Relationship between sleep deprivation and academic performance of university students

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Abstract
This study investigates the relationship between sleep deprivation and academic performance among undergraduate students in public universities of Islamabad. The objective was to explore how sleep deprivation relates to academic performance. Data was collected through a self-developed questionnaire designed with a Five-Point Likert scale. The questionnaire gathered information on sleep deprivation and examined the GPA of students. Using simple random sampling, the study involved a diverse group of students. Chi-square analysis was applied to the collected data to determine the relationships between the variables. The results indicated no direct relationship between sleep deprivation and academic performance. However, researching deeper into specific sub-variables, it became obvious that sleeping schedule significantly impacted academic outcomes, while other aspects of sleep such as sleeping difficulties and drowsiness did not show a significant association with academic performance. These findings suggest that while overall sleep deprivation may not directly influence academic performance, specific aspects of these variables can have a notable impact. This study highlights the complexity of factors affecting academic success and underscores the importance of considering sub-variables in educational research. This highlights the importance of addressing sleep-related challenges to enhance students' overall academic achievements.
Keywords: Sleep deprivation, academic performance, university students, undergraduates

Introduction

Sleep deprivation refers to the condition where an individual constantly fails to obtain enough sleep, in terms of duration or quality. It occurs when the amount of sleep obtained falls significantly below the recommended hours necessary for the health and functioning of the human body. While the ideal sleep duration varies by age and individual, most adults require almost 7 to 8 hours of continuous sleep per night to maintain physical, mental, and emotional well-being.

Sleep deprivation is a broad concept that includes a state of insufficient sleep, which may arise from intentional or unavoidable sleeplessness, as well as ongoing sleep-related issues. Sleep is as vital to the human body as sustenance and hydration, yet a significant portion of the population does not receive an adequate amount. Among students worldwide, complaints of sleep disturbances are widespread, often attributable to heightened stress levels stemming from escalating academic demands (Pascoe et al., 2020).

Factors contributing to sleep deprivation include lifestyle choices, such as staying up late, irregular sleep schedules, and excessive use of electronic devices before bedtime. Additionally, work-related demands, stress, medical conditions, and environmental factors can disrupt sleep patterns. Continuing sleep deprivation can have serious consequences on various aspects of health, including cognitive performance, mood regulation, immune function, and overall quality of life.

Furthermore, busy schedules, recent social opportunities, and sudden changes in the sleeping environment can serve as additional contributing factors (Haile, Alemu, & Habtewold, 2017). Sleep is an essential component for human survival, influencing their ability to perform daily tasks effectively. Much like other species, humans structure their daily routines around a 24-hour cycle, and this organization is influenced by both internal and external factors. It is widely recognized that individuals sleep patterns and experiences of sleeplessness depend on factors such as age, professional demands, physiological and psychosocial characteristics, mental health conditions, and potentially, certain medical conditions.

Beyond sleep consistency, the quality of sleep is significantly linked to academic performance (Ribeiro, Sobral, Coelho, Pires & Rodrigues, 2023). The Pittsburgh Sleep Quality Index, a widely employed measure, encompasses factors such as optimal sleep-wake routines, duration of sleep, time taken to fall asleep, frequency of awakenings, and subjective assessment of sleep depth to define sleep quality. Among college students, there is a prevalent issue of poor sleep quality, with individuals from minority and disadvantaged backgrounds often experiencing more severe and persistent problems with sleep quality (Carnethon & Johnson, 2019).

According to Nishida, Okano, Ichinose, Suyama, Youn (2023), the sleep-wake cycle is a natural rhythm that the body autonomously establishes, roughly aligning with 24 hours in adults. Consequently, individuals tend to adhere to fairly consistent routines. This cycle is synchronized with other crucial sleep patterns, including deep body temperature fluctuations and regular cell mitosis. Abrupt alterations in sleep schedules can disrupt this internal coordination among sleep patterns, potentially leading to adverse effects such as insomnia, attention deficits, and a decline in performance. These consequences are commonly observed in shift workers and individuals who rapidly traverse time zones or engage in irregular work shifts. In the case of college students Ribeiro et al. (2023) found that each additional day per week with disruptions in sleep or dreams elevates the likelihood of students dropping a course by 14 percent and lowers their GPA (grade point average) by roughly 0.02 points.

