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## The Effect of Night Study Patterns on Academic Performance among Medical Students at Bahri University, Khartoum State, Sudan, 2025.

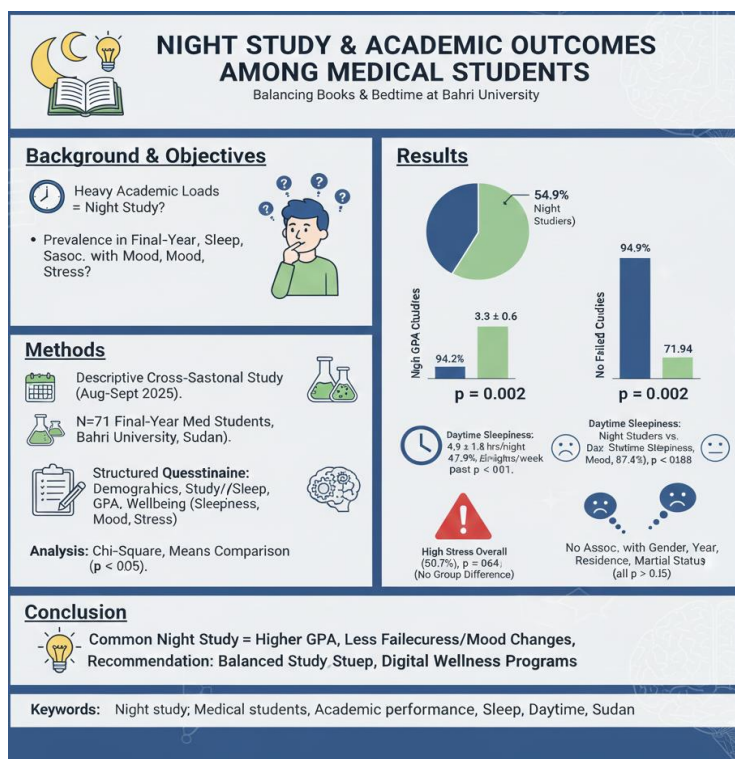
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## Abstract Background

**M**edical students often adopt night-time study habits to cope with heavy academic loads and long curricula. While many believe that studying at night improves focus and productivity, the real impact of these patterns on academic performance and well-being is still unclear, especially in Sudanese medical schools.

**Objectives:** To assess the prevalence of night study habits among final-year medical students at Bahri University and to examine their association with academic performance, sleep, mood, stress, and sociodemographic characteristics.

**Methods:** A descriptive cross-sectional study was conducted among 71 final-year medical students at Bahri University, Khartoum State, Sudan, in 2025. Data were collected using a structured questionnaire covering sociodemographic characteristics, study and sleep patterns, academic performance (GPA, failed courses, satisfaction), and indicators of well-being (daytime sleepiness, mood changes, stress). Associations between night study habit (yes/no) and outcome variables were analyzed using Chi-square tests and comparison of means, with a significance level of  $p < 0.05$ .

**Results:** More than half of the students (54.9%) reported primarily studying at night. The overall mean age was  $24.3 \pm 3.4$  years, and most participants were female (54.9%), single (64.8%), and in their fifth year of study (60.6%). Night studiers had a significantly higher mean GPA than non-night studiers ( $3.3 \pm 0.5$  vs.  $2.9 \pm 0.6$ ,  $p = 0.002$ ) and were more likely to have no failed courses (94.9% vs. 71.9%,  $p = 0.024$ ). Although academic satisfaction did not differ significantly ( $p = 0.115$ ), a larger proportion of night studiers were satisfied or very satisfied with their performance (61.5% vs. 40.6%). Night studiers slept an average of  $4.9 \pm 1.8$  hours per night and studied past midnight on  $4.2 \pm 1.9$  nights per week. They reported lower rates of daytime sleepiness (17.9% vs. 84.4%,  $p < 0.001$ ) and fewer mood changes (59.0% vs. 87.5%,  $p = 0.008$ ). Stress levels were high overall (50.7% “stressful/very stressful”), with no significant difference between groups ( $p = 0.064$ ). No significant associations were found between night study and gender, year of study, residence, or marital status (all  $p > 0.05$ ).

