



Investigating the Quality of Sleep and the Prevalence of Insomnia Among Adolescents with Self-Injury and Suicidal Behaviors

Kendine Zarar Verme ve İntihar Davranışları Gösteren Ergenlerde Uyku Kalitesinin ve Uykusuzluğun Yaygınlığının Araştırılması

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Kerman University Faculty of Medicine, Shaid Behesti Hospital, Department of Psychiatry, Kerman, Iran

Abstract

Objective: Sleep disorders and insomnia are major health problems that significantly impact mental health, quality of life, and risky behaviors such as self-harm in adolescents. This study aimed to investigate sleep quality, insomnia severity, and demographic and clinical factors affecting sleep quality among adolescents in Kerman, Iran.

Materials and Methods: In 2023, 80 adolescents aged 12–20 years with self-harming behaviors were recruited from the psychiatry and counseling centers of Kerman University of Medical Sciences. Data were collected using the Pittsburgh Sleep Quality Index and Insomnia Severity Index questionnaires, structured interviews, and self-report questionnaires. The questionnaires were scored using standardized rules, and various statistical tests were used in the analysis.

Results: The mean age of the participants was 16.36, and 56.2% were male. Poor sleep quality was detected in 96.25% of adolescents. Insomnia severity was determined as mild (13.75%), moderate (23.75%), severe (40%), and very severe (22.5%). A significant negative correlation was found between age and insomnia severity, with poorer sleep quality in males. Insomnia severity was higher in those with higher education levels and sleep quality was significantly lower in those with chronic illnesses. Associations were also found between a history of hospitalization and substance abuse.

Conclusion: In conclusion, factors such as age, gender, education, chronic illness, and harmful behaviors were shown to play significant roles in sleep quality and insomnia severity in adolescents. The importance of multidimensional interventions (cognitive-behavioral therapy for insomnia, stress management, and sleep hygiene education) is emphasized.

Keywords: Sleep disorders, insomnia, sleep quality, adolescents, self-harm

Öz

Amaç: Uyku bozuklukları ve uykusuzluk, ergenlerde ruh sağlığını, yaşam kalitesini ve kendine zarar verme gibi riskli davranışları önemli ölçüde etkileyen önemli sağlık sorunlarıdır. Bu çalışma, İran'ın Kerman kentindeki ergenlerde uyku kalitesini, uykusuzluk şiddetini ve bunu etkileyen demografik ve klinik faktörleri araştırmayı amaçlamaktadır.

Gereç ve Yöntem: 2023 yılında, Kerman Tıp Bilimleri Üniversitesi psikiyatri ve danışmanlık merkezlerinden kendine zarar verme davranışları gösteren 12–20 yaş arası 80 ergen çalışmaya dahil edilmiştir. Veriler, Pittsburgh Uyku Kalitesi İndeksi ve Uykusuzluk Şiddeti Uykusuzluk Şiddeti İndeksi anketleri, yapılandırılmış görüşmeler ve öz bildirim anketleri kullanılarak toplanmıştır. Anketler standart kurallara göre puanlanmış ve analizde çeşitli istatistiksel testler kullanılmıştır.

Bulgular: Katılımcıların yaş ortalaması 16,36 olup, %56,2'si erkektir. Ergenlerin %96,25'inde kötü uyku kalitesi tespit edilmiştir. Uykusuzluk şiddeti sırasıyla hafif (%13,75), orta (%23,75), şiddetli (%40) ve çok şiddetli (%22,5) olarak belirlendi. Yaş ve uykusuzluk şiddeti arasında anlamlı negatif korelasyon bulundu ve erkeklerde uyku kalitesi daha düşüktü. Uykusuzluk şiddeti, eğitim seviyesi yüksek olanlarda daha yüksek, kronik hastalığı olanlarda ise uyku kalitesi anlamlı derecede düşüktü. Ayrıca, hastaneye yatış ve madde bağımlılığı öyküsü ile de ilişki bulundu.

Sonuç: Sonuç olarak, yaş, cinsiyet, eğitim, kronik hastalık ve zararlı davranışlar gibi faktörlerin ergenlerde uyku kalitesi ve uykusuzluk şiddetinde önemli rol oynadığı gösterilmiştir. Çok boyutlu müdahalelerin (bilişsel davranışçı terapi - uykusuzluk, stres yönetimi ve uyku hijyeni eğitimi) önemi vurgulanmaktadır.