The capacity of students to attain sufficient sleep is influenced by the phase delay in adolescents' sleep beginning and the sensitive inconsistency in their sleep schedules. This shift in sleep patterns usually starts in the teenage years and continues into the twenties. According to the International Classification of Sleep Disorders, issues like dyssomnias, parasomnias, and various medical and psychological disorders, which are often overlooked, can cause problems with students' sleep. As a result, students might turn to medications to deal with these issues. Sleep is a fundamental psychological process crucial for human well-being and proper functioning (Lawson, Wellens-Mensah & Nantogma, 2019). The Suprachiasmatic Nucleus (SCN) regulates the production of melatonin, a hormone that induces sleep, especially during the night (Ma & Morrison, 2020). Environmental cues, particularly light, are influenced by physiological systems that adhere to a circadian rhythm, including the sleep-wake cycle, body temperature fluctuations, and hormone releases (Kaliyaperumal, Elango, Alagesan & Santhanakrishanan, 2017).

The study conducted by Al Salmani et al. (2020) reveals a high incidence of sleep-related issues, particularly narcolepsy, restless leg syndrome, insomnia, and obstructive sleep apnea while sleepwalking and nightmares were less common. Among most students, various forms of sleep disturbances were observed. Interestingly, women tended to report more sleep disturbances than men (Buboltz Jr, Brown & Soper, 2001). The cross-sectional study highlights a notable association between sleep disorders and lower grade point averages (GPAs), especially among female students, suggesting a gender-specific vulnerability. The findings underscore the importance of addressing sleep health in the academic context to enhance student well-being and performance.

Numerous investigations have been required to determine the frequency of sleep disorders in college students. Specifically, conditions such as insomnia, restless leg syndrome (RLS), circadian rhythm disorders

(CRDs), affective disorders, narcolepsy, and obstructive sleep apnea (OSA) are commonly cited in studies focused on college student populations (Al Salmani, Al Shidhani, Al Qassabi, Al Yaaribi & Al Musharfi, 2020). Previous studies indicate that the prevalence of insomnia among college students is approximately 69% (Leong, Liew & Shin, 2023). Meanwhile, conditions such as CRD (19.6%), mood disorders (14.5%), nightmares (6.6%), somnolence (5.7%), and narcolepsy (1.3%) are rare (Abdulah & Piro, 2018).

Sleep consistency, rather than the total duration of sleep, appears to be a consistently robust indicator of academic performance in college students (Okano, Kaczmarzyk, Dave, Gabrieli & Grossman2019). The study by Okano et al. (2020) demonstrated that the duration, regularity, and quality of sleep in the month and week leading up to an academic test were associated with higher grades and explained almost 25 percent of the variation in academic performance.

Poor sleep quality among these students is a significant predictor of reduced academic performance. To summarize, adequate sleep is crucial for optimal cognitive functioning. The consistency of sleep patterns and self-reported sleep quality exhibit the strongest correlations with academic achievement. While it is generally believed that adults require approximately 8 hours of sleep per day, the sleep patterns of young adults differ from those of older adults in several aspects, including the need for extended sleep. Nevertheless, there are variations among individuals, with some people (referred to as 'long sleepers') requiring more than 9 hours of sleep, while others (referred to as 'short sleepers') function adequately on less than 6 hours.

The objective of this study is mentioned below:

1. To identify the relationship between sleep deprivation and the academic performance of university students.

To accomplish the above objectives, the following hypotheses were tested; there are two directional hypotheses and two null hypotheses (H_1 & H_0).

1. H_1. There is a significant positive relationship between sleep deprivation and the academic performance of university students.
2. H_0. There is no significant relationship between sleep deprivation and the academic performance of university students.

