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The Impact of Internet Addiction on Self-Control and Sleep Quality in Adolescents: A Comparative Analysis

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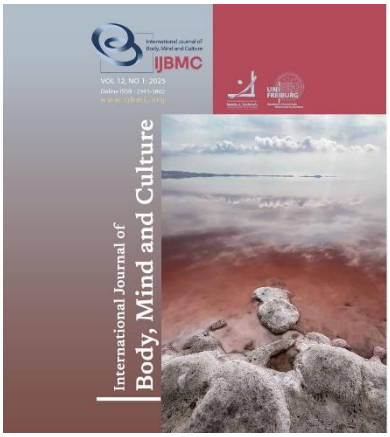

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ABSTRACT

Objective: To compare self-control and sleep quality between adolescents with internet addiction and their non-addicted peers.

Methods and Materials: A causal-comparative study was conducted involving 360 high school students from Babol, Iran, during the 2023-24 academic year. Participants included 180 internet-addicted adolescents and 180 non-addicted adolescents, identified using Young's Internet Addiction Test. Data were collected using Tangney's Self-Control Scale and the Pittsburgh Sleep Quality Index. Multivariate analysis of variance (MANOVA) was performed to analyze group differences.

Findings: MANOVA results revealed significant differences in self-control and sleep quality between the two groups (P<0.05). Internet-addicted adolescents exhibited significantly lower self-control scores and poorer sleep quality compared to their non-addicted peers (P<0.01). Group differences accounted for 31% of the variance in these variables.

Conclusion: Internet addiction significantly impairs self-control and sleep quality in adolescents. These findings underscore the importance of targeted interventions, including parental guidance, counseling, and behavioral therapies, in mitigating these adverse effects and fostering healthier developmental outcomes. Future research should expand to other regions and consider longitudinal designs to strengthen causal inferences.

Keywords: Internet addiction, Self-control, Sleep quality, Adolescents, Behavioral interventions.

Introduction

The internet has become an integral part of contemporary society, serving as a powerful tool for work, communication, and entertainment. Despite its vast potential, excessive and dysfunctional use of the internet has emerged as a critical issue, often referred to as internet addiction (Monterio et al., 2023). Internet addiction, also described as pathological or problematic internet use, is characterized by a compulsive need to use the internet, leading to significant social, psychological, relational, and academic harm (Xu et al., 2021). Recent statistics highlight the growing prevalence of internet addiction, with approximately 210 million individuals worldwide reportedly suffering from this condition (Miller, 2024). The pervasive nature of social media further exacerbates this trend, as 56.8% of the global population actively engages with these platforms, with usage expected to continue rising.

Adolescents are particularly vulnerable to internet addiction, as they constitute a substantial portion of

internet users. According to UNICEF, one-third of internet users globally are under the age of 18. Studies indicate that internet addiction can disrupt adolescents' time management, sleep patterns, and daily exercise routines, potentially weakening their immune systems (Rosen et al., 2014). Moreover, it negatively impacts social relationships (Tsitsika et al., 2014), academic performance (Chou et al., 2005), and mental health, increasing the likelihood of depressive symptoms (Lam & Peng, 2010). These adverse outcomes highlight the critical role of self-control in mitigating the adverse effects of internet addiction.

Self-control is a systematic process involving conscious efforts to influence behaviors and achieve goals (Borgatti et al., 2018; Cavicchioli et al., 2019). Studies have consistently demonstrated a strong relationship between self-control and problematic internet use. High levels of self-control act as a protective factor against internet addiction, while low self-control increases vulnerability (Agbaria, 2020; Agbaria & Bdier, 2021). Low self-control is associated with a range of adverse outcomes, including obesity, substance abuse, poor supervision, and procrastination. In contrast, effective self-control contributes to better physical and mental health, academic success, and improved problem-solving abilities (Hagger et al., 2010; Lian et al., 2017).

One significant consequence of impaired self-control is poor sleep quality, a physiological necessity for recovery from daily fatigue and overall well-being (Hosseini, 2022). Sleep quality is critical for adolescents' socio-emotional adjustments and academic outcomes (Li et al., 2023). However, poor sleep habits and insufficient sleep are often linked to low self-control. Adolescents with poor self-control tend to stay awake longer, thereby compromising sleep duration and quality due to daily obligations, such as attending school (Agarwal et al., 2020; Agarwal & Luqman, 2017). The Pittsburgh Sleep Quality Index (PSQI) identifies seven components of sleep quality, including sleep duration, disturbances, and latency, with higher scores indicating poorer sleep quality (Agarwal et al., 2020).

