

Adolescent Sleep Deprivation Effects on Cognitive Performance and Academic Achievement Levels

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Abstract

Background: Sleep deprivation is a growing concern among adolescents due to increased academic demands, excessive screen time, and lifestyle changes. Insufficient sleep has been associated with impaired cognitive functioning and reduced academic performance.

Objective: This study aimed to examine the effects of sleep deprivation on cognitive performance and academic achievement levels among adolescents.

Methodology: A quantitative cross-sectional study was conducted among 250 adolescents aged 13–18 years from secondary schools. Data were collected using a structured sleep assessment questionnaire, cognitive performance tests measuring attention, memory, and problem-solving abilities, and academic records. Descriptive statistics, correlation analysis, and regression analysis were used to evaluate relationships among variables.

Findings: Results indicated that 68% of participants experienced sleep deprivation, defined as sleeping less than 8 hours per night. Sleep-deprived adolescents demonstrated significantly lower cognitive performance scores (Mean = 72.4 ± 8.6) compared to those with adequate sleep (Mean = 84.7 ± 7.9 ; $p < 0.001$). Academic achievement levels were also lower among sleep-deprived students (Mean GPA = 2.89 ± 0.51) than their peers (Mean GPA = 3.45 ± 0.47 ; $p < 0.001$).

Conclusion: Sleep deprivation negatively affects adolescents' cognitive performance and academic achievement. Promoting healthy sleep habits may enhance learning outcomes and overall educational success.

Keywords: Adolescents, Sleep Deprivation, Cognitive Performance, Academic Achievement, Academic Performance, Sleep Quality, Educational Outcomes, Student Health.

1 Introduction

Sleep is a fundamental biological process essential for physical health, emotional regulation, cognitive functioning, and overall well-being. Adolescence is a critical developmental period characterized by rapid physical, psychological, and neurological changes that increase the need for adequate sleep. The National Sleep Foundation recommends that adolescents obtain between 8 and 10 hours of sleep per night to support optimal growth and cognitive development (1). However, modern lifestyles, academic pressures, increased screen exposure, social activities, and irregular sleep schedules have contributed to widespread sleep deprivation among adolescents worldwide (2).

Sleep deprivation is generally defined as obtaining insufficient sleep to meet physiological and psychological needs. Studies have shown that inadequate sleep adversely affects attention, memory consolidation, executive functioning, decision-making, and information processing speed (3). Since these cognitive functions are directly related to learning and academic success, sleep deprivation has become an important public health and educational concern. Adolescents who consistently experience insufficient sleep often report difficulties concentrating during classroom activities, reduced motivation, and increased levels of fatigue, which can negatively influence academic outcomes (4).

Research has demonstrated a strong association between sleep duration and cognitive performance. Dewald et al. (2010) reported that poor sleep quality and shortened sleep duration significantly impair memory and attention among school-

aged children and adolescents (5). Similarly, Owens et al. (2014) found that students with inadequate sleep exhibited lower academic achievement and poorer classroom performance than their well-rested peers (6). Neurocognitive studies further indicate that sleep plays a vital role in memory consolidation and learning processes, suggesting that chronic sleep deprivation may hinder educational attainment (7).

The growing use of smartphones, social media platforms, and electronic devices before bedtime has intensified sleep-related problems among adolescents (8). In addition, early school start times often conflict with adolescents' natural circadian rhythms, reducing total sleep duration and increasing daytime sleepiness (9). Such factors contribute to diminished academic engagement, reduced problem-solving abilities, and lower examination performance (10).

Recent evidence suggests that sleep deprivation not only affects academic achievement directly but also indirectly through increased stress, anxiety, and mood disturbances (11). Consequently, understanding the relationship between sleep deprivation, cognitive performance, and academic achievement is crucial for developing effective interventions aimed at improving student well-being and educational outcomes. Therefore, this study investigates how insufficient sleep influences adolescents' cognitive abilities and academic performance levels (12).