Anahtar Kelimeler: Uyku bozuklukları, uykusuzluk, uyku kalitesi, ergenler, kendine zarar verme

Address for Correspondence/Yazışma Adresi: Farzaneh Jahanbakhsh, Kerman University Faculty of Medicine, Shaid Behesti Hospital, Department of Psychiatry, Kerman, Iran
E-mail: f.jahanbakhsh@kmu.ac.ir **ORCID-ID:** orcid.org/0000-0002-3469-4026

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Introduction

Sleep is a highly complex process that goes beyond simply closing one's eyes and plays a fundamental role in physical and mental health. It is defined as an active, unconscious state in which the brain is relatively at rest and primarily responds to internal stimuli. Although the exact purpose of sleep has not been fully elucidated, several theories, including the inactivity theory, energy conservation theory, restorative theory, and brain plasticity theory, have attempted to clarify its functions (1). However, none of these theories is comprehensive, reflecting the complex and not fully understood nature of sleep. Thus, it is widely accepted that no single theory explains all aspects of sleep, and a combination of these theories may provide a better explanation (2-4).

Insomnia is defined as dissatisfaction with sleep quality or quantity, encompassing difficulties in falling asleep, staying asleep, or waking up early in the morning, with an inability to return to sleep. According to the Diagnostic and Statistical Manual of Mental Disorders, insomnia is diagnosed as a clinical disorder when these issues cause significant distress or impairment in daily functioning (5,6). Insomnia is one of the most prevalent sleep disorders globally, affecting 10–30% of the general population, with rates reaching 50–60% in certain groups, such as the elderly and those with chronic illnesses (7). In Iran, the prevalence of insomnia ranges between 28% and 42% across different age and social groups (8).

Poor sleep quality in adolescents is linked to declining academic performance, reduced concentration, behavioral issues, and emotional problems such as anxiety and depression (9). A critical and alarming consequence of insomnia in this population is the increased risk of self-harm and suicidal behavior (10). Multiple studies have demonstrated that adolescents with insomnia have higher suicidal ideation and are more prone to engage in self-injurious behaviors. Sleep disturbances impair emotional regulation, increase impulsivity, and disrupt cognitive function, all factors contributing to suicidal ideation and behaviors (9-11).

Neurobiological research suggests that chronic sleep deprivation alters stress response systems, increases inflammatory markers, and affects neurotransmitter balance, potentially creating a biological pathway for suicidal thoughts (12,13). Suicide is a major public health concern worldwide and a leading cause of death, particularly among the youth. Given these considerations, investigating the relationship between sleep quality and self-harm in adolescents is crucial (14-16).

This study aimed to investigate sleep quality and insomnia prevalence among adolescents with self-injurious and suicidal behaviors admitted to Shahid Beheshti Hospital in Kerman, providing insights for targeted interventions and preventive strategies.

Materials and Methods

Research Setting, Population, and Sample Size

In 2023, 80 adolescents aged 12 to 20 years, presenting with self-injurious behaviors and suicidal ideation, were recruited

from the psychiatry and counseling centers of the Kerman University of Medical Sciences. Inclusion criteria included age between 12 and 20 years, documented self-harm or suicidal behavior within the previous six months, and ability to provide informed consent. The exclusion criteria were severe cognitive impairment, psychotic disorders, and current use of medications affecting sleep quality.

Inclusion and Exclusion Criteria

Inclusion criteria were adolescents aged 12–19 years presenting with non-suicidal self-injury or suicide attempts, willingness to participate, obtaining written informed consent from parents or legal guardians, verbal assent from adolescents, and ability to complete the questionnaires. Exclusion criteria included failure to obtain informed consent; presence of severe physical or psychiatric conditions (e.g., active psychosis, severe intellectual disability, or acute intoxication) impairing participation; use of psychotropic or sleep-altering medications not stabilized for at least one month; a current primary diagnosis of severe substance use disorder that would confound sleep assessment); withdrawal from the study at any point; cognitive impairments or neurological disorders that interfered with comprehension or completion of the questionnaires; and incomplete or unreliable responses.

Ethical Considerations

The study protocol was approved by the Research Ethics Committee of Kerman University of Medical Sciences (approval code: 402000337/IR.KMU.AH.REC.1402.104, date: 02.08.2025). The research was conducted in 2023, and ethics approval was obtained retrospectively in 2025. Participation was voluntary, and all participants and their legal guardians were fully informed about the study's objectives and procedures. Written informed consent was obtained from the guardians of all participants. Confidence in personal information was maintained throughout the study by assigning each participant a code. Participation was voluntary, and individuals were free to withdraw at any time. In case of significant psychological concerns identified during the assessment, participants were referred for further psychiatric evaluation.

