescents. The observed association was stronger for problematic social media use than for intensive use alone, suggesting that behavioral patterns of digital engagement may be as relevant as exposure duration. Similarly, Ahmed et al. (2024) conducted a systematic review and meta-analysis of studies identified through PubMed, Scopus, and PsycINFO. Their review included 182 studies involving more than 1.16 million participants and found that problematic social media use was significantly associated with sleep problems, depression, anxiety, and poorer psychological well-being. Nevertheless, considerable heterogeneity was observed across the included studies, indicating that associations between social media use and health outcomes varied according to population characteristics, exposure definitions, and methodological approaches (Raudsepp, 2019).

Recent evidence has further demonstrated that the relationship between social media engagement and sleep quality is more complex than the assumption that all social media exposure necessarily impairs sleep. Yu et al. (2024), in a scoping review examining social media use, sleep, and mental health among young people, reported that most cross-sectional studies identified associations between social media use and adverse sleep outcomes, including delayed bedtimes, prolonged sleep-onset latency, shorter sleep duration, and poorer sleep quality (Hamilton et al., 2020). However, the authors emphasized that limited longitudinal evidence restricted the ability to determine the direction of these relationships. Experimental research has produced similarly nuanced findings. (Sennock, 2024), for example, examined the effects of 45 minutes of social media exposure before bedtime among adolescents aged 12–14 years and reported no discernible differences in objectively measured sleep quality compared with reading conditions. These findings suggest that the relationship between social media use and sleep outcomes may depend on the timing, duration, content, and behavioral characteristics of digital engagement. Such variations reinforce the importance of conducting population-specific investigations rather than assuming that findings from one geographical or sociocultural context can be generalized to another (Woods & Scott, 2016).

Despite the growing body of evidence, several research gaps remain. First, substantial international evidence has originated from Europe, North America, China, and multinational populations, whereas studies focusing specifically on adolescents in eastern Indonesia remain comparatively limited (Hutagalung et al., 2022). Second, previous investigations have differed considerably in their operational definitions of social media exposure and sleep outcomes, ranging from general screen time and problematic social media use to single-item sleep assessments and validated multidimensional instruments. Third, international reviews have consistently identified methodological heterogeneity, while many studies have relied on cross-sectional designs that limit causal interpretation. Consequently, the research gap addressed in

the present study concerns the extent to which the association between social media use and sleep quality can be identified within the specific educational and sociocultural context of adolescents at Sekolah Menengah Atas Negeri (SMAN) 1 Kota Ternate. By employing structured measures of social media use and sleep quality, the study seeks to provide context-specific evidence that complements existing international findings.

Addressing this research gap is important because poor sleep quality during adolescence may affect physical and psychological health, academic engagement, and students' ability to function effectively throughout the school day. Meanwhile, the continued expansion of digital connectivity makes complete restrictions on adolescents' access to social media neither practical nor necessarily beneficial, given its educational, informational, and social functions. Instead, contextually relevant empirical evidence is needed to inform strategies that encourage healthier digital engagement and sleep behaviors. The novelty of this study lies primarily in its geographical and educational context, as it examines adolescents attending SMAN 1 Kota Ternate, a population that remains relatively underrepresented in the broader literature on social media use and sleep quality. Furthermore, the study combined a structured assessment of social media use with the Pittsburgh Sleep Quality Index (PSQI) to examine the association between these variables among 289 adolescents. This approach provided a regional perspective on an established public health concern while acknowledging the methodological limitations of cross-sectional observational research.

Accordingly, this study aimed to examine the association between social media use and sleep quality among adolescents at SMAN 1 Kota Ternate. Specifically, the study sought to describe respondents' characteristics, classify their levels of social media use, assess their sleep quality using the PSQI, and determine whether a statistically significant association existed between these variables. Through these objectives, the research sought to contribute empirical evidence to the literature on adolescent digital behavior and sleep health while extending the geographical scope of existing investigations to Ternate, North Maluku. The study also aimed to provide a contextual basis for understanding how the association between social media engagement and sleep quality manifested within a specific Indonesian secondary school population. However, because the research employed a cross-sectional design, its findings were intended to identify statistical associations rather than establish causal relationships.

