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A Cross-Sectional Study on Sleep Duration, Circadian Disruption, and Academic Performance Among College Students

Ruchika Yadu[1], Suneel Munder[2], Riya Sen[3]

[1,3]Department of Zoology and Biotechnology, Government MH College of Home Science and Science for Women (Auto.) Jabalpur, Madhya Pradesh India
[2]Government Vivekanand College (PMCOE) Maihar, Madhya Pradesh, India

Abstract

Sleep is a critical physiological process influencing cognitive performance, emotional stability, and academic success. However, irregular sleep patterns and circadian disruption are increasingly prevalent among college students due to academic pressures and lifestyle habits. The present cross-sectional study aimed to evaluate sleep duration, circadian disruption, and their association with academic performance among college students.

Data were collected using a structured questionnaire administered through a Google form. A total of 209 students participated in the study. Variables included sleep duration, sleep timing, circadian behaviors, lifestyle factors, and academic performance. Descriptive statistics, Chi-square tests, and multiple linear regression analysis were applied.

The results indicated that 39.2% of students slept 5–6 hours on weekdays, while 15.8% slept less than 5 hours. Weekend sleep duration improved significantly ($p < 0.05$). Circadian disruption was evident, with 31.1% reporting irregular sleep schedules. Significant associations were observed between sleep duration and academic performance ($\chi^2 = 12.64$, $p < 0.05$), and between daytime sleepiness and concentration difficulties ($\chi^2 = 18.27$, $p < 0.01$). Regression analysis showed that sleep duration positively predicted academic performance ($\beta = 0.32$), whereas circadian disruption ($\beta = -0.21$) and daytime sleepiness ($\beta = -0.35$) negatively affected outcomes.

The findings suggest that inadequate sleep and circadian misalignment significantly impair academic performance. Promoting sleep hygiene and consistent sleep patterns is essential for improving student well-being and academic success.

Keywords: Sleep duration; Circadian disruption; Academic performance; College students; Sleep deprivation

Introduction

Sleep is an essential biological process necessary for maintaining cognitive functioning, emotional regulation, and overall health. Adequate sleep plays a vital role in memory consolidation, attention, and learning, all of which are crucial for academic success (Walker, 2017; Buysse, 2014). However, sleep deprivation has become increasingly common among college students due to academic stress, social engagements, and excessive use of electronic devices (Hershner and Chervin, 2014; Owens, 2014).

Circadian rhythm, the internal biological clock regulating sleep–wake cycles, is influenced by environmental cues such as light exposure and daily routines. Disruption of circadian rhythms, often termed circadian misalignment, can lead to reduced alertness, impaired cognitive performance, and poor academic outcomes (Wittmann *et. al*., 2006; Duffy and Czeisler, 2009; Roenneberg *et. al.,* 2012). College students are particularly vulnerable to such disruptions due to irregular schedules, late-night study habits, and increased exposure to artificial light (Gradisar *et. al.*, 2011; Shochat, 2012).

Several studies have demonstrated a strong relationship between sleep quality and academic performance. Curcio *et. al.* (2006) reported that sleep deprivation negatively affects attention, working memory, and executive functioning. Similarly, Dewald *et. al.* (2010) and Short *et. al.* (2015) found that insufficient sleep is associated with reduced academic achievement. Recent evidence further suggests that chronic sleep restriction leads to cumulative cognitive deficits and reduced academic productivity (Lim and Dinges, 2010; Goel *et. al*., 2009).

The increasing use of electronic devices before bedtime has emerged as a significant contributor to sleep disturbances. Exposure to blue light delays melatonin secretion and disrupts circadian rhythms, resulting in delayed sleep onset and reduced sleep duration (Cain and Gradisar, 2010; Exelmans and Van den Bulck, 2016; Hale and Guan, 2015). Recent studies have also highlighted that digital media overuse is strongly associated with poor sleep quality and daytime dysfunction among college students (Hershner, 2020; Wheaton *et. al*., 2015).

