

Modeling the Use of Social Networks and Sleep Disturbance with the Mediating Role of Internet Addiction in Adolescents

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Article Info

Article type:

Original Research

How to cite this article:

Abdollahzadeh, A., Mousavikia, S., Asadi, F. (2024). Modeling the Use of Social Networks and Sleep Disturbance with the Mediating Role of Internet Addiction in Adolescents. *Iranian Journal of Neurodevelopmental Disorders*, 3(1), 165-173.

<https://doi.org/10.61838/kman.jndd.3.1.18>



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ABSTRACT

Purpose: This study aimed to examine the mediating role of internet addiction in the relationship between social network usage and sleep disturbance among adolescents.

Methods and Materials: A descriptive correlational design was used with a sample of 410 adolescents from Tehran, selected based on the Morgan and Krejcie table through stratified random sampling. Standardized instruments were used to measure Social Network Usage (SMUIS), Internet Addiction (IAT), and Sleep Disturbance (PSQI). Data were analyzed using SPSS-27 for descriptive and correlational statistics and AMOS-21 for Structural Equation Modeling (SEM). Pearson correlation coefficients assessed relationships between variables, and SEM tested the mediation model with fit indices evaluated using established thresholds.

Findings: Results showed that Social Network Usage was significantly correlated with both Internet Addiction ($r = .59, p < .001$) and Sleep Disturbance ($r = .47, p < .001$). Internet Addiction also showed a strong positive correlation with Sleep Disturbance ($r = .62, p < .001$). The SEM analysis revealed good model fit ($\chi^2/df = 1.96$, GFI = 0.94, CFI = 0.96, RMSEA = 0.048). Social Network Usage had a significant direct effect on Sleep Disturbance ($\beta = .21, p < .001$) and an indirect effect through Internet Addiction ($\beta = .32, p < .001$), confirming a partial mediation. The total effect of Social Network Usage on Sleep Disturbance was substantial ($\beta = .53, p < .001$).

Conclusion: Internet addiction plays a significant mediating role in the relationship between social network usage and sleep disturbance among adolescents. Interventions targeting healthy digital habits may be critical for improving sleep quality and reducing internet dependency in youth populations.

Keywords: Social network usage; Internet addiction; Sleep disturbance; Adolescents.

1. Introduction

Sleep plays a foundational role in maintaining adolescents' cognitive, emotional, and physical development, yet increasing evidence suggests that sleep disturbances are alarmingly prevalent among youth in contemporary digital societies. Adolescents, in particular, are vulnerable to a range of sleep problems, including delayed sleep onset, reduced sleep duration, and poor sleep quality, often driven by psychosocial and environmental stressors (Li et al., 2025; Liu et al., 2025). This vulnerability is compounded by the growing pervasiveness of digital technologies, especially social networks, which are reshaping behavioral and neural patterns of rest and stimulation. As digital engagement becomes an indispensable part of adolescents' identity formation and peer interactions, the relationship between social network use and sleep health warrants close scientific scrutiny.

The intersection of social media use and sleep disturbance has garnered increasing attention due to its implications for mental health, cognitive performance, and emotional regulation. Digital devices and online platforms, although enabling global connectivity and social affirmation, have also introduced constant exposure to light-emitting screens, over-engagement with peer feedback, and delayed disengagement from virtual environments (Pang et al., 2024; Seah et al., 2025). These factors are associated with heightened physiological arousal, circadian misalignment, and disrupted melatonin secretion, all of which contribute to poor sleep outcomes. Moreover, excessive use of social networks may predispose adolescents to psychological constructs such as FoMO (fear of missing out) and compulsive checking, further eroding bedtime routines and increasing vulnerability to insomnia (Luo & Hu, 2022; Yang et al., 2022). Adolescents are particularly susceptible to these phenomena due to their developmental sensitivity to social validation and peer feedback.

There is also mounting evidence that internet addiction—a behavioral addiction characterized by excessive or poorly controlled preoccupations, urges, or behaviors regarding computer use and internet access—plays a mediating role in the association between social network usage and sleep disturbance (Çakar & Erdemir, 2023; Sharma et al., 2024). Internet addiction disrupts emotional regulation, increases cognitive hyperarousal, and is closely linked to delayed sleep phase and sleep fragmentation. Adolescents with problematic internet use often report significantly poorer sleep quality and exhibit higher levels of depression,

irritability, and daytime dysfunction compared to their peers (Giorgio et al., 2024; Mohammadi et al., 2022). This connection is not only physiological but also psychological, as internet dependency fuels cognitive distortions, excessive rumination, and the erosion of offline coping strategies, further diminishing rest quality and contributing to sleep disorders.