Method and Tools of Data Collection

Three tools were used for data collection. First, a Demographic and Clinical History Checklist was used, which collected data on age, gender, education, physical and mental health history, past sleep patterns, and medication use. The second was the Pittsburgh Sleep Quality Index (PSQI), a validated 19-item questionnaire assessing sleep quality over the past month across seven domains. Scores ranged from 0 to 21, with scores higher than 5 indicating poor sleep quality. The Persian version of the PSQI has demonstrated good reliability (Cronbach's alpha: 0.78) (17). We also used the Insomnia Severity Index (ISI), a 7-item scale evaluating insomnia symptoms, including difficulty falling asleep, difficulty staying asleep, early morning awakenings, dissatisfaction with sleep, and their impact on daily functioning. The scores ranged from 0 to 28 and were categorized into four levels: mild (0–7), moderate (8–14),

severe (15–21), and very severe (22–28). The Persian version has shown good reliability (18,19).

After obtaining consent, the participants completed the questionnaires in a quiet, distraction-free environment. For those unable to complete the forms independently, a trained researcher conducted face-to-face interviews. Each session lasted for approximately 30–45 minutes. Data were checked daily for completeness and accuracy, entered into a secure database, and double-entered by two independent researchers for validation.

Statistical Analysis

Data were entered into SPSS version 27 and Python statistical libraries by two independent researchers to minimize entry errors. Descriptive statistics were used to summarize the demographic and clinical data. Inferential statistical methods, such as t-tests, chi-square tests, Firth logistic regression (due to high prevalence of the outcome), and pathway analysis, were used to assess the relationships between sleep patterns and suicidal behaviors. The significance level was set at $p < 0.05$.

Results

In this study, 80 participants were included, with a mean age of 16.36 ± 1.90 years. Boys comprised 56.2% of the sample, while girls accounted for 43.8%. Most participants were in the first stage of secondary school (71.2%) and lived in a private home with their family. A history of addiction was reported by 67.5% of the participants, and 63.7% had parents with a history of addiction. All participants had consumed tea or coffee and a high proportion (77.5%) had a history of psychiatric problems. Additionally, 23.8% of participants reported underlying medical conditions. Among the self-harm methods, wrist cutting (36.25%) was the most frequently observed (Table 1).

The PSQI and ISI were used to assess the sleep patterns. The median subjective sleep quality score was 3 [interquartile range (IQR), 2–3], indicating poor perceived sleep quality. The mean score for sleep onset delay was 2.05 ± 0.90 , reflecting a prolonged time to fall asleep. Sleep duration had a median of 1 (IQR, 0–2), while sleep efficiency was extremely low (median, 0; IQR, 0–0). Sleep disturbances were notable (mean 1.71 ± 0.62), and the use of sleep medications was minimal (median 0, IQR 0–3). Daytime dysfunction was also common (median, 2.50; IQR, 2–3). The overall PSQI score was 11.03 ± 3.15 , with 96.25% (77) of participants exhibiting poor sleep quality. The overall ISI score was 16.60 ± 5.72 , with 40% (32) having severe insomnia, 23.75% (19) moderate, 22.5% (18) very severe, and 13.75% (11) mild insomnia.

Analysis by age showed no significant differences in sleep quality ($p = 0.385$) or overall insomnia severity ($p = 0.23$). Moderate insomnia, however, was more prevalent in the 19–20 years age group ($p = 0.033$).

Gender did not significantly influence overall sleep quality ($p = 0.335$), although mild insomnia was more common among girls ($p < 0.001$) and moderate insomnia was more common in boys ($p < 0.001$). No significant differences were observed for severe

or very severe insomnia between genders. Regarding education level, the prevalence of sleep quality disorders was similar ($p = 0.637$); mild insomnia was more frequent among high school students ($p = 0.017$), and severe insomnia was more frequent among middle school students ($p = 0.018$) (Table 2).

When considering clinical characteristics, participants' history of addiction did not significantly affect sleep quality ($p = 0.551$), although mild insomnia was more prevalent among those without a history of addiction ($p = 0.007$). Parental addiction did not affect overall sleep quality ($p = 0.084$); however, mild insomnia was more frequent among participants whose parents did not have a history of addiction ($p < 0.001$) (Table 3).

A history of psychiatric disorders did not significantly influence overall sleep quality ($p = 0.805$); however, moderate insomnia was more common among participants with a history of psychiatric disorders ($p = 0.018$), whereas severe insomnia was more prevalent in those without such a history ($p = 0.019$). Sleep quality was also not significantly associated with hospitalization history ($p = 0.295$), although mild insomnia occurred more frequently among participants without a hospitalization history ($p = 0.003$) (Table 4).