The findings of this study were expected to provide scientific and practical contributions. From a scientific perspective, the research could strengthen the evidence base concerning the association between social media use and adolescent sleep quality and serve as a reference for subsequent investigations involving secondary school students in eastern Indonesia. From a practical perspective, the findings could encourage adolescents to adopt more responsible social media practices and healthier bedtime routines, assist parents in recognizing the importance of managing nighttime digital device use, and support schools in developing educational initiatives addressing digital well-being and sleep hygiene. The results could also provide preliminary information for healthcare professionals and educational stakeholders when designing preventive programs addressing potentially problematic nighttime social media engagement. Ultimately, understanding this association could contribute to the promotion of healthier digital habits while recognizing the legitimate social, educational, and informational benefits that social media provides to adolescents.

METHOD

This study employed a quantitative analytical observational design with a cross-sectional approach to examine the association between social media use and sleep quality among adolescents at Sekolah Menengah Atas Negeri (SMAN) 1 Kota Ternate, Indonesia. The study population comprised students enrolled at the school, from whom 289 respondents were selected using a cluster-based sampling technique with proportional allocation. Social media use and sleep quality were assessed during the same study period to identify potential associations between the two variables.

Data were collected using two structured instruments: the Social Media Use Scale to assess the intensity of social media use and the Pittsburgh Sleep Quality Index (PSQI) to evaluate sleep quality. Both questionnaires were administered to the selected respondents. Completed questionnaires were subsequently reviewed for completeness, coded, and categorized according to respondents' characteristics, levels of social media use, and sleep quality classifications.

Data were processed and analyzed using IBM SPSS Statistics software. Univariate analysis was conducted to describe respondents' characteristics, social media use intensity, and sleep quality through frequency distributions and percentages. Bivariate analysis was performed using Pearson's chi-square test of independence to examine the association between categorical levels of social media use and sleep quality. Statistical significance was determined at a threshold of $p < 0.05$.

RESULTS AND DISCUSSION

Univariate analysis results

Table 1. Characteristics of Respondents Based on Age

Age	N	Percentage (%)
15	66	22.8%
16	109	37.7%
17	94	32.5%
18	19	6.6%
19	1	0.3%
Total	289	100%

Source: Primary data processed by the researchers, 2026.

Based on Table 1, of the 289 respondents studied, 66 (22.8%) were aged 15 years, 109 (37.7%) were aged 16 years, 94 (32.5%) were aged 17 years, 19 (6.6%) were aged 18 years, and only 1 (0.3%) was aged 19 years, which was the smallest age group.

Table 2. Characteristics of Respondents Based on Gender

Gender	N	Percentage (%)
Male	142	49.1%
Female	147	50.9%
Total	289	100%

Source: Primary data processed by the researchers, 2026.

Based on Table 2, of the 289 respondents studied, 147 (50.9%) were female, slightly outnumbering the 142 (49.1%) male respondents.

Table 3. Characteristics of Respondents Based on Offline Game Use

Offline Game Use	N	Percentage (%)
Plays offline games	216	74.7%
Does not play offline games	73	25.3%
Total	289	100%

Source: Primary data processed by the researchers, 2026.

Based on Table 3, 216 (74.7%) of the 289 respondents played offline games, whereas 73 (25.3%) did not.

Table 4. Characteristics of Respondents Based on Social Media Use

Social Media Use	N	Percentage (%)
Light User	11	3.8%
Medium User	229	79.2%
Heavy User	49	17.0%
Total	289	100%

Source: Primary data processed by the researchers, 2026.

Based on Table 4, of the 289 respondents studied, 229 (79.2%) used social media with moderate intensity, which was the largest group, followed by 49 (17.0%) respondents with heavy intensity and 11 (3.8%) respondents with light intensity.

Table 5. Characteristics of Respondents Based on Sleep Quality

Sleep Quality	N	Percentage (%)
Good	85	29.4%
Poor	204	70.6%
Total	289	100%

Source: Primary data processed by the researchers, 2026.

Based on Table 5, of the 289 respondents studied, 204 (70.6%) had poor sleep quality, which was the largest group, compared with 85 (29.4%) respondents who had good sleep quality.

Bivariate analysis results

Table 6. Bivariate Analysis of Social Media Use and Sleep Quality

			Sleep Quality				Total	<i>p-value</i>
			Good		Poor			
			N	%	N	%	N	
Social Media	Light User	Medium User	6	54.5	5	45.5	11	100
	Heavy User		71	31.0	158	69.0	229	100
							0.022	

	8	16.3	41	83.7	49	100
Total	85	29.4	204	70.6	289	100

Source: Primary data processed by the researchers, 2026.