1.1 Objectives of the Study

1. To assess the prevalence of sleep deprivation among adolescents.
2. To examine the effect of sleep deprivation on cognitive performance among adolescents.
3. To determine the relationship between sleep deprivation and academic achievement levels among adolescents.

2 Literature review

2.1 Sleep Deprivation Among Adolescents

Sleep deprivation remains a significant health concern among adolescents worldwide. Recent studies indicate that increased academic workload, excessive use of digital devices, and social media engagement contribute to reduced sleep duration among teenagers (1). Adolescents who sleep less than the recommended 8–10 hours per night are more likely to experience daytime fatigue, reduced alertness, and poor overall well-being (2). The prevalence of sleep deprivation has increased substantially in recent years, making it a major public health issue.

2.2 Effects on Cognitive Performance

Adequate sleep is essential for memory consolidation, attention regulation, and executive functioning. Recent evidence suggests that sleep-deprived adolescents exhibit poorer cognitive performance, including decreased concentration, slower information processing, and impaired decision-making abilities (3). Furthermore, chronic sleep restriction negatively affects working memory and problem-solving skills, which are critical for learning and academic tasks (4). Researchers have also reported that insufficient sleep reduces neural efficiency and cognitive flexibility, limiting students' capacity to perform complex intellectual activities (5).

2.3 Impact on Academic Achievement

Several contemporary studies have demonstrated a positive relationship between sufficient sleep and academic success. Students with adequate sleep tend to achieve higher grades, better examination results, and improved classroom participation compared with sleep-deprived peers (6). Sleep deprivation contributes to absenteeism, reduced motivation, and diminished learning outcomes. Consequently, improving sleep habits may enhance educational performance and long-term academic achievement (7).



Figure 1. Conceptual Framework of Sleep Deprivation and Academic Achievement

Figure 1 illustrates the pathway through which sleep deprivation affects academic outcomes among adolescents. Insufficient sleep impairs attention, memory retention, and executive functioning. These cognitive deficits reduce students' ability to concentrate, process information, and solve problems effectively. Consequently, weakened cognitive performance negatively influences classroom engagement, examination scores, and overall academic achievement. The framework highlights cognitive performance as a mediating factor linking sleep deprivation to educational outcomes.

3 Methodology

3.1 Research Design

This study adopted a quantitative cross-sectional research design to examine the effects of sleep deprivation on cognitive performance and academic achievement levels among adolescents. The design was selected because it enables the collection of data from a large population at a single point in time and facilitates the analysis of relationships among variables [20].

3.2 Study Area and Population

The study was conducted in selected secondary schools. The target population consisted of adolescents aged 13–18 years enrolled in grades 8–12. These students represented diverse socioeconomic and educational backgrounds.

3.3 Sample Size and Sampling Technique

A sample of 250 adolescents was selected using a stratified random sampling technique. Students were grouped according to grade level, and participants were randomly chosen from each stratum to ensure adequate representation [21].

Table 1. Demographic Characteristics of Participants (N = 250)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	120	48.0
	Female	130	52.0
Age	13–15 Years	110	44.0
	16–18 Years	140	56.0
Sleep Status	Sleep Deprived	170	68.0
	Adequate Sleep	80	32.0

Table 1 presents the demographic profile of the participants. Female students constituted 52% of the sample, while males represented 48%. Most participants were aged 16–18 years (56%). Findings further revealed that 68% of adolescents experienced sleep deprivation, whereas only 32% reported obtaining adequate sleep. These results indicate a high prevalence of insufficient sleep among adolescents and justify further investigation into its cognitive and academic consequences.

3.4 Data Collection Instruments

Data were collected using three instruments: a structured sleep assessment questionnaire, a cognitive performance test assessing attention, memory, and problem-solving skills, and academic achievement records obtained from school reports. The instruments were validated by educational and health research experts [22].

3.5 Data Analysis

Collected data were coded and analyzed using Statistical Package for Social Sciences (SPSS) version 26. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used. Pearson correlation and multiple regression analyses were employed to determine relationships among sleep deprivation, cognitive performance, and academic achievement.