The mechanism of self-harm did not significantly influence overall sleep quality ($p = 0.139$). However, moderate insomnia was significantly associated with wrist cutting ($p = 0.005$), whereas no significant differences were found for severe or very severe insomnia across different self-harm mechanisms (Table 5). Correlation analyses revealed no significant relationship between age and the total PSQI score ($r: 0.08$, $p = 0.538$), whereas age was negatively correlated with the total ISI score ($r: -0.52$, $p < 0.001$), indicating that insomnia severity decreased with increasing age. No significant correlation was observed between the total PSQI and ISI scores ($r: 0.1$, $p = 0.42$).

Results from the Firth Logistic Regression Model indicated that age, gender, education level, personal or parental addiction history, hospitalization, medication consumption, and self-harm mechanism did not significantly affect the odds of experiencing a sleep quality disorder (all $p > 0.05$) (Table 6).

Pathway analysis showed that age had a positive direct effect on PSQI (0.60), with a negligible indirect effect via ISI (0.02), resulting in a total effect of 0.62. Male gender had a negative direct effect on PSQI (-4.16) and an indirect effect through ISI (1.21), yielding a total effect of -2.95, indicating overall poorer sleep quality in males. Higher education level had a minor negative total effect on PSQI (-0.66), which was partially mediated by insomnia severity. Underlying medical conditions had a strong negative direct effect (-4.58) on PSQI, with a mediating indirect effect (3.18), producing a total effect of -1.40, suggesting that insomnia severity partially mitigated the negative impact of underlying diseases on sleep quality (Figure 1).

Discussion

This study demonstrated a high prevalence of poor sleep quality and insomnia among adolescents with self-harm and suicidal behaviors. These findings align with previous literature indicating that sleep disturbances are closely associated with

emotional dysregulation, impulsivity, and increased risk of self-injury (20). The significant negative correlation between age and insomnia severity suggests that younger adolescents may experience more severe sleep difficulties, which may exacerbate mental health challenges. This finding suggests that age may be a protective factor against insomnia in this age group. This relationship appears to be linked to developmental changes, cognitive and behavioral maturation, and improved emotion-regulation abilities in older adolescents. With age, adolescents may develop better skills for managing stress and anxiety, and adopt healthy sleep habits, which may contribute to improved sleep quality. Similar results have been reported previously. For example, Shi et al. (21) demonstrated that as adolescents age, sleep patterns tend to stabilize and insomnia severity decreases. Their study highlighted the role of neural structural development, particularly in emotion-regulating regions such as the prefrontal cortex and amygdala, in this improvement. Furthermore, Casement et al. (22) explained that central nervous system maturation and improved stress

response regulation might reduce the impact of stressors on sleep in older adolescents. Enhanced circadian rhythms and reduced sensitivity to sleep-disrupting factors may also play a role. Pathophysiologically, the efficiency of negative feedback mechanisms in the hypothalamic-pituitary-adrenal (HPA) axis improves with age, leading to reduced stress responses. This improvement may help adolescents avoid sleep disturbances when facing daily stressors and anxieties (23). Additionally, hormonal changes associated with puberty, such as gradual declines in melatonin levels at certain times of the day, may contribute to better sleep-wake cycle regulation and reduced insomnia in older adolescents (24). However, some studies have reported conflicting findings. For instance, Yuksel et al. (24) found that increasing age in some adolescents may be associated with heightened academic pressure, social stressors, and greater responsibilities, which could disrupt sleep. These discrepancies may stem from cultural differences, social structures, sleep assessment methods, or study samples. Overall, the findings of the present study align with a significant portion

Table 1. Distribution of demographic and clinical characteristics of participants in the study.

Variable	Frequency (percentage)	
Gender	Boys	45 (56.2%)
	Girls	35 (43.8%)
Education level	First stage of secondary school	57 (71.2%)
	Second stage of secondary school	23 (28.7%)
Residence	Personal home with family	44 (55.0%)
	Rental home with family	30 (37.5%)
	Dormitory	3 (3.8%)
	Rental home with roommates	3 (3.8%)
Addiction in participants	Yes	54 (67.5%)
	No	26 (32.5%)
Addiction in parents	Yes	51 (63.7%)
	No	29 (36.2%)
Tea or coffee consumption	Yes	80 (100.0%)
	No	0 (0%)
History of psychiatric problems in participants	Yes	62 (77.5%)
	No	18 (22.5%)
History of underlying medical conditions in participants	Yes	61 (76.2%)
	No	19 (23.8%)
Hospitalization history in participants	Yes	43 (53.8%)
	No	37 (46.2%)
Drug consumption in participants	Yes	44 (55.0%)
	No	36 (45.0%)
Self-harm method	Wrist cutting	29 (36.25%)
	Self-inflicted wounds on other parts of the body	4 (5%)
	Pill ingestion	9 (11.25%)
	Combination of pill ingestion and self-inflicted wounds	15 (18.75%)
	Head trauma	9 (11.25%)
	Unspecified	14 (17.5%)

of prior research and suggest that increasing age may be associated with improved sleep quality and reduced insomnia severity. This relationship is likely mediated by a combination of psychological, neurological, and hormonal factors occurring during adolescent development.