The results of the bivariate analysis obtained by applying the chi square test, obtained a p-value = 0.022, where the p-value used was 0.05, this proves that the p-value of $0.022 < 0.05$, so that the results state that there is a significant relationship between the use of social media and sleep quality, which means H1 is accepted and H0 is rejected.

Characteristic of respondent based on age

The findings of the study obtained from 289, the age of teenagers who access social media the most are those aged 16 years totaling 109 (37.7%) respondents, followed by teenagers aged 17 years totaling 94 (32.5%) respondents, then teenagers aged 15 years totaling 66 (22.8%) respondents, and the age of teenagers who access social media the least are those aged 19 years totaling 1 (0.3%) respondents and 18 years totaling 19 (6.6%) respondents, if seen from the results of the study obtained from 289 respondents at SMA Negeri 1 Kota Ternate, the age that dominates the most in this study, namely teenagers aged 16 years, this is because teenagers aged 16 years are the most numerous age in grades XI and XII at SMA Negeri 1 Kota Ternate.

This study is in line with the results of a study conducted at SMA N 8 Semarang on 291 samples, it was found that the age of teenagers who accessed social media the most were teenagers aged 16 years as many as 98 respondents (33.7%), teenagers aged 17 years as many as 79 respondents (27.1%), and teenagers aged 15 years as many as 73 respondents (25.1%), and teenagers aged 18 years as many as 41 respondents (14.1%). The results of this study are also in line with a study conducted on all 11th grade students at SMK Bhinneka Karya Simo, out of 34 respondents, the age group that accessed social media the most was teenagers aged 16 years as many as 28 respondents (82.4%) (Suyatno et al., 2022); Yuhana, Mariyati and Sugiyanto, 2023).

Teenagers aged 16 years are in the final stage of adolescence, in this final stage, teenagers are in a period of consolidation towards adulthood which gives rise to the achievement of increasingly solid interests in intellectual functions and a sense of seeking opportunities to unite with others in new experiences. The characteristics of teenagers at that age usually have a desire to socialize and establish friendships with others, so that the need for socialization can be met today, with the presence of technological developments in the field of telecommunications such as social media that can make it easier for teenagers to socialize with others. Teenagers are burdened with school assignments and in order to make it easier to do these assignments, teenagers can use social media as a place to support intellectual (Syamsoedin, Bidjuni and Wowiling, 2015).

Characteristic of respondent based on Gender

The findings of the study obtained from 289 respondents, the use of social media was most often found in women, as many as 147 (50.9%) respondents compared to men, namely 142 (49.1%) respondents, it can be seen that women are more dominant in this study, this is also because the number of female students at SMA Negeri 1 Kota Ternate is greater than the number of male students.

The findings of this study are in line with a study of adolescents in class XI Mathematics and Natural Sciences (MIA) at SMA Negeri 1 Langowan, which found that among 80 samples, most social media users were female, totaling 53 students (66.25%). These results are also consistent with a study of 62 students in class XI MIA at SMA Negeri 9 Manado, in which 34 (54.8%) of the adolescents who accessed social media were female (Syamsoedin, Bidjuni and Wowiling, 2015; Woran, Kundre and Pondaag, 2021).

Adolescent girls use social media more often than adolescent boys because they have a greater need to share and tell stories with others. Girls in their teens also tend to get to know the people around them more closely. According to Rahmawati et al. (2019), as cited in Suyatno, Hakim and Purwaningsih (2022), there are more social media users among women than among men because men generally use social media mainly for business and personal purposes, whereas women are more dominant in social interaction on social media, using these platforms to build relationships, improve their appearance, and handle personal or business matters (Syamsoedin, Bidjuni and Wowiling, 2015; Woran, Kundre and Pondaag, 2021; Suyatno, Hakim and Purwaningsih, 2022).

Characteristic of respondent based on Social Media

The results showed that most respondents used social media with moderate intensity, namely 229 (79.2%) respondents, followed by heavy intensity in 49 (17.0%) respondents and light intensity in 11 (3.8%) respondents.