Methodology

The research methodology encompasses research design, target population, sample selection, data collection instruments, and procedural steps employed in gathering study data. Quantitative research methods were used in the study. Exam results are used to measure the quantitative aspect. The research was a survey study and descriptive. It was a correlational study exploring the relationship between sleep deprivation, and academic performance in the universities of Rawalpindi Islamabad. According to

Creswell (2011) correlational research design can be used for relating variables or predicting outcomes. Remembering the finished objective to achieve the destination of the study, the poll review strategy was utilized. A self-structured questionnaire was used as a primary source of gathering information.

Population is an arranged group of people or events from which the specimen is picked and to which the study results will total up (Marion 2004). The population of the study consisted of undergraduate students from the public universities of Islamabad and Rawalpindi.

S #	Universities	Departments	population
1	NUML	BS Phycology	1100
		BS Computer Science	900
2	Comsats	BS Psychology	850
		BS Computer Science	2000
Total	**2**	**4**	**4850**

Table 1: Population table

This study will mainly focus on undergraduate students from. Universities of Islamabad include COMSATS University and NUML University. Two departments from two universities in Islamabad, Department of Psychology and the Department of Computer Sciences.

The sample for this study was selected according to the table provided by L.R Gay, According to L.R Gay, when the population is large then 10% of the population is selected as a sample and when the population is small then 20% of the population is selected as a sample.

S #	Universities	Departments	population	Sample
1	NUML	BS Phycology	1100	110
		BS Computer Science	900	90
2	COMSATS	BS Psychology	850	85
		BS Computer Science	2000	200
Total	**2**	**4**	**4850**	**485**

Table 2: Sample of the study.

A stratified sampling technique was used for the sample selection. Stratified sampling is a sampling technique in which sample proportions are made as population proportions on the stratification variables (Johnson & Christensen, 2012). Stratified sampling is often used when the population is not equal and two or more of the strata in the population have low incidence relative to the other stratum (Gay, 2006).

The researcher adopted the following procedure for the selection of the sample:

a) All the students of undergraduate programs in public universities of Islamabad Rawalpindi.
b) Two departments were selected to gather data (BS Psychology and BS Computer Science).
c) Two universities based on the availability of these two programs in universities were selected as the sample.
d) The students were chosen using the Simple Random Sampling method.

After an extensive literature review regarding the relationship between sleep deprivation and academic performance. A self-structured instrument was designed to gather the data from students. The questionnaire consisted of a five-point Likert scale (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree).

The researcher collected data by using self-developed questionnaire. These questionnaires were designed by using the Five-Point Likert scale. The responses were collected from undergraduate students of public universities in Islamabad. After finishing the survey, the data was organized and analyzed using SPSS version 29.0.2.0. This software helped to deeply examine the entire situation using various techniques. According to Bilsborrow (2016), data collection involves systematically gathering, compiling, and arranging information from different sources.

RESULTS

Relationship between dependent and independent variables

In this section, an attempt has been made to determine the relationship between the dependent and independent variables using chi-square and contingency coefficient statical techniques. Opinions of the respondents on their academic performance were targeted as a dependent variable and sleeping schedule, sleeping difficulties, drowsiness, study schedule, study environment, short breaks, ICTs, active performance, and learning techniques were sub-variables of sleep deprivation and study habits which are independent variables. The procedure adopted for computation is given below:

Dependent Variable

First of all, GPA scores in the previous semester were collected from 485 respondents in order to identify their academic performance. The

maximum and minimum obtained scores were 4 and 1. Responses were then divided into three categories Low (0 – 3), Medium (2.1 – 3), and High (3.1 – 4) on the bases of GPA scored.

Independent Variable

Sleep deprivation

The opinions for sleep deprivation among respondents were collected and their maximum and minimum values were obtained which were 53 and 27. The values were then divided into three categories Bad (27 – 35), Good (36 – 44), and Excellent (45 – 53) based on the responses.

Furthermore, the sub-variables of sleep deprivation are discussed below:

Sleeping Schedule: The opinions of 485 respondents were collected in order to examine their sleeping schedule and then the minimum and maximum value was obtained. The maximum value was 19 and the minimum score was 6. Then the responses were divided into three categories Bad (6 – 10), Good (11 – 15), and Excellent (16 – 20) based on opinions.