Additionally, internet addiction exacerbates sleep disturbances through its impact on circadian rhythms. The use of electronic devices, particularly before bedtime, disrupts sleep due to cognitive, emotional, or physiological stimulation (Kumar et al., 2023). Studies have shown that prolonged exposure to screens, especially the blue light emitted by devices, suppresses melatonin production, delaying sleep initiation and reducing overall sleep quality (Çelebioğlu et al., 2020). Adolescents spending six or more hours online daily are significantly more likely to experience sleep disorders and high levels of internet addiction (Hammad & Al-shahrani, 2024).

Given the growing concern over internet addiction and its impact on adolescents' self-control and sleep quality, this study aims to fill the research gap by examining these relationships. Existing literature highlights the crucial need for targeted interventions to address these issues and enhance adolescents' developmental outcomes. By examining the differences in self-control and sleep quality between internet-addicted and non-addicted adolescents, this study aims to provide valuable insights to the field and inform evidence-based strategies for prevention and intervention.

Methods and Materials

Study Design and Participants

The present study is applied in its objective and employs a descriptive, post-event causal-comparative design to address the research question. The statistical population consisted of high school students in the second secondary level in Babol during the 2023–2024 academic year. The study aimed to compare internet-addicted and non-addicted adolescents to examine differences in self-control and sleep quality.

A sample of 360 adolescents was selected using a multi-stage cluster random sampling method. To enhance representativeness, schools from diverse socioeconomic backgrounds (public and private) were included. However, acknowledging the limitations of this approach, future research should aim to expand the sample to multiple cities and regions, thereby ensuring a more representative and culturally diverse population. The gender composition of the sample (141 females, 219 males) reflects the need for further balance in gender distribution to generalize the findings more effectively.

Participants were selected based on the following inclusion criteria: Aged between 15–18 years and currently studying in high schools in Babol, access to the internet at home or school, for the internet-addicted group: a score above the cutoff on Young's Internet

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Addiction Test (YIAT), for the non-addicted group: a score below the cutoff on YIAT and the absence of clinical diagnoses such as schizophrenia, schizoaffective disorder, or bipolar disorder. The exclusion criteria ensured participants were not diagnosed with severe psychological or neurological disorders that could confound the results. This approach aligns with the study's aims but could be strengthened by addressing additional confounding variables such as socioeconomic status, parental involvement, and general health.

After obtaining ethical approval and necessary permissions from the university and the Department of Education in Babol, the researcher visited high schools in Babol, introduced themselves, and selected the sample through cluster random sampling based on inclusion and exclusion criteria. The Tangney SCQ and Pittsburgh PSQI questionnaires were distributed among the participants, who completed them individually. Throughout the entire process, the researcher closely interacted with participants, addressing any ambiguities or questions that arose.

Instruments

Young's Internet Addiction Test (IAT): This questionnaire, developed by Kimberly Young in 1996, comprises 20 items on a five-point Likert scale (ranging from 1 = rarely to 5 = always) to assess individuals' dependence and addiction to the internet. The 20-item version measures six subscales: salience, excessive use, neglect of work, anticipation, lack of self-control, and neglect of social life. The minimum and maximum scores on this questionnaire are 20 and 100, respectively. Scores between 20 and 49 indicate non-addiction, 50 and 79 indicate moderate addiction risk, and 80 and 100 indicate severe addiction. This standardized questionnaire has shown reliability and validity in previous studies, with a Cronbach's alpha of 0.90. The Persian version has also been validated in Iran, with reliability coefficients of 0.81 (Nasti) and 0.88 (Ghasemzadeh, as cited in Bahri et al., 2010).

Tangney's Self-Control Questionnaire (SCQ): This questionnaire, developed by Tangney et al. in 2004, includes two subscales: inhibitory self-control and initiating self-control. It is designed to measure individuals' self-control. The questionnaire is available in both short and long forms, with the long form consisting of 36 items. This study used the long form. Responses are scored on a five-point Likert scale (1 = does not describe me at all, 5 = always describes me). The minimum and maximum scores on the SCQ are 36 and 180, respectively. Internal consistency for the long form has been reported as high, with a Cronbach's alpha of 0.89 in Tangney et al.'s (2004) studies.