This finding is consistent with a study of 62 students in class XI MIA at SMA Negeri 9 Manado, which found that the largest group of respondents used social media for a moderate duration (3–4 hours), namely 31 students (50.0%). A study of 105 samples at Universitas Kristen Satya Wacana likewise showed that 61 respondents accessed social media with moderate intensity. According to Syamsoedin, Bidjuni and Wowiling (2015), adolescents use social media for a moderate duration because they must balance their time between social media use, academic activities at school, socializing and getting to know other people, and completing educational tasks (Syamsoedin, Bidjuni and Wowiling, 2015; Nahdia Falca and Kristianingsih, 2023).

The results of this study show that adolescents mostly used social media at a moderate intensity. In the researchers' view, this is because adolescents have to divide their time between studying, engaging in real-life social activities, and using social media. In addition, most adolescents at SMA Negeri 1 Kota Ternate also played offline games, namely 216 (74.7%) respondents. The adolescents who played offline games were also social media users, so besides using social media, they also spent part of their time on offline games. These factors may explain why adolescents at SMA Negeri 1 Kota Ternate accessed social media with moderate intensity.

Characteristic of respondent based on sleep quality

The results showed that 204 (70.6%) respondents had poor sleep quality, compared with 85 (29.4%) respondents who had good sleep quality. This result is consistent with a study of grade XII students at SMK Negeri 2 Binjai, which found that of 79 respondents, 48 (60.8%) had poor sleep quality and 31 (39.2%) had good sleep quality. It is also in line with a study of adolescents in class XI MIA at SMA Negeri 1 Langowan, which found that of 80 respondents, 58 students (72.5%) had poor sleep quality and 22 students (27.5%) had good sleep quality (Woran, Kundre and Pondaag, 2021; Siallagan, Ginting and Margaret, 2023).

The researchers found several reasons why adolescents had difficulty sleeping, including accessing social media, listening to music, overthinking about the future, and studying or completing assignments. This is in line with the study by Ainida et al. (2020) among adolescents at Madrasah Aliyah Negeri 4 Banjar, which reported that adolescents have a pre-sleep routine consisting of one or more activities, depending on the individual. Such activities commonly include listening to music, using the internet, watching television, reading books, using a laptop, playing games, chatting with friends via mobile phone, doing assignments, and studying. Similarly, Woran et al. (2021), in a study of adolescents at SMA Negeri 1 Langowan, reported that poor sleep quality among adolescents may be caused by frequently doing assignments at night, chatting with friends, browsing, downloading, engaging in hobby-related activities, and streaming films and vlogs as nighttime entertainment (Ainida, Dhian Ririn Lestari and Rizany, 2020; Woran, Kundre and Pondaag, 2021).

Relationship between Social Media Use and Sleep Quality

The chi-square test yielded a p-value of 0.022, indicating a significant relationship between social media use and sleep quality among adolescents at SMA Negeri 1 Kota Ternate.

This finding is consistent with the study by Woods and Scott (2016) of 476 adolescents aged 11–17 years in Scotland, which found a significant relationship between social media use and sleep quality, with higher levels of social media use associated with poorer sleep quality. It is also in line with the study by Ainida et al. (2020) of 209 adolescents attending Madrasah Aliyah Negeri 4 Banjar, which found a significant relationship between social media use and sleep quality among adolescents (Woods and Scott, 2016; Ainida, Dhian Ririn Lestari and Rizany, 2020).

Various factors can affect a person's sleep, one of which is lifestyle. The lifestyle of today's adolescents, which is inseparable from smartphones, can lead them to use social media at any time, and this can disrupt their sleep patterns when they use social media late into the night (Woran, Kundre and Pondaag, 2021).

According to Aynaci, Gulden and Kubra (2018), several factors underlie the relationship between sleep quality and social media use. First, social media users may use their devices before going to bed but fail to stop using them, resulting in shorter sleep duration; this is driven by worry about losing social contact when not connected to social media. One factor that can make adolescents addicted to social media is fear of missing out (FoMO). The term FoMO was first introduced in 2013 in a study by Przybylski, Murayama, DeHaan, and Gladwell, who defined it as the worry a person feels that others are having rewarding experiences from which they are absent. A person experiencing FoMO wants to know everything that is happening around them, which encourages them to keep using social media without time limits and may lead to social media addiction. Social media users often continue using it late into the night and,

without realizing it, postpone their sleep, resulting in sleep deprivation. A study by (Ainida et al., 2020) among adolescents at Madrasah Aliyah Negeri 4 Banjar reported that one of the disturbed components of adolescent sleep quality was sleep latency. Sleep latency is the time from going to bed until falling asleep, and sleep is considered to be of good quality when sleep latency is ≤ 15 minutes; in that study, most respondents stated in the questionnaire that social media delayed their bedtime (Aynaci et al., 2018; Fathadhika & Afriani, 2018; Ainida et al., 2020; Suhartati, 2021).