The biopsychosocial consequences of disrupted sleep are multifaceted and extend into academic, interpersonal, and neurological domains. From a neurological standpoint, functional connectome studies have highlighted that adolescents with chronic sleep disturbances exhibit aberrant connectivity in the default mode network, limbic regions, and prefrontal areas, impairing memory consolidation and executive functioning (Huang et al., 2024; Kim et al., 2023; Yang et al., 2021). Such dysregulations mirror those observed in affective disorders and behavioral addictions, further reinforcing the intertwined nature of sleep disruption and psychological distress. In parallel, social neuroscience research indicates that insufficient sleep reduces adolescents' sensitivity to social rewards, increases emotional reactivity, and weakens prosocial behaviors, thereby intensifying their reliance on online interactions to fill emotional voids (Chen, 2024; Seah et al., 2025).

The sociocultural landscape of adolescent life also amplifies the risk factors contributing to poor sleep quality. As youths increasingly experience social pressures mediated by online personas, their self-worth becomes tied to virtual engagement metrics such as likes, comments, and follower counts (Batool et al., 2025; Zhang et al., 2023). This dependence on external validation contributes to elevated social comparison, anxiety, and depressive symptoms, which are independently associated with sleep disruptions. For instance, adolescents with high social interaction anxiety report shorter sleep duration and lower sleep efficiency, with body image concerns acting as a critical mediating factor (Batool et al., 2025). Similarly, research indicates that loneliness, social exclusion, and perceived social loss are all predictors of poor sleep outcomes in both adolescent and older adult populations, signifying a universal biopsychosocial mechanism linking social dysfunction to sleep deterioration (Düken et al., 2024; Ekström et al., 2024; Li et al., 2025).

Emerging findings have also underscored the contextual differences and demographic moderators that shape these associations. Factors such as age, gender, cultural context, and socioeconomic status can influence the intensity and manifestation of internet use behaviors and their subsequent

impact on sleep health (Jiang & Yu, 2025; Pang et al., 2023). For instance, while both male and female adolescents are vulnerable to internet addiction, males are more likely to engage in online gaming, whereas females may lean toward compulsive social media engagement—each contributing uniquely to sleep disruption pathways. Furthermore, the neuropsychiatric symptomatology associated with sleep problems appears to vary across settings; for example, residents in institutional care or those exposed to early life stressors demonstrate higher incidences of sleep dysregulation and depressive symptom clusters (Lin et al., 2024; Matsuda & Kikutani, 2024).

Notably, in recent years, multiple studies have attempted to model the complex pathways connecting social behavior, digital dependency, and sleep dysfunction through advanced statistical frameworks such as structural equation modeling (SEM). These models enable researchers to uncover both direct and indirect effects, especially the mediating influence of internet addiction between social media use and sleep parameters (Liu et al., 2025; Mitchell & Nugiel, 2024). For example, structural pathways have demonstrated that internet addiction may account for a significant proportion of variance in the relationship between screen time and sleep onset latency, suggesting that digital compulsivity, rather than duration alone, drives negative outcomes.

Despite this growing body of research, there remains a relative paucity of empirical studies focusing on adolescents in Middle Eastern contexts, particularly in Iran, where cultural expectations, family dynamics, and educational pressures uniquely interact with technological behaviors. Studies in similar sociocultural settings suggest that digital platforms are not only a source of social engagement but also a coping mechanism for adolescents facing academic stress and familial rigidity, making the relationship with sleep more complex and culturally embedded (Luo & Hu, 2022; Sarlak et al., 2023). Moreover, the vast majority of sleep research in adolescent populations has focused on Western samples, thereby limiting the generalizability of global models to non-Western youth populations who navigate different socio-emotional landscapes.

Given these gaps, the present study seeks to contribute to the growing literature by exploring the direct and indirect relationships among social network usage, internet addiction, and sleep disturbance among adolescents in Tehran.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a descriptive correlational research design to investigate the relationships between social network usage, internet addiction, and sleep disturbance among adolescents. The statistical population consisted of high school students in Tehran. Based on the Krejcie and Morgan (1970) table for determining sample size, a total of 410 participants were selected through stratified random sampling to ensure representative distribution across school districts and gender. The inclusion criteria involved being between the ages of 14 and 18, having active social media accounts, and willingness to participate voluntarily. Exclusion criteria included diagnosed psychiatric disorders or neurological sleep disorders, based on self-report. The study was conducted in accordance with ethical standards and approved by the relevant institutional ethics committee.