Pittsburgh Sleep Quality Index (PSQI): This self-report questionnaire, developed by Buysse et al. in 1989, assesses sleep quality through a standard questionnaire that is easy to understand and complete. It distinguishes between "good sleepers" and "poor sleepers" by evaluating sleep quality and quantity over one month. The PSQI includes seven subscales: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. Scores for each dimension range from 0 (no disturbance) to 3 (severe disturbance). The total score, calculated by summing the scores of the seven dimensions, ranges from 0 to 21, with scores above 5 indicating poor sleep quality. The reliability of the PSQI has been reported with a Cronbach's alpha of 0.83 by Kakouei et al. (2010).

Data Analysis

Data analysis was conducted by Measures of central tendency (mean), variability (standard deviation), and distribution (skewness and kurtosis). Multivariate analysis of variance (MANOVA) at a significance level of $\alpha = 0.05$, using SPSS version 25.

Findings and Results

Based on the results, 180 students (50%) were identified as adolescents with internet addiction, while the remaining 180 students (50%) were categorized as non-addicted or normal. Among the participants, 141 students (39.17%) were female, and 219 students (60.83%) were male.

Table 1

Mean (SD) of study variables in the two groups of students

Variables	Internet Addiction		Normal	
	Mean	SD	Mean	SD
Self-Control				
Initial Self-Control	58.10	8.22	67.17	7.72
Secondary Self-Control	59.43	8.30	67.64	7.95
Total Score	117.53	14.90	134.82	13.95
Sleep Quality				
Subjective Sleep Quality	2.97	1.78	2.28	1.70
Sleep Duration	1.62	1.67	0.98	1.36
Sleep Efficiency	1.25	1.25	0.62	1.01
Sleep Disturbances	1.31	1.01	0.95	0.98
Use of Sleeping Pills	1.31	1.01	0.86	0.87
Daytime Dysfunction	1.31	1.57	0.71	1.22
Sleep Latency	0.78	1.04	0.56	0.86
Total Score	10.57	5.71	6.98	4.76

Table 1 presents the mean and standard deviation for the study variables, including self-control (initial and secondary) and sleep quality (subjective sleep quality, sleep duration, sleep efficiency, sleep disturbances, use of sleeping pills, daytime dysfunction, and sleep latency) among adolescents with and without internet addiction.

Table 2

Results of Levene's and Box's M Tests for Total Scores of Study Variables

Test	Variable	F Value	df1	df2	p-value
Levene's Test	Self-Control	0.180	1	358	0.672
	Sleep Quality	1.192	1	358	0.213
Box's M Test	M Value	14.701	2.428	6	0.064

Results from Table 2 indicate that the assumption of homogeneity of error variances for self-control and sleep quality among internet-addicted and normal adolescents was statistically non-significant (p>0.05), meeting the assumption. Additionally, the results of Box's M Test showed that the homogeneity of variance-covariance matrices for self-control and sleep quality scores was also statistically non-significant (p>0.05).

Table 3

MANOVA Results for Total Scores of Study Variables

Effect	Test Name	Value	F	df Hypothesis	df Error	p-value	Eta Squared
Group	Pillai's Trace	0.314	54.352	3	356	0.001	0.314
	Wilks' Lambda	0.686	54.352	3	356	0.001	0.314
	Hotelling's Trace	0.458	54.352	3	356	0.001	0.314
	Roy's Largest Root	0.458	54.352	3	356	0.001	0.314

As shown in Table 3, the significance levels of all tests confirm the suitability of using MANOVA. These results suggest a significant difference in the total scores of self-control and sleep quality between adolescents with internet addiction and normal adolescents for at least one of the variables. The effect size (Eta Squared) indicates that 31% of the variance is attributable to group differences in these variables.

Table 4

Results of MANOVA for Total Scores of Study Variables

Source	Variable	Sum of Squares	df	Mean Square	F Value	p-value
Group	Self-Control	26873.772	1	26873.772	128.666	0.001

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	Sleep Quality	1156.552	1	1156.552	41.473	0.001
Error	Self-Control	74773.783	358	208.865		
	Sleep Quality	9983.423	358	27.887		
Total	Self-Control	5806,932.000	360			
	Sleep Quality	39283.000	360			

Based on Table 4, there is a significant difference in total scores for self-control (F= 128.666, p<0.001) and sleep quality (F= 41.473, p<0.001) between the two groups. Normal adolescents scored significantly higher on self-control measures and significantly lower on sleep quality measures compared to internet-addicted adolescents (lower scores on the PSQI indicate better sleep quality). In conclusion, normal adolescents exhibited significantly better self-control and sleep quality compared to adolescents with internet addiction, confirming that these variables differ between the two groups.