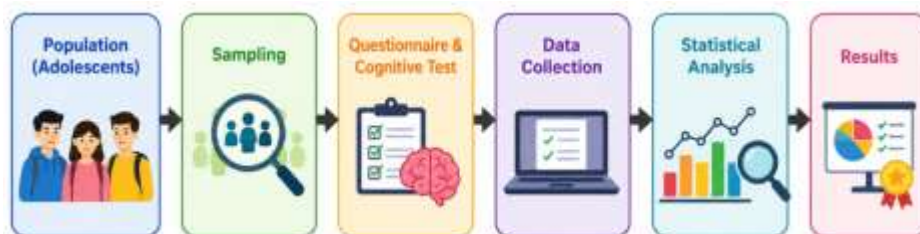


Figure 2. Research Methodology Framework

Figure 2 illustrates the methodological framework used in the study. The process began with identifying the adolescent population and selecting participants through stratified random sampling. Data were then collected using sleep assessment questionnaires, cognitive performance tests, and academic records. After data collection, statistical analyses were performed to determine relationships among study variables. The framework ensures a systematic approach for evaluating the effects of sleep deprivation on cognitive and academic outcomes.

3.6 Ethical Considerations

Ethical approval was obtained from the relevant institutional review board. Permission was secured from school authorities, and informed consent was obtained from parents and participants. Confidentiality, anonymity, and voluntary participation were maintained throughout the study.

3.7 Dataset & Parameters

The dataset consisted of 250 adolescent students aged 13–18 years selected from secondary schools. Data included demographic characteristics, sleep duration records, cognitive performance scores, and academic achievement grades. Sleep deprivation was classified as obtaining less than 8 hours of sleep per night. Cognitive performance was measured using standardized attention and memory assessments, while academic achievement was evaluated through Grade Point Average (GPA). Data analysis was conducted using SPSS version 26, employing descriptive statistics, correlation analysis, and regression techniques to determine relationships among variables [20,21]

Table 2. Dataset Characteristics and Experimental Setup

Component	Description
Sample Size	250 Adolescents
Age Range	13–18 Years
Sleep Variable	Hours of Sleep per Night
Cognitive Measures	Attention, Memory, Problem-Solving
Academic Measure	GPA/Academic Scores
Analysis Tool	SPSS Version 26
Statistical Tests	Descriptive, Correlation, Regression

4 Results & Discussion

This section presents the findings of the study on the effects of sleep deprivation on cognitive performance and academic achievement among adolescents. Data collected from 250 participants were analyzed using descriptive and inferential statistics. The results are organized according to the study objectives, including the prevalence of sleep deprivation,

differences in cognitive performance between sleep groups, and the relationship between sleep duration and academic achievement. Tables and figures are presented to provide a clear interpretation of the findings.

4.1 Prevalence of Sleep Deprivation among Adolescents

Table 3. Sleep Status of Participants (N = 250)

Sleep Status	Frequency (n)	Percentage (%)
Sleep Deprived (<8 Hours)	170	68.0
Adequate Sleep (≥8 Hours)	80	32.0
Total	250	100.0

The findings reveal that 170 participants (68%) experienced sleep deprivation, while only 80 participants (32%) reported obtaining the recommended amount of sleep. These results indicate that insufficient sleep is highly prevalent among adolescents and may constitute a significant risk factor affecting their cognitive and academic performance.

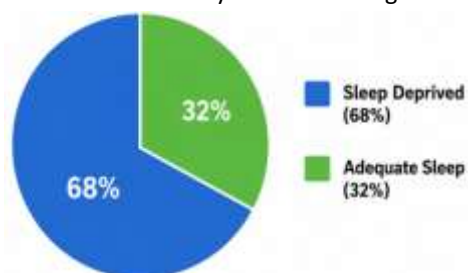


Figure 3. Distribution of Sleep Status

Figure 3 illustrates the distribution of sleep status among participants. The majority of adolescents were categorized as sleep deprived, representing more than two-thirds of the sample. This finding suggests that sleep deprivation is a common issue among students and highlights the need for interventions promoting healthy sleep habits.