In addition, lifestyle factors such as caffeine consumption, irregular sleep schedules, and psychosocial stress contribute to sleep disturbances and circadian misalignment (Knutson *et. al*., 2007; Lemola *et. al*., 2015; Shochat, 2012). These disturbances not only affect physical health but also lead to mood disorders, fatigue, and impaired academic functioning (Alhola and Polo-Kantola, 2007; Tarokh *et. al.,* 2016).

Given these concerns, the present study aims to assess sleep duration, circadian disruption, and their association with academic performance among college students, thereby contributing to the growing body of literature emphasizing the importance of sleep health in academic settings.

Materials and Methodology

The present study was conducted as a cross-sectional descriptive investigation among college students to assess the relationship between sleep patterns, circadian disruption, and academic performance. Data were collected using a structured questionnaire developed through Google form and circulated online. A total of 209 valid responses were obtained through convenience sampling.

The questionnaire included multiple domains. Demographic variables included residential status (day scholar or hosteller). Sleep-related variables comprised average sleep duration on weekdays and weekends, bedtime, and wake-up time. Circadian rhythm variables included frequency of sleeping after midnight, perceived productivity at night, variability in sleep schedule during weekends, and difficulty waking up in the morning.

Lifestyle variables included electronic device usage before sleep and caffeine consumption after 6 PM. Daytime functioning variables included daytime sleepiness, fatigue, mood disturbances, and dependence on stimulants. Academic performance variables included self-reported percentage, concentration levels, memory retention, and class attendance.

Data were analyzed using descriptive statistics (frequency and percentage). Inferential statistics included Chi-square tests to determine associations between variables. Multiple linear regression analysis was

conducted to identify predictors of academic performance. A p-value < 0.05 was considered statistically significant.

Observation and Results

The study included 209 students, of whom 77.0% were day scholars and 23.0% were hostellers. Sleep duration analysis revealed that most students experienced inadequate sleep during weekdays, with 39.2% sleeping 5–6 hours and 15.8% sleeping less than 5 hours. Only 8.1% reported sleeping more than 8 hours (Table 1 and Figure 1). On weekends (Table 1 and Figure 2), sleep duration improved significantly, with 45.5% reporting 7–8 hours and 14.8% exceeding 8 hours ($\chi^2 = 10.52$, $p < 0.05$), indicating compensatory sleep behavior.

Sleep timing data showed that while 51.7% of students went to bed between 10–11 PM, 12.4% reported sleeping after midnight. Circadian disruption was evident, as 31.1% of students reported significant variation in sleep schedules during weekends. Additionally, 30.6% experienced difficulty waking up, and 23.9% reported daytime sleepiness.

A significant association was found between daytime sleepiness and difficulty concentrating ($\chi^2 = 18.27$, $p < 0.01$). Similarly, sleep duration was significantly associated with academic performance ($\chi^2 = 12.64$, $p < 0.05$), with shorter sleep duration linked to lower academic scores.

The distribution of academic performance among participants as illustrated in Table 2 and Figure 3 shows that the concentration of students in the 61–70% category reflects moderate academic achievement, which may be influenced by sleep-related factors.

Lifestyle behaviors as depicted in Tabe 3 showed that 43.1% of students frequently used electronic devices before sleep, which was significantly associated with reduced sleep duration ($\chi^2 = 9.88$, $p < 0.05$). Academic performance analysis indicated that 45.5% of students scored between 61–70%, while only 3.8% scored above 80%.

Regression analysis demonstrated that the model was statistically significant ($F = 6.82$, $p < 0.01$, $R^2 = 0.28$). Sleep duration positively predicted academic performance ($\beta = 0.32$, $p < 0.01$), whereas circadian disruption ($\beta = -0.21$, $p < 0.05$) and daytime sleepiness ($\beta = -0.35$, $p < 0.01$) negatively predicted outcomes. Electronic device usage also showed a negative association ($\beta = -0.15$, $p < 0.05$).