Discussion and Conclusion

The findings of this study revealed significant differences between adolescents with internet addiction and their non-addicted peers in terms of total self-control and sleep quality scores. Normal adolescents scored significantly higher in self-control variables compared to those with internet addiction. Similarly, normal adolescents scored significantly lower in sleep quality variables, indicating better sleep quality compared to internet-addicted adolescents (lower scores on the PSQI denote better sleep quality). This suggests that normal adolescents have superior self-control and sleep quality compared to adolescents who are addicted to the internet. Therefore, it can be concluded that self-control and sleep quality differ significantly between these two groups. These results align with previous research (Agbaria, 2020; Agbaria & Bdier, 2021; Ahmed Hammad et al., 2024; Deng et al., 2024; Fekih-Romdhane et al., 2022; Hammad & Al-shahrani, 2024; Hosseini, 2022; Kumar et al., 2023; J. Li et al., 2021; S. Li et al., 2021; Li et al., 2023; Saber & Masih, 2024). These studies consistently highlight that internet addiction is influenced by self-control and sleep quality.

Addiction occurs when the brain recognizes substances or behaviors that trigger the release of dopamine, a neurotransmitter associated with pleasure and reward prediction. Repeated exposure to such substances or behaviors increases the desire for them, leading to tolerance and a need for more stimuli to achieve the same pleasurable effects. Larry Rosen's perspective suggests that technology and the internet can alter brain function. With addiction, the brain releases serotonin, a neurotransmitter that influences mood, alongside dopamine. In response to anxiety, the brain produces hormones that trigger a surge of energy and mental focus to manage stress. This compulsive behavior, such as checking social media platforms, affects anxiety, sleep quality, and self-control (Agarwal et al., 2020).

Additionally, these findings are consistent with Ryan and Deci's (2002) self-determination theory, which emphasizes the role of psychological needs such as autonomy and competence. Individuals with higher self-control are more likely to feel autonomous and competent, which enables them to engage in meaningful activities and pursue their personal goals. This fosters a sense of purpose, reducing their inclination toward internet addiction. Mechanisms related to electronic device use at bedtime disrupt sleep through cognitive, emotional, or physiological stimulation. Exposure to intense light, especially short wavelengths emitted by electronic devices, delays the sleep phase, disrupting the sleep-wake cycle. Blue light exposure suppresses melatonin production, interfering with sleep initiation. Poor sleep quality, in turn, affects growth due to reduced secretion of growth hormone. Psychologically, late-night computer use increases arousal, disrupting the calming mechanisms necessary for sleep, and further elucidates the negative impact of internet addiction on sleep habits (Agarwal et al., 2020; Agarwal & Luqman, 2017; Çelebioğlu et al., 2020).

Students represent the future of every society. However, internet addiction and related psychological issues pose significant barriers, leading to consequences such as school dropout, unemployment, medical expenses, absenteeism, long-term disabilities, stress-related lifestyle disruptions, and an increased risk of early mortality due to suicide. The findings of this study emphasize the urgent need for interventions and strategies to prevent internet addiction, especially among adolescents. Implement diverse and engaging

curricula designed to build resilience against internet addiction in adolescents. Parents should monitor the time their children spend online and the frequency of their gaming activities. Strengthen emotional and social support systems by involving parents, teachers, and psychologists to address students' psychosocial needs. Conduct workshops and therapies such as cognitive-behavioral therapy (CBT), acceptance and commitment therapy (ACT), and mindfulness-based interventions for students and their parents. This study was conducted exclusively among high school students in Babol during the 2023-2024 academic year, which limits the generalizability of the findings. Future research should include students from other cities to facilitate comparisons of results. Additionally, the reliance on self-reported questionnaires introduces the possibility of response bias, which should be addressed in subsequent studies.

This study provides valuable insights into the impact of internet addiction on self-control and sleep quality among adolescents. By identifying significant group differences, it highlights the need for preventative measures and interventions to address these challenges. However, the study's limitations, including its cross-sectional design, reliance on self-reported data, and small sample size, must be acknowledged. Future research should employ longitudinal designs, objective measurement tools, and more diverse populations to validate and extend these findings. Addressing these issues will contribute to a more comprehensive understanding of internet addiction and its broader implications for adolescent health and development.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Declaration of Helsinki, which provides guidelines for ethical research involving human participants. Ethical considerations in this study were that participation was entirely optional.

Transparency of Data

By the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contribute to this study.

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