Gender differences in sleep quality and insomnia patterns were observed, consistent with existing research showing higher insomnia prevalence in females but poorer subjective sleep quality in males (25). Latina et al. (9) also reported that adolescent girls, due to greater vulnerability to stress and anxiety, exhibit more disrupted and prolonged sleep patterns than boys. These factors may contribute to the higher prevalence of mild insomnia in girls. Pathophysiologically, sex differences in cortisol and melatonin secretion may explain these findings. Studies suggest that girls are more sensitive to hormonal fluctuations related to the menstrual cycle, which can disrupt sleep-wake rhythms (26). Additionally, adolescent girls often experience greater psychosocial stressors and exhibit heightened sensitivity to these factors, potentially leading to persistent but milder insomnia (27). In contrast, among boys, environmental and behavioral factors, such as greater pre-sleep digital device use and irregular sleep patterns, may explain the higher prevalence of moderate insomnia (28). However, some studies have noted

that gender alone may not be a strong independent predictor of insomnia, with mediating factors such as mental health, sleep habits, and social stressors playing significant roles (29). In summary, the findings of this study align with much of the existing literature, indicating that insomnia patterns differ between adolescent boys and girls and may be influenced by psychological, biological, and social factors.

Higher education levels were paradoxically linked to increased insomnia severity, possibly reflecting academic stress, although further investigation is warranted. Chronic medical conditions and a history of hospitalization were strongly associated with worse sleep outcomes, likely reflecting the bidirectional relationship between physical and mental health. Previous studies have reported similar findings. Liu et al. (30) demonstrated in a longitudinal study that students with higher academic levels may experience insomnia symptoms due to academic pressures and performance expectations. These pressures include prolonged study hours, exam stress, and reduced sleep time. Shi et al. (21) also noted that daytime fatigue from sleep deprivation and insomnia can negatively impact academic performance, creating a vicious cycle of academic stress and poor sleep. Pathophysiologically, academic stress may disrupt the HPA axis and chronically elevate cortisol

Table 2. Comparison of the frequency of sleep quality disorders and different insomnia severities by age, gender and education level.

Variables		Sleep quality		Insomnia severity			
		Sleep disturbance	Good sleep quality	Mild insomnia	Moderate insomnia	Severe insomnia	Very severe insomnia
Age groups	12-14 years	13 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	7 (53.8%)	6 (46.2%)
	15-16 years	19 (100.0%)	0 (0.0%)	4 (21.1%)	3 (15.8%)	6 (31.6%)	6 (31.6%)
	17-18 years	36 (92.3%)	3 (7.7%)	7 (17.9%)	13 (33.3%)	13 (33.3%)	6 (15.4%)
	19-20 years	6 (100.0%)	0 (0.0%)	0 (0.0%)	3 (50.0%)	3 (50.0%)	0 (0.0%)
	p-value	0.385		0.23	0.033	0.484	0.053
Gender	Boys	42 (93.3%)	3 (6.7%)	0 (0.0%)	19 (42.2%)	17 (37.8%)	9 (20.0%)
	Girls	35 (100.0%)	0 (0.0%)	11 (31.4%)	0 (0.0%)	15 (42.9%)	9 (25.7%)
	p-value	0.335		< 0.001	< 0.001	0.818	0.736
Education level	First stage of secondary school	54 (94.7%)	3 (5.3%)	4 (7.0%)	13 (22.8%)	28 (49.1%)	12 (21.1%)
	Second stage of secondary school	23 (100.0%)	0 (0.0%)	7 (30.4%)	6 (26.1%)	4 (17.4%)	6 (26.1%)
	p-value	0.637		0.017	0.983	0.018	0.848

Table 3. Comparison of sleep quality disorder and various insomnia severity levels based on personal and parental history of addiction.