Sleeping Difficulties: The opinions of respondents were collected to identify the sleeping difficulties among them, and then the maximum and minimum values were obtained which were 15 and 4. Then their difference was calculated and divided by three. The responses were then divided into three categories Bad (4 – 7), Good (8 – 11), and Excellent (12 – 15) based on the responses.

Drowsiness: Opinions from respondents were collected to understand the level of drowsiness they experience. Then the maximum and minimum values were obtained which are 23 and 8. Then the responses were divided into three categories Bad (8 – 13), Good (14 – 19), and Excellent (20 – 25) based on their opinions.

Association between Sleeping Schedule and Academic Performance

Table 3 indicates that almost a quarter (24.32%) of the respondents with good sleeping schedules get higher grades while it is noticed that respondents with bad sleeping schedules also get higher grades (10.72%). Furthermore, table 4.15 also shows a significant association ($\chi^{2\ cal.} = 15.908$) between sleeping schedule and academic performance. Hence the data concludes that there is a significant relationship between the sleeping schedule and students' academic performance.

Table 3: Relationship between Academic performance and sleeping schedule.

Sleeping Schedule	Academic Performance		
	Low	Medium	High
	Percentages		
Bad	4.95	2.47	3.09
Good	20.82	19.79	22.89
Excellent	4.95	8.66	12.37
$\chi^{2\ cal.} = 15.908$	$\chi^{2\ tab} = 9.48$	df = 4	Significant

Sleeping Difficulties and Academic Performance

Table 4 indicates that almost a quarter (22.89%) of the respondents who are facing medium levels of sleeping difficulties are getting higher grades. At the same time, it is noticed that the respondents with higher levels of sleeping problems are also performing better in their academics (12.37%). Furthermore, table 4.16 also shows a non-significant association ($\chi^{2\ cal.}$ = 5.564) between sleeping difficulties and academic performance. Hence the data concludes that there is a non-significant relationship between sleeping difficulties and academic performance.

Table 4: Relationship of sleeping difficulties with academic performance.

Sleeping Difficulties	**Academic Performance**		
	Low	**Medium**	**High**
	Percentages		
Low	5.56	6.80	10.72
Medium	22.88	21.03	24.32
High	2.26	3.09	3.29
$\chi^{2\ cal.}$ = 5.654	$\chi^{2\ tab}$ = 9.48	df = 4	non-significant

Drowsiness and Academic Performance

Table 5 presents that almost a quarter (29.07%) of the respondents are experiencing medium levels of drowsiness and are performing better in academic performance while students with low levels of drowsiness (6.39%) are also performing better in academics. Furthermore, table 4.17 also shows that there exists a non-significant association ($\chi^{2\ cal.}$ = 8.824) between drowsiness and academic performance.

Table 5: Relationship of drowsiness with academic performance.

Drowsiness	**Academic Performance**		
	Low	**Medium**	**High**
	Percentages		
Low	8.66	5.15	6.39
Medium	20.41	23.29	29.07
High	1.65	2.47	2.89
$\chi^{2\ cal.}$ = 8.824	$\chi^{2\ tab}$ = 9.48	df = 4	non-significant

Sleep Deprivation and Academic Performance

Table 6 shows that most of the respondents (26.39%) experience medium levels of sleep deprivation and achieve higher grades in academics. Furthermore, table 4.24 also shows that there is a non-significant relationship between sleep deprivation and academic performance. Hence the null hypothesis is accepted and the alternate hypothesis is rejected.

Table 6: Relationship between sleep deprivation and academic performance.

Sleep Deprivation	Academic Performance		
	Low	Medium	High
	Percentages		
Low	9.48	8.25	9.48
Medium	20.0	21.24	26.39
High	1.24	1.44	2.47
$\chi^{2\ cal.} = 2.418$	$\chi^{2\ tab} = 9.48$	df = 4	non-significant

Findings

The objective of this study was to find out the relationship between sleep deprivation and the academic performance of university students. This objective was achieved by applying the chi-square test and the results conclude that:

- There is a non-significant relationship between sleep deprivation and academic performance as the calculated value ($\chi^{2\ cal.} = 2.418$) is greater than the tabulated value. whereas the sub-variables of sleep deprivation like sleeping schedule and drossiness showed a non-significant relationship whereas, sleeping difficulties had a significant relationship with academic performance.