2.2. Measures

2.2.1. Sleep Disturbance

To assess sleep disturbance as the dependent variable, the Pittsburgh Sleep Quality Index (PSQI) developed by Buysse, Reynolds, Monk, Berman, and Kupfer (1989) was employed. The PSQI is a widely used standardized tool consisting of 19 self-rated items grouped into seven subscales: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Each subscale score ranges from 0 to 3, yielding a global score between 0 and 21, with higher scores indicating poorer sleep quality. A total score greater than 5 generally indicates clinically significant sleep disturbance. Numerous studies have confirmed the validity and reliability of the PSQI across adolescent populations and various cultural contexts, with Cronbach's alpha coefficients typically reported above 0.70.

2.2.2. Social Networks Usage

To measure the extent of social networks usage, the study utilized the Social Media Use Integration Scale (SMUIS) developed by Jenkins-Guarnieri, Wright, and Johnson (2013). This instrument contains 10 items and is designed to assess the cognitive and behavioral integration of social media into daily life. The scale includes two main subscales: Emotional Connection to Social Media and Social Integration and Emotional Connection. Each item is rated on a 6-point Likert scale ranging from "strongly disagree" to

"strongly agree," with higher scores reflecting deeper psychological involvement and more frequent usage of social networks. The SMUIS has demonstrated strong internal consistency (Cronbach's $\alpha > 0.80$) and construct validity in adolescent samples, making it suitable for use in psychological and behavioral studies involving social media engagement.

2.2.3. Internet Addiction

To evaluate internet addiction as the mediating variable, the study applied the Internet Addiction Test (IAT) developed by Young (1998). This 20-item scale assesses the degree of problematic internet use across dimensions such as compulsivity, escapism, and functional impairment. Items are rated on a 5-point Likert scale ranging from "rarely" (1) to "always" (5), producing a total score between 20 and 100. Scores are categorized into normal (20–49), mild (50–79), and severe (80–100) levels of internet addiction. The IAT has been extensively validated and is one of the most frequently used instruments for assessing internet addiction in adolescents. It has shown high internal consistency (Cronbach's α above 0.85) and satisfactory test-retest reliability in numerous cross-cultural studies.

Table 1

Means and Standard Deviations of Study Variables (N = 410)

Variable	Mean (M)	Standard Deviation (SD)
Social Network Usage	31.47	5.82
Internet Addiction	56.13	10.29
Sleep Disturbance	9.64	3.41

As shown in Table 1, participants reported a moderate to high level of social network engagement ($M = 31.47$, $SD = 5.82$). The average Internet Addiction score ($M = 56.13$, $SD = 10.29$) fell in the mild dependency range. Sleep

2.3. Data Analysis

Data were analyzed using SPSS version 27 and AMOS version 21. First, descriptive statistics including means, standard deviations, frequencies, and percentages were calculated to summarize participant characteristics. Pearson correlation coefficients were then computed to examine bivariate relationships between sleep disturbance and each of the independent variables (social network usage and internet addiction). Finally, Structural Equation Modeling (SEM) was applied using AMOS-21 to test the proposed mediation model, evaluating both direct and indirect effects. Model fit indices such as Chi-square, CFI, GFI, RMSEA, and TLI were used to assess the adequacy of the model.

3. Findings and Results

Of the 410 participants, 219 individuals (53.41%) were female and 191 (46.59%) were male. In terms of age, 102 students (24.88%) were aged 14, 111 (27.07%) were 15, 98 (23.90%) were 16, 54 (13.17%) were 17, and 45 (10.98%) were 18 years old. Regarding grade level, 137 participants (33.41%) were in the 9th grade, 136 (33.17%) in 10th grade, and 137 (33.41%) in 11th grade. These proportions ensured adequate representation across the adolescent age spectrum and educational stages.

Disturbance had a mean of 9.64 ($SD = 3.41$), indicating poor sleep quality among the majority of adolescents based on PSQI thresholds.

Table 2

Pearson Correlations Among Study Variables

Variable	1	2	3
1. Social Network Usage	—		
2. Internet Addiction	.59** ($p < .001$)	—	
3. Sleep Disturbance	.47** ($p < .001$)	.62** ($p < .001$)	—

Social Network Usage was significantly positively correlated with Internet Addiction ($r = .59$, $p < .001$) and Sleep Disturbance ($r = .47$, $p < .001$). Furthermore, Internet

Addiction showed a strong positive correlation with Sleep Disturbance ($r = .62$, $p < .001$), suggesting that greater

compulsive internet use is associated with poorer sleep outcomes (Table 2).