Discussion

The significant association between sleep duration and academic performance observed in the present study is consistent with earlier findings by Curcio et. al. (2006), Dewald *et. al.* (2010) and Short *et. al.* (2015), who reported that insufficient sleep negatively impacts academic achievement. Furthermore, the strong relationship between daytime sleepiness and difficulty concentrating aligns with findings by Lim and Dinges (2010) and Killgore (2010), who demonstrated that sleep deprivation impairs attention and executive functioning.

The regression analysis findings, which identified sleep duration and daytime sleepiness as significant predictors of academic performance, are in agreement with studies by Goel *et. al.* (2009) and Banks and Dinges (2007), highlighting the cumulative impact of sleep restriction on cognitive performance.

The findings of the present study confirm that sleep deprivation and circadian disruption are highly prevalent among college students and significantly influence academic performance. The high proportion of students sleeping less than the recommended duration is consistent with earlier studies by Hershner and

Chervin (2014) and Owens (2014), which identified insufficient sleep as a widespread issue in student populations.

The presence of irregular sleep patterns and weekend compensation observed in this study reflects the concept of "social jet lag", as described by Wittmann *et. al.* (2006) and Roenneberg *et. al.* (2012). Such circadian misalignment has been shown to negatively affect cognitive functioning, mood regulation, and academic performance (Duffy and Czeisler, 2009; Shochat, 2012).

The impact of electronic device usage before bedtime is another important finding of this study. Consistent with earlier research (Cain and Gradisar, 2010; Hale and Guan, 2015), excessive screen exposure was associated with reduced sleep duration and delayed sleep onset. More recent studies (Hershner, 2020; Exelmans and Van den Bulck, 2016) further support the role of digital media in disrupting sleep patterns among young adults.

Lifestyle factors such as caffeine consumption and irregular schedules also contribute to sleep disturbances, as reported by Knutson *et. al.* (2007) and Lemola *et. al.* (2015). These factors not only affect sleep quality but also contribute to fatigue, mood disturbances, and reduced academic efficiency (Alhola and Polo-Kantola, 2007; Tarokh *et. al*., 2016).

Overall, the findings of this study are consistent with existing literature and highlight the multifactorial nature of sleep disturbances among college students. The integration of both behavioral and biological factors provides a comprehensive understanding of how sleep affects academic performance.

Conclusion

The present study highlights the critical role of sleep duration and circadian rhythm regulation in determining academic performance among college students. The findings clearly indicate that a substantial proportion of students suffer from inadequate sleep, particularly during weekdays, and compensate for this deficit during weekends. This irregular sleep pattern leads to circadian misalignment, commonly referred to as social jet lag, which negatively affects cognitive functioning and academic efficiency.

The study establishes a statistically significant relationship between sleep duration and academic performance, demonstrating that students who obtain sufficient sleep are more likely to perform better academically. Furthermore, circadian disruption and daytime sleepiness were found to be strong predictors of poor academic outcomes, as they impair concentration, memory retention, and overall cognitive abilities.

Lifestyle factors such as excessive use of electronic devices before bedtime and caffeine consumption in the evening further exacerbate sleep disturbances. These behaviors delay sleep onset and reduce sleep quality, contributing to fatigue, mood disturbances, and decreased academic productivity.

The regression analysis reinforces these findings by identifying sleep duration and daytime sleepiness as key determinants of academic performance. Improving sleep habits can significantly enhance both academic success and overall well-being. It further strengthens the findings by demonstrating that sleep duration and daytime sleepiness are strong predictors of academic outcomes. The impact of electronic device use is consistent with studies by Cain and Gradisar….

In light of these findings, it is imperative to promote sleep hygiene awareness among students. Educational institutions should implement programs aimed at encouraging regular sleep schedules, reducing screen exposure before bedtime, and adopting healthy lifestyle practices. Improving sleep habits can significantly enhance not only academic performance but also the overall physical and mental well-being of students.