Variable		Sleep quality		Insomnia severity			
		Sleep disturbance	Good sleep quality	Mild insomnia	Moderate insomnia	Severe insomnia	Very severe insomnia
History of addiction	Yes	51 (94.4%)	3 (5.6%)	3 (5.6%)	16 (29.6%)	23 (42.6%)	12 (22.2%)
	No	26 (100.0%)	0 (0.0%)	8 (30.8%)	3 (11.5%)	9 (34.6%)	6 (23.1%)
	p-value	0.551		0.007	0.133	0.661	1
Parental addiction history	Yes	51 (100.0%)	0 (0.0%)	0 (0.0%)	16 (31.4%)	20 (39.2%)	15 (29.4%)
	No	26 (89.7%)	3 (10.3%)	11 (37.9%)	3 (10.3%)	12 (41.4%)	3 (10.3%)
	p-value	0.084		< 0.001	0.064	1	0.092

levels, a key mechanism in sleep disturbances among higher-achieving students (23). Elevated cortisol not only makes falling asleep difficult but also impairs deep, restorative sleep. Yuksel et al. (24) further found that adolescents in higher grades may experience persistent insomnia due to increased social and academic pressures. These pressures can disrupt sleep onset and maintenance through heightened stress, anxiety, and pre-sleep rumination. However, some studies have reported contradictory findings. For example, adolescents in lower grades may develop insomnia due to irregular sleep habits and excessive digital device use (31). These discrepancies may arise from cultural, educational, or social differences. Overall, the results of this study align with prior research, suggesting that education level may indirectly affect insomnia severity through academic stress and changes in sleep patterns, both of which are mediated by multiple psychological and pathophysiological factors.

The present study found that adolescents with underlying medical conditions exhibited higher insomnia severity. Path analysis confirmed a significant adverse direct effect of medical history on sleep quality, which was partially mediated by insomnia severity. Previous studies have supported this association. Yuksel et al. (24) demonstrated that adolescents with chronic conditions (e.g., asthma, diabetes, autoimmune disorders) face greater insomnia risk due to medication needs, activity limitations, and illness-related anxiety. Van Someren (23) noted that chronic diseases may disrupt sleep via biological pathways such as HPA axis dysfunction and systemic inflammation. Pro-inflammatory cytokines (e.g., interleukin-6 and tumor necrosis factor-alpha)

directly impair sleep architecture. De Zambotti et al. (27) found that chronic pain from medical conditions fragments sleep patterns, increasing nighttime awakenings. Psychologically, adolescents with chronic illnesses may experience sleep difficulties due to health-related worries and pre-sleep rumination (32). However, not all chronic conditions affect sleep equally; well-controlled diseases (e.g., mild asthma) may be associated with lower insomnia severity (33,34). Collectively, these findings indicate that medical conditions influence insomnia through physiological and psychological pathways, highlighting the need for symptom management and stress reduction interventions.

The present study found that mild insomnia severity was significantly higher among adolescents without prior hospitalization than among those hospitalized. Other insomnia levels and sleep quality did not differ significantly between the groups. This suggests that hospitalization during adolescence may have long-term sleep-disrupting effects. Previous studies have supported this relationship. Uccella et al. (34) found hospitalized adolescents face greater insomnia risk due to hospitalization-related stress, negative hospital experiences, and circadian disruption. Hom et al. (35) noted that repeated hospitalizations may trigger post-traumatic anxiety, directly impairing sleep through intrusive pre-sleep thoughts. Pathophysiological, frequent hospitalizations may chronically elevate cortisol levels and alter HPA axis activity, disrupting normal sleep initiation and maintenance (36). Hospital environments (e.g., artificial lighting, medical equipment noise, and staff interruptions) also

Table 4. Comparison of sleep quality disorder and various insomnia severity levels based on history of psychiatric disorders, chronic underlying diseases, and hospitalization.

Variable		Sleep quality		Insomnia severity			
		Sleep disturbance	Good sleep quality	Mild insomnia	Moderate insomnia	Severe insomnia	Very severe insomnia
Psychiatric disorder history	Yes	59 (95.2%)	3 (4.8%)	8 (12.9%)	19 (30.6%)	20 (32.3%)	15 (24.2%)
	No	18 (100.0%)	0 (0.0%)	3 (16.7%)	0 (0.0%)	12 (66.7%)	3 (16.7%)
	p-value	0.805		0.984	0.018	0.019	0.724
	Yes	58 (95.1%)	3 (4.9%)	8 (13.1%)	16 (26.2%)	28 (45.9%)	9 (14.8%)
	No	19 (100.0%)	0 (0.0%)	3 (15.8%)	3 (15.8%)	4 (21.1%)	9 (47.4%)
	p-value	0.769		1	0.532	0.096	0.008
Hospitalization history	Yes	37 (100.0%)	0 (0.0%)	0 (0.0%)	12 (32.4%)	19 (51.4%)	6 (16.2%)
	No	40 (93.0%)	3 (7.0%)	11 (25.6%)	7 (16.3%)	13 (30.2%)	12 (27.9%)
	p-value	0.295		0.003	0.153	0.09	0.327

Table 5. Frequency of sleep quality disorders and different levels of insomnia based on self-harm mechanism.