Prior to conducting the main analyses, assumptions for Pearson correlation and SEM were tested and confirmed. Normality was assessed using skewness and kurtosis coefficients, which for all variables ranged between -0.97 and 1.21, falling within the acceptable range of ± 2 . Linearity and homoscedasticity were visually inspected through scatterplots and found to be satisfactory. Multicollinearity

was evaluated using the Variance Inflation Factor (VIF), with all VIF values below 2.60, indicating acceptable independence among predictors. Additionally, Mahalanobis distance was used to identify multivariate outliers, and no significant outliers were detected beyond the critical chi-square value for $p < .001$ and $df = 3$ ($\chi^2 = 16.27$). Thus, the dataset met all required statistical assumptions for subsequent analyses.

Table 3

Fit Indices of the Structural Equation Model

Fit Index	Value	Recommended Threshold
χ^2	164.28	—
df	84	—
χ^2/df	1.96	< 3
GFI	0.94	≥ 0.90
AGFI	0.91	≥ 0.90
CFI	0.96	≥ 0.95
RMSEA	0.048	≤ 0.06
TLI	0.95	≥ 0.95

The model demonstrated excellent fit with the data: $\chi^2/df = 1.96$, GFI = 0.94, AGFI = 0.91, CFI = 0.96, TLI = 0.95, and RMSEA = 0.048. All indices fall within or exceed the

recommended thresholds, indicating that the hypothesized model reliably represents the observed data (Table 3).