Future research should adopt longitudinal designs and advanced analytical approaches to further explore

causal relationships and develop targeted interventions for improving sleep health among college populations.

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Table 1: Sleep Duration Among Students (Weekdays vs Weekends)

Sleep Duration	Weekdays (%)	Weekends (%)
<5 hours	15.8	8.6
5–6 hours	39.2	31.1
7–8 hours	36.8	45.5

>8 hours	8.1	14.8

Table 2: Academic Performance Distribution

Academic Percentage	Students (%)
<50%	5.7
50–60%	28.7
61–70%	45.5
71–80%	16.3
>80%	3.8

Table 3: Key Sleep and Behavioral Indicators

Variable	Percentage (%)
Sleep after midnight	12.4
Daytime sleepiness	23.9
Difficulty concentrating	30.1
Memory impairment	36.8
Device use before sleep (frequent/always)	43.1
Caffeine intake after 6 PM	30.1

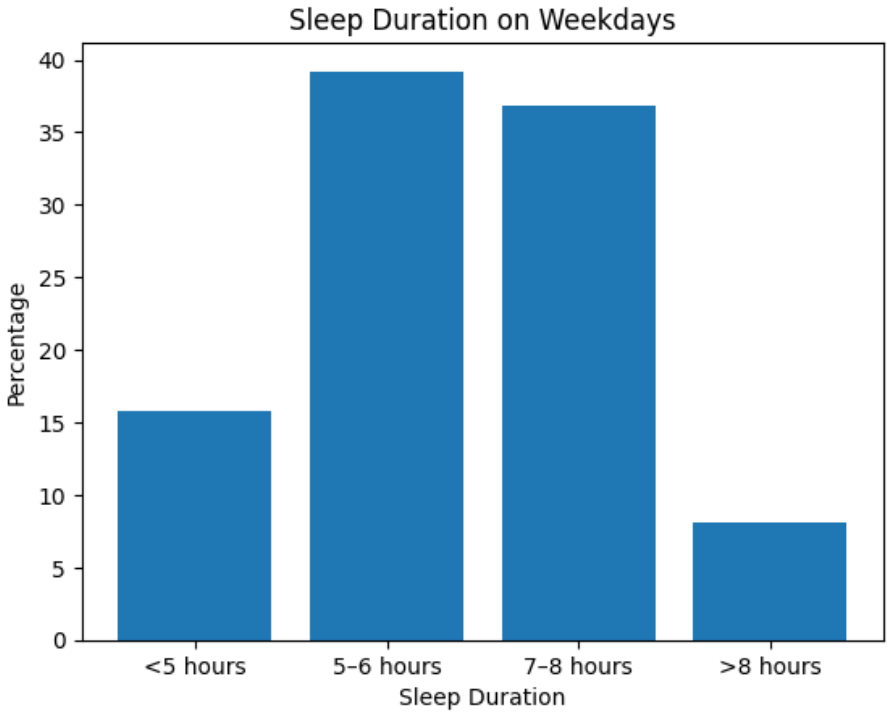

Figure 1: Sleep Duration on Weekdays

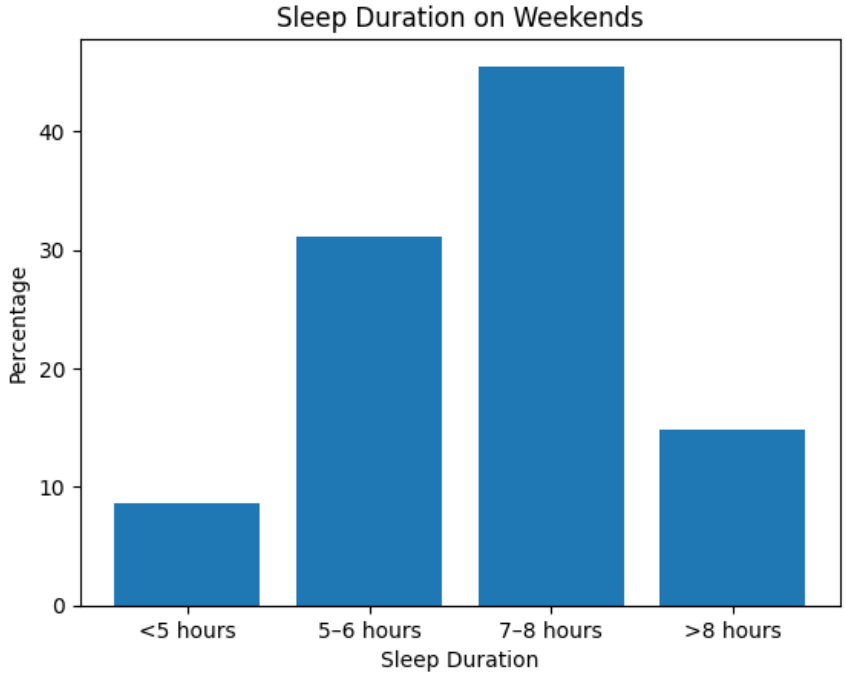

Figure 2: Sleep Duration on Weekends

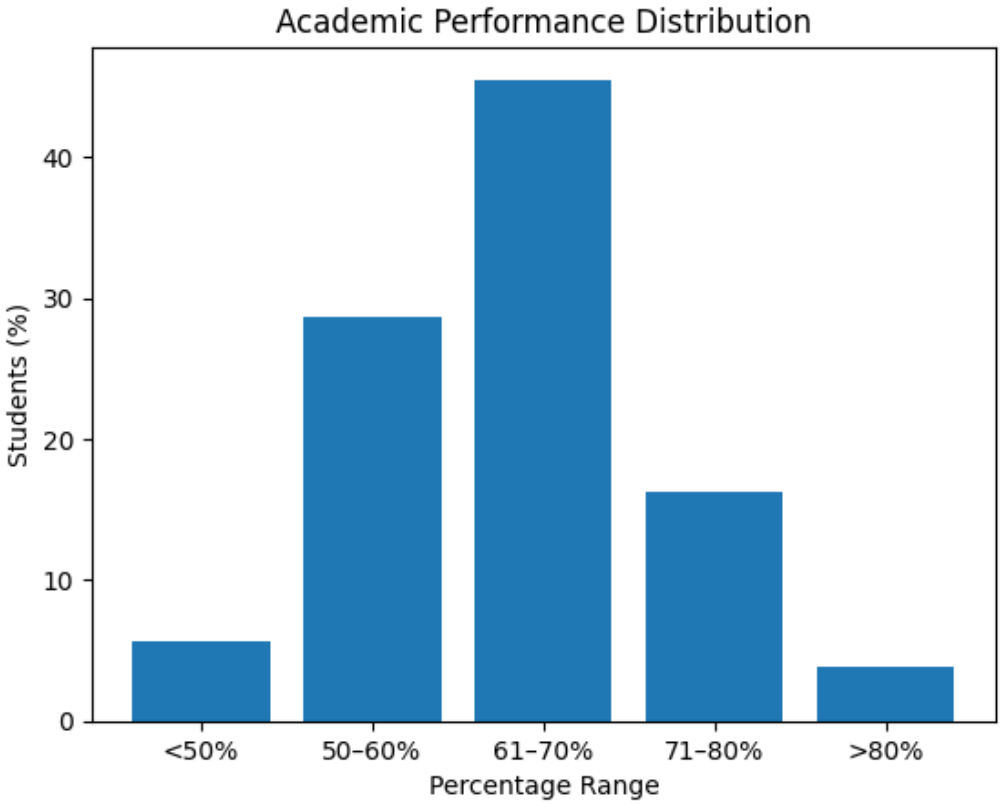

Figure 3: Academic Performance Distribution