Variables	Sleep quality		Insomnia severity			
	Sleep disturbance	Good sleep quality	Mild insomnia	Moderate insomnia	Severe insomnia	Very severe insomnia
Self-inflicted wounds on other parts of the body	4 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (100.0%)	0 (0.0%)
Wrist cutting	29 (100.0%)	0 (0.0%)	0 (0.0%)	13 (44.8%)	10 (34.5%)	6 (20.7%)
Pill ingestion	21 (87.5%)	3 (12.5%)	0 (0.0%)	3 (12.5%)	12 (50.0%)	9 (37.5%)
Head trauma	9 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	6 (66.7%)	3 (33.3%)
p-value	0.139		-	0.005	0.052	0.312

severely disrupt sleep patterns (37). However, some studies suggest that these effects may be temporary, with social support and psychological interventions mitigating the negative impacts (38). Overall, hospitalization history may influence insomnia severity through psychological, physiological, and environmental pathways, warranting supportive interventions for affected adolescents.

The present study found that mild insomnia severity was significantly higher among adolescents without a history of substance use than among those with such a history. Other insomnia levels and sleep quality did not show significant differences. This suggests that substance use may complexly

influence sleep quality and insomnia severity, mediated by factors such as substance type, duration of use, withdrawal, and psychosocial elements. Previous studies support this association. Basu et al. (39) demonstrated that substance addiction directly and indirectly disrupts sleep architecture, particularly with stimulants and alcohol, increasing nighttime awakenings and reducing sleep quality. Fernandez-Mendoza et al. (31) noted that adolescents with a substance use history exhibit elevated systemic inflammation and HPA axis hyperactivity, both sleep-disrupting factors. Pathophysiologically, addictive substances (especially opioids and stimulants) alter dopamine and serotonin levels, impairing natural sleep processes (40). Yuksel

Table 6. Firth logistic regression model to assess the impact of study variables on the odds of sleep quality disorder.

Variable		Odds ratio	95% CL (lower)	95% CL (upper)	p-value
Age (years)		2.47	0.08	75.94	0.606
Gender	Girls	1	-		0.633
	Boys	0	0	3.18E+10	
Educational level	First stage of secondary school	1	-		0.96
	Second stage of secondary school	5.47	0	2.54E+29	
Addiction	Negative	1	-		0.966
	Positive	4.27	0	9.32E+29	
Addiction in parents	Negative	1	-		0.788
	Positive	0	0	2.21E+24	
Hospitalization history	Negative	1	-		0.937
	Positive	12.65	0	2.3E+28	
Medication consumption	Negative	1	-		0.92
	Positive	27.29	0	2.93E+29	
Self-harm method	Pill ingestion		-		0.893
	Wrest cutting	0.01	0	1.71E+25	

CL: Confidence limit.

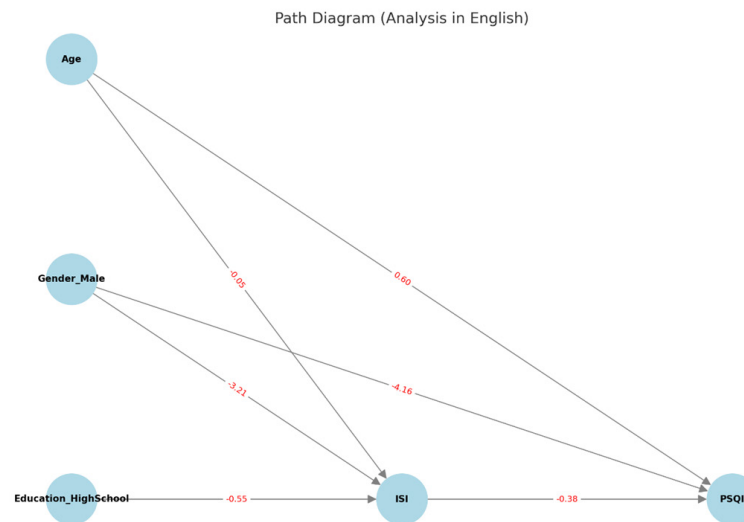


Figure 1. Pathway Analysis of the impact of the main study variables on insomnia severity and sleep quality questionnaire scores. PSQI: Pittsburgh Sleep Quality Index, ISI: Insomnia Severity Index.

et al. (24) highlighted psychological factors, as substance-using adolescents often experience vicious cycles of anxiety, depression, and sleep disturbances. However, some insomnia symptoms may temporarily improve during withdrawal, although this improvement is often unstable (20). A history of substance use may influence the severity of insomnia through neurological, psychological, and physiological changes, necessitating integrated pharmacological and psychological interventions.