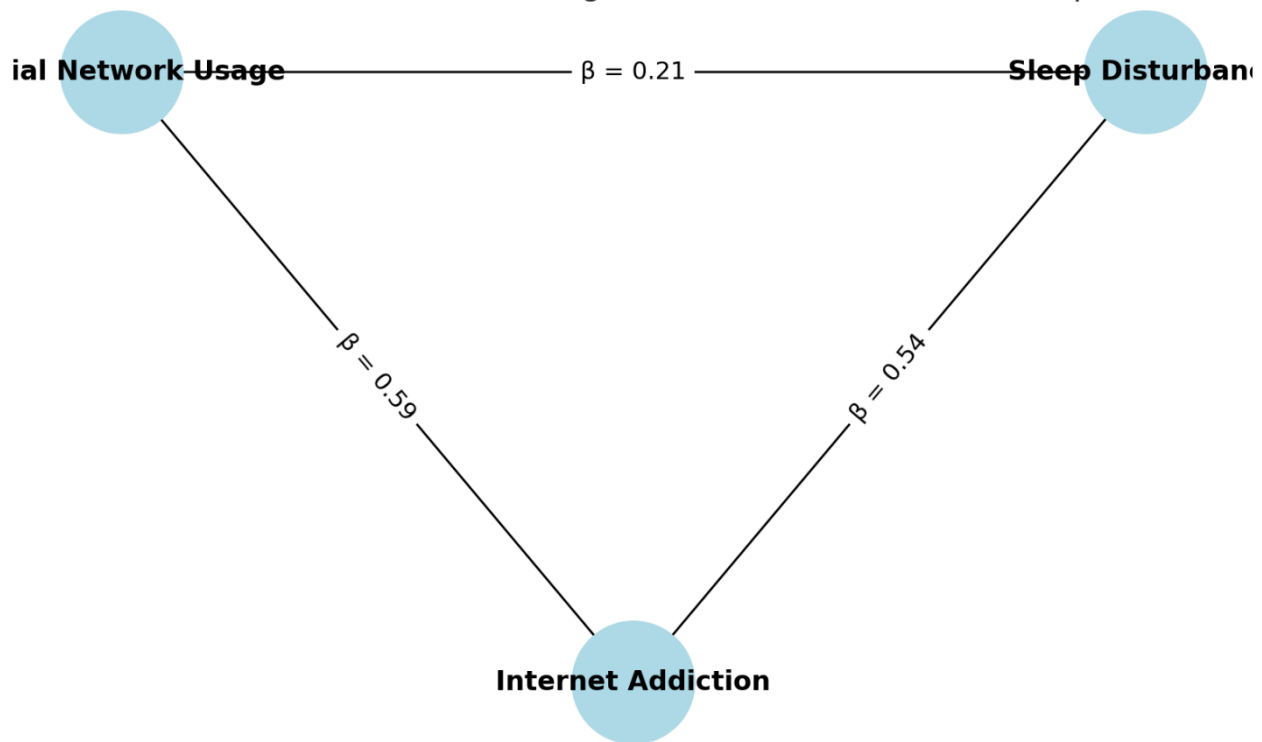
Table 4

Direct, Indirect, and Total Effects Between Variables in the Structural Model

Path	b	S.E	β	p
Social Network $\rightarrow$ Internet Addiction	0.71	0.06	.59	$< .001$
Internet Addiction $\rightarrow$ Sleep Disturbance	0.13	0.01	.54	$< .001$
Social Network $\rightarrow$ Sleep Disturbance (direct)	0.09	0.02	.21	$< .001$
Social Network $\rightarrow$ Sleep Disturbance (indirect via IA)	0.09	0.01	.32	$< .001$
Social Network $\rightarrow$ Sleep Disturbance (total effect)	0.18	0.02	.53	$< .001$

All path coefficients were statistically significant ($p < .001$). Social Network Usage had a direct effect on Internet Addiction ($\beta = .59$), which in turn significantly predicted Sleep Disturbance ($\beta = .54$). The direct path from Social Network Usage to Sleep Disturbance ($\beta = .21$) was also

significant, but smaller than the total effect ($\beta = .53$), highlighting the partial mediating role of Internet Addiction. The indirect effect ($\beta = .32$) was substantial, confirming that internet dependency is a key mechanism through which social media usage impacts sleep quality (Table 4).

Figure 1*Model with Beta Coefficients*

4. Discussion and Conclusion

The present study aimed to examine the direct and indirect relationships between social network usage, internet addiction, and sleep disturbance among adolescents in Tehran. Using Structural Equation Modeling (SEM), the results confirmed the hypothesized mediation model: social network usage was positively associated with sleep disturbance, and this relationship was significantly mediated by internet addiction. In other words, adolescents who reported higher levels of engagement with social media platforms were more likely to experience greater levels of internet addiction, which in turn predicted increased sleep disturbance. Pearson correlation analyses also demonstrated significant positive correlations between social network usage and sleep disturbance, as well as between internet addiction and sleep disturbance.

These findings are consistent with a growing body of research that suggests digital behavior patterns significantly impact adolescents' sleep health. The observed direct effect of social network usage on sleep disturbance aligns with the notion that prolonged engagement with social platforms interferes with circadian rhythms and bedtime routines, often due to late-night screen exposure and psychological arousal

triggered by social feedback loops (Pang et al., 2024; Seah et al., 2025). Adolescents may stay awake scrolling through feeds, checking notifications, or engaging in online interactions, which delays sleep onset and shortens total sleep time. Additionally, light emitted from screens is known to suppress melatonin production, a physiological mechanism well-documented in sleep science.

The mediating role of internet addiction in this relationship further reinforces the pathological nature of compulsive digital engagement. Internet addiction encompasses behavioral components such as impaired control, withdrawal symptoms, and functional impairment, all of which can significantly disrupt sleep architecture and quality (Çakar & Erdemir, 2023; Sharma et al., 2024). In this study, adolescents with higher social network usage were more likely to report symptoms associated with internet addiction, such as compulsive checking, emotional dependence, and inability to limit use, which in turn predicted higher levels of sleep disturbance. These findings are in line with previous studies highlighting internet addiction as a crucial mediator in the link between technology use and adverse psychological outcomes,

including poor sleep (Mohammadi et al., 2022; Zhang et al., 2023).

Furthermore, the current findings echo neurological studies that associate problematic internet use and sleep disruption with changes in brain network functioning. For instance, disrupted connectivity in the default mode network and alterations in resting-state brain activity have been documented among individuals with poor sleep quality and heavy internet use, especially in adolescent populations (Huang et al., 2024; Kim et al., 2023; Yang et al., 2021). These neurobiological insights complement our behavioral findings by suggesting that digital overuse does not only interfere with behavioral sleep patterns but may also alter neurological substrates involved in rest, cognitive regulation, and emotional processing.

Social and psychological vulnerabilities also interact with the observed patterns. Adolescents who are more socially isolated or anxious often use digital platforms as a form of emotional compensation, thereby increasing the likelihood of developing internet addiction and subsequent sleep problems. Research has shown that social anxiety, when paired with low body image satisfaction, contributes to sleep disturbances, with online environments intensifying both comparisons and internal stress (Batoool et al., 2025; Luo & Hu, 2022). This dual pressure of internal insecurity and external digital overexposure might explain why adolescents in this study with higher internet addiction scores also reported significantly higher sleep disturbance levels.