The second explanation proposed by Aynaci, Gulden and Kubra (2018) is that social media use can increase emotional, cognitive, and physiological arousal. The third explanation is that the bright light emitted by the devices used to access social media can delay the circadian rhythm (Aynaci et al., 2018; Suhartati, 2021).

Light emitted by mobile phones can reduce the production of melatonin, which is involved in regulating and maintaining the circadian rhythm that determines when a person sleeps and wakes up. Melatonin is produced by the pineal gland and helps people fall asleep and restore their energy while sleeping. Bright light suppresses melatonin production, whereas darkness and quiet stimulate it. Melatonin production depends on the amount of light received by the eyes: when a lot of light enters, melatonin formation is inhibited, whereas in dark conditions melatonin production increases rapidly and induces sleepiness. Excessive social media use and the habit of using a mobile phone before bedtime can prolong the time spent on social media, thereby disrupting the regulation of melatonin and leading to fewer hours of sleep and lower sleep quality (Suhartati et al., 2021; Masdalia et al., 2023).

Sleep quality refers to a person's ability to stay asleep and obtain good-quality sleep, that is, sleeping peacefully, feeling refreshed upon waking in the morning, and having the energy to carry out activities. Sleep quality can also affect overall health and quality of life. For adolescents who are still in school, poor sleep quality may cause them to feel sleepy during lessons, arrive late to class, have difficulty concentrating, be reluctant to talk, and feel tired in the morning, which can hinder the quality of learning. In this study, most respondents had poor sleep quality: among respondents with moderate social media use, 158 (69.0%) had poor sleep quality, and among those with heavy social media use, 41 (83.7%) had poor sleep quality. These data show that the higher the intensity of social media use, the higher the proportion of respondents with poor sleep quality. Adolescents' inability to manage their social media use appropriately at school or at home can lead to irregular rest patterns that worsen sleep quality (Woran et al., 2021; Masdalia et al., 2023).

CONCLUSION

The findings revealed a statistically significant association between social media use and sleep quality among adolescents at Sekolah Menengah Atas Negeri (SMAN) 1 Kota Ternate ($p = 0.022$). Most respondents demonstrated moderate levels of social media use (79.2%), while a substantial proportion experienced poor sleep quality (70.6%). These results indicated an association between social media use intensity and sleep quality, although the cross-sectional study design did not establish causality or determine the direction of this relationship. Potential mechanisms included delayed sleep onset associated with nighttime screen exposure, increased cognitive and emotional arousal, and exposure to short-wavelength

light emitted by digital devices, which may suppress melatonin secretion and disrupt circadian rhythms. The demographic findings showed that 16-year-old adolescents represented the largest age group, while female respondents reported more frequent social media engagement than their male counterparts. Psychological factors, particularly fear of missing out (FoMO), may also contribute to prolonged social media use during nighttime hours. Furthermore, excessive social media engagement before bedtime may be associated with adverse daytime outcomes, including fatigue, daytime sleepiness, and reduced concentration during classroom activities. However, these potential mechanisms and consequences were not directly evaluated in the present study. Future research should employ longitudinal or experimental designs to clarify the temporal relationship between social media use and sleep quality and investigate the underlying behavioral and physiological mechanisms. Meanwhile, promoting responsible social media use, particularly before bedtime, and encouraging consistent sleep hygiene practices may help support healthier sleep patterns and adolescents' academic well-being.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest—whether personal, commercial, or financial—that could influence the objectivity of this research.

AUTHOR CONTRIBUTIONS

All authors contributed equally to the entire research process, including conceptualization, data collection and analysis, as well as the writing and editing of the final manuscript.

DECLARATION OF GENERATIVE AI USAGE

During the preparation of this manuscript, the authors used Artificial Intelligence (AI) strictly for grammar checking and language editing purposes. AI was not utilized in the data collection process, substantive analysis, or the formulation of research conclusions.

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