The present study found that mild insomnia severity was significantly higher among adolescents without a history of parental substance use than among those with such a history. Other insomnia levels and sleep quality did not show significant differences. This may reflect the environmental, psychological, and genetic factors linking parental substance use to adolescent sleep quality and insomnia severity. Previous studies have supported this relationship. Uccella et al. (34) explained that adolescents with substance-using parents face greater sleep problems due to chronic family stress, household instability, and adverse childhood experiences. Basu et al. (39) found that these adolescents exhibit more irregular sleep patterns and poorer sleep quality, associated with anxiety, rumination, and HPA axis hyperactivity. Pathophysiologically, chronic stress from dysfunctional family environments elevates cortisol and other stress hormones, directly disrupting sleep-wake cycles (23). Edwards et al. (41) suggested genetic predispositions may also play a role, as these adolescents may inherit greater susceptibility to insomnia. Psychologically, lack of emotional support and chronic insecurity may exacerbate insomnia, with some adolescents adopting unhealthy parental sleep habits (38). However, supportive environments and psychological interventions may mitigate these effects (42). Overall, parental substance use may influence adolescent insomnia severity through environmental, psychological, and genetic pathways, highlighting the need for family centered interventions.

The present study found that different self-harm mechanisms were associated with varying insomnia severity patterns. Adolescents using specific methods (e.g., wrist-cutting or pill ingestion) exhibited different insomnia severity levels. This suggests that self-harm mechanisms may reflect distinct psychological and pathophysiological features linked to insomnia severity. Previous studies support this association. Nguyen et al. (20) found that aggressive self-harm methods (e.g., cutting) correlate with more severe and persistent insomnia. Zhou et al. (43) identified poor sleep quality and anxiety symptoms as mediators between self-harm experiences and insomnia severity, with emotional dysregulation exacerbating sleep disturbances. Pathophysiologically, self-harm may transiently reduce stress via dopamine-driven reward system activation, but ultimately perpetuates sleep-disrupting cycles (10). Pill ingestion for self-harm may further destabilize sleep through drug side effects and metabolic changes (44). Khazaie et al. (10) emphasized the interplay between psychological (e.g., emotional regulation) and physiological (e.g., HPA axis hyperactivity) factors in the

sleep-self-harm relationship. However, the self-harm mechanism alone may not predict insomnia severity, with anxiety severity, depression, and social support also playing key roles (45). Overall, different self-harm mechanisms may influence insomnia severity through distinct psychological and biological pathways, underscoring the need for tailored sleep intervention.

Study Limitations

This study adds to the literature by specifically characterizing sleep patterns in adolescents engaged in self-harm in an Iranian context, where data are limited. However, the small sample size and cross-sectional nature of this study limit causal inference. Future longitudinal and large-scale studies are needed to confirm these associations and evaluate interventions.

These findings underscore the importance of targeted sleep interventions, such as cognitive-behavioral therapy for insomnia (CBT-I), stress management techniques, and sleep hygiene education integrated within mental health services for this vulnerable population. Early identification and management of sleep problems may reduce the burden of suicidal behaviors among adolescents.

Conclusion

This study highlights the high prevalence and severity of sleep disturbances, especially insomnia, among adolescents with self-harming behaviors and suicidal ideation. Age, gender, education level, and chronic medical conditions significantly influence sleep quality and insomnia severity in this population. The findings emphasize the necessity of integrating comprehensive sleep assessments and interventions into adolescent mental health services, particularly targeting those at risk of self-injury and suicide. Evidence-based approaches, such as CBT-I, sleep hygiene education, and stress management, should be prioritized. Further research using larger sample sizes and longitudinal designs is needed to establish causal relationships and develop effective sleep-focused interventions to reduce self-harm and suicide risk in adolescents.

Ethics

Ethics Committee Approval: The study protocol was approved by the Research Ethics Committee of Kerman University of Medical Sciences (approval code: 402000337/IR.KMU.AH.REC.1402.104, date: 02.08.2025).

Informed Consent: Written informed consent was obtained from the guardians of all participants.

Footnotes

Authorship Contributions

Concept: M.Y., F.J., Design: M.Y., F.J., Data Collection or Processing: S.V.S., Analysis or Interpretation: S.V.S., Literature Search: L.S., Writing: L.S.

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