DISCUSSION

The study's findings provide a comprehensive overview of sleep deprivation and their relationship with academic performance among university students. This discussion delves into the implications of these findings, compares them with existing literature, and highlights the practical significance of the results.

Sleep is a fundamental psychological process crucial for human well-being and proper functioning (Lawson et al., 2019). In this study, a significant proportion of students (44.7%) reported sleeping less than six hours per night, which is insufficient according to sleep health guidelines, the recommended sleep duration is between 7–9 hours per day (Estevan, Sardi, Tejera, Silva, & Tassino, 2021). Also, it is recommended that sleep duration for adolescents is at least 9 hours and should optimally occur between 11:00 PM and 8:00 AM (Wang et al., 2016). Also, previous studies stated that Short sleep duration is associated with deficits in cognitive performance (Miyata et al., 2013). Adequate sleep is essential to refresh the students every day and help them learn and process memory (Maheshwari & Shaukat, 2019). Poor sleep habits and quality are associated with higher levels of tension, irritability, depression, confusion, and reduced life satisfaction (Buboltz Jr, Soper, Brown, & Jenkins, 2002). Despite these risks, only a quarter (26.4%) of students maintained a consistent sleeping schedule, which aligns with research indicating that Sleep habits are different for different individuals depending on their age, occupational demands, social engagements, psychiatric and somatic conditions, and also

individual physiological characteristics (Augner, 2011). Several studies have supported the contention that sleep habits and quality are related to cognitive and academic performance (Buboltz Jr et al., 2002). Furthermore, the findings reveal that many students experience trouble falling asleep and have difficulty returning to sleep after waking up. These disturbances contribute to delayed sleep phase syndrome may be a significant problem in university students, resulting in chronic sleep loss and lowered academic performance (Lack, 1986), also, Difficulty with awakening is commonly endorsed by individuals with mood disorders (Trotti, 2017). Furthermore, the mean scores suggest that students often hung between neutral and agreement regarding sleep difficulties, indicating a prevalent issue that justifies further intervention. Sleepiness and daytime fatigue were common among respondents, with many finding it difficult to wake up and feeling tired throughout the day. In the previous study, it is mentioned that Sleep disturbances are common at many stages of the lifespan and are particularly salient during periods of late adolescence and early adulthood due to the effect on social, academic, and occupational outcomes (Hayley et al., 2017).

These results have several implications. Universities should implement programs to educate students on the importance of sleep and strategies to improve sleep quality, such as maintaining regular sleep schedules and minimizing electronic device use before bedtime. In conclusion, this study highlights the intricate relationship between sleep deprivation and academic performance among university students. While no overarching significant relationships were found, the detailed insights into sub-variables provide valuable guidance for targeted interventions to support student success.

CONCLUSION

According to the findings of this study, we can conclude that sleep deprivation and study patterns are somehow connected to academic performance among university students. While the overall relationship between sleep deprivation and academic performance is non-significant which means that sleep deprivation and study patterns don't influence students' academic performance directly, but to develop an in-depth understanding it's essential to consider specific sub-variables. For instance, sleeping difficulties significantly impact academic performance, whereas other aspects of sleep, such as sleeping schedule and drowsiness, do not show a significant association. These factors emphasize the importance of addressing sleep-related challenges to enhance students' overall academic success.

RECOMMENDATION

Although the present study was conducted with maximum effort there are certain recommendations.

- Prioritize sleep quality by focusing on both sleep duration and quality. Adequate sleep is essential for cognitive function, memory consolidation, and overall well-being.

- Establish consistent sleep patterns to maintain regular sleep schedules, even on weekends. Irregular sleep patterns can disrupt circadian rhythms and impact academic performance.
- Manage stress and time effectively and use stress management techniques (e.g., mindfulness, and relaxation exercises) to reduce anxiety and improve sleep quality.
- Invest in mental health services and counseling to address stress-related sleep disturbances.

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