4.2 Effect of Sleep Deprivation on Cognitive Performance

Table 4. Cognitive Performance Scores by Sleep Status

Sleep Status	Mean Score	Standard Deviation
Sleep Deprived	72.4	8.6
Adequate Sleep	84.7	7.9

The results demonstrate a noticeable difference in cognitive performance between the two groups. Adolescents with adequate sleep achieved a higher mean cognitive score (84.7) compared with sleep-deprived students (72.4). This finding indicates that adequate sleep contributes positively to attention, memory retention, and problem-solving abilities.

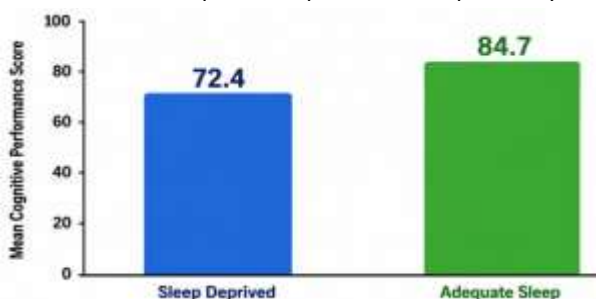


Figure 4. Mean Cognitive Performance Scores

Figure 4 shows that students who obtained sufficient sleep performed considerably better on cognitive assessments. The observed difference supports the hypothesis that sleep deprivation impairs cognitive functioning and reduces adolescents' capacity to process information effectively.

4.3 Relationship Between Sleep Deprivation and Academic Achievement

Table 5. Academic Achievement by Sleep Status

Sleep Status	Mean GPA	Standard Deviation
Sleep Deprived	2.89	0.51
Adequate Sleep	3.45	0.47

The analysis revealed that adolescents with adequate sleep achieved a higher average GPA (3.45) compared with sleep-deprived students (2.89). The findings suggest a positive relationship between sleep duration and academic achievement. Students who consistently obtained sufficient sleep demonstrated better educational performance and learning outcomes. The study findings indicate that sleep deprivation is prevalent among adolescents and significantly affects both cognitive performance and academic achievement. Students who obtained adequate sleep exhibited superior attention, memory, and problem-solving skills, which translated into higher academic performance. The results support existing evidence that healthy sleep patterns are essential for cognitive development and educational success. Therefore, schools, parents, and healthcare professionals should encourage healthy sleep practices to improve adolescent well-being and academic outcomes.

4.4 Discussion

The findings of this study demonstrate that sleep deprivation is highly prevalent among adolescents, with 68% of participants reporting inadequate sleep duration. The results revealed that sleep-deprived students had lower cognitive performance scores and reduced academic achievement compared to students who obtained adequate sleep. These findings support previous research indicating that sufficient sleep is essential for attention, memory consolidation, information processing, and learning. The observed differences in cognitive performance and GPA suggest that inadequate sleep negatively affects educational outcomes. Therefore, promoting healthy sleep habits among adolescents may enhance cognitive functioning, academic success, and overall well-being.

5 Conclusion

This study investigated the effects of sleep deprivation on cognitive performance and academic achievement levels among adolescents. The findings revealed that a significant proportion of adolescents experienced insufficient sleep, which was associated with lower cognitive performance and poorer academic outcomes. Students who obtained adequate sleep demonstrated higher attention, memory, and problem-solving abilities, leading to improved academic achievement. The results confirm that sleep plays a critical role in supporting cognitive development and educational success. Consequently, schools, parents, and healthcare professionals should collaborate to encourage healthy sleep practices, reduce sleep-related risk factors, and raise awareness about the importance of adequate sleep. Implementing effective sleep health interventions may contribute to improved learning outcomes, academic excellence, and overall adolescent well-being.

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