The findings also resonate with studies examining the role of loneliness, social exclusion, and emotional disconnection in sleep disruption. Previous research has shown that individuals experiencing social marginalization, such as older adults or refugees, demonstrate heightened vulnerability to sleep-related issues, with emotional regulation and resilience acting as mediating factors (Düken et al., 2024; Ekström et al., 2024; Giorgio et al., 2024). In a similar vein, adolescents in this study may experience a disconnect between online popularity and real-world support, leading to increased emotional fatigue and sleep disturbance. The immersive nature of social media may create an illusion of connectedness while deepening underlying feelings of loneliness and sleep-inhibiting stress.

Another key contribution of this study is its cultural specificity. Conducted in Tehran, this research offers insights into adolescent behavior within a sociocultural context often underrepresented in global sleep studies. Cultural norms around family discipline, academic achievement, and community belonging may intensify the

psychological pressures experienced by adolescents, thereby increasing their reliance on social media as a form of escapism or self-expression. Consistent with this, studies from culturally similar contexts suggest that adolescents often use online spaces to navigate conflicting societal expectations, which, although psychologically relieving in the short term, can lead to long-term behavioral dysregulation and sleep problems (Pang et al., 2023; Sarlak et al., 2023).

Importantly, this study also adds to the methodological discourse on adolescent sleep research by applying SEM to disentangle the direct and indirect pathways. The fit indices confirmed the adequacy of the hypothesized model, supporting the idea that internet addiction functions as a psychological bridge linking social network behavior to sleep dysfunction. This echoes previous studies employing SEM frameworks that uncovered similar mediation effects in populations such as firefighters, migrant elderly, and students (Li et al., 2025; Liu et al., 2025; Mitchell & Nugiel, 2024). Such analytical rigor not only strengthens the validity of the findings but also offers a template for future investigations across different age groups and cultural contexts.

Moreover, our findings bear practical relevance for intervention development. Adolescents with higher exposure to online content, particularly during nighttime hours, may benefit from psychoeducational programs emphasizing digital hygiene, time management, and self-regulation. Sleep-focused interventions that incorporate behavioral therapy alongside digital literacy may be particularly effective in breaking the cycle of late-night social media use and poor sleep outcomes. Furthermore, school-based wellness initiatives could be designed to include internet use assessments as part of broader mental health screening procedures.

In summary, this study confirms that internet addiction significantly mediates the relationship between social network use and sleep disturbance in adolescents, suggesting a tripartite interaction between behavior, cognition, and rest. These findings contribute to a holistic understanding of how digital behaviors interact with psychological vulnerabilities to affect biological outcomes such as sleep.

Despite its contributions, this study is not without limitations. First, the use of self-report questionnaires may introduce biases related to social desirability and subjective misreporting. Adolescents may underreport their digital use or overestimate their sleep quality due to privacy concerns or lack of awareness. Second, the cross-sectional nature of

the study limits the ability to draw causal inferences. While mediation was statistically significant, longitudinal data would be necessary to confirm the directionality of the observed relationships. Third, although the study sampled a diverse group of adolescents from Tehran, the results may not be generalizable to adolescents in rural areas or other cultural contexts with different digital engagement norms and sleep routines.

Future research should employ longitudinal or experimental designs to establish causality between social network usage, internet addiction, and sleep disturbance. Tracking adolescents over time would allow researchers to determine whether increases in digital engagement precede sleep problems or vice versa. Additionally, future studies could benefit from incorporating physiological sleep measures such as actigraphy or polysomnography to validate self-reported data. Expanding the sample to include diverse geographical regions, socioeconomic backgrounds, and cultural settings will also enhance the generalizability of findings. Lastly, qualitative approaches such as in-depth interviews may provide richer insight into adolescents' motivations for social media use and the subjective experience of digital fatigue.

From a practical standpoint, educators, parents, and mental health professionals must be equipped with tools to identify and mitigate the negative effects of excessive social network usage. Schools should incorporate digital wellness modules into health education curricula to teach adolescents about the consequences of nighttime screen exposure and compulsive internet use. Parental monitoring tools and behavioral contracts may be implemented to support healthy device use. Mental health practitioners should consider assessing internet addiction in adolescents presenting with sleep complaints, and interventions should be tailored to address the psychological dependency on online platforms alongside traditional sleep hygiene education.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

We hereby thank all individuals for participating and cooperating us in this study.

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the interview and participated in the research with informed consent.

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