**Conclusion:** In this sample of final-year medical students, night study was common and was associated with higher GPA and fewer failed courses, despite markedly reduced sleep duration. Night studiers also reported less daytime sleepiness and fewer mood changes, suggesting possible adaptation to nocturnal study patterns. However, given the cross-sectional, self-reported data and small sample size, these findings should be interpreted cautiously. Educational programs should promote balanced study routines that support both academic success and adequate sleep, and future studies with larger samples and objective sleep measures are recommended.

**Keywords:**

Night study; Medical students; Academic performance; Sleep; Daytime sleepiness; Sudan

# 1. Introduction

**Background:** The practice of nocturnal study has traditionally been criticized by the older generation, who considered it detrimental to children’s health and wellbeing. They frequently depicted the night as harmful or unfavorable for young, impressionable minds. Children were commonly instructed to adopt the maxim: “Early sleep and early awakening promote physical health, mental clarity, and overall productivity.” [1]

Mothers persistently encouraged their children to follow a diurnal sleep-wake schedule, emphasizing early rising as the healthiest routine. The underlying intention was to ensure that children synchronized their biological rhythms with the circadian cycle, thereby maintaining physiological harmony with nature. However, this conventional perspective has begun to shift, as the emerging generation has developed its own acceptance of nighttime academic activity as a valid adaptation to their lifestyle. [2]

The pre-dawn tranquility, with minimal sensory stimulation and absence of external disturbances, enhances cognitive processing and stimulates innovative ideation. Research has shown that nocturnal study promotes memory consolidation, facilitating easier recall of information during subsequent daytime hours. In contrast, the heightened environmental stimuli and social interactions of the daytime hinder concentration and often necessitate multitasking, which diminishes attentional capacity and reduces memory retention. At night, however, the absence of chaos allows focused learning and more effective information processing, making study sessions more productive. [3]

Despite these advantages, uncertainty persists among students regarding the optimal study period, as individual chronotypes largely determine sleep-wake cycles and preferred learning hours. Altering established circadian rhythms is challenging, particularly in students, but gradual modifications may realign the biological clock. Morning-type individuals attempting to adopt nocturnal study frequently experience drowsiness before midnight due to their intrinsic sleep pattern, whereas evening-type individuals sustain productivity beyond sunrise, though such extremes may not be suitable for student lifestyles. Effective adoption of nocturnal study requires strict time-management strategies and adherence to structured schedules to balance cognitive performance with sleep hygiene and overall health. [4]

## 1.2-Litreature review:

### 1.2.1 *Study skills:*

Study skills, or study strategies, refer to structured approaches employed to enhance learning efficiency. They encompass a range of techniques designed to facilitate the organization, acquisition, retention, and retrieval of information, as well as to support performance in assessments. These are discrete, transferable methods that can typically be learned within a short period and applied across multiple academic disciplines. More broadly, any technique that strengthens an individual's capacity to comprehend, memorize, and recall information thereby improving examination outcomes can be classified as a study skill, including time management practices and motivational strategies. [5]

Examples include the use of mnemonic devices to aid memory retention, methods for effective reading, attention and concentration techniques, and efficient systems of note-taking. [6]

Given their general applicability, study skills should be distinguished from strategies tailored to specific disciplines (such as music performance or technological training) and from innate personal attributes, including intelligence or temperament. Equally important is for students to develop an awareness of their habitual study patterns, as this self-reflection enables them to recognize obstacles to learning and adapt more readily to new, evidence-based techniques. [7]

#### ***Rehearsal and Rote Learning***

Rehearsal and rote learning represent fundamental approaches to memory acquisition. Memorization is the process of committing information to memory, often through deliberate repetition. This may include factual data, names, numerical information, diagrams, texts, music, or visual and auditory material. A common technique is rote learning, involving repeated reading or rewriting of notes. While effective for short-term recall, its limitation lies in the passive nature of reading and listening. Educational theorists, such as John Dewey, emphasize the need for critical thinking during learning analyzing, questioning, and evaluating evidence rather than memorizing mechanically. [8]

#### **The REAP Method**

The REAP method (Read, Encode, Annotate, Ponder) is a strategy designed to deepen engagement

with texts. It involves reading for comprehension, encoding by paraphrasing into personal terms, annotating with critical insights, and pondering through reflection, discussion, or supplementary reading. This process promotes elaboration and aligns with the zone of proximal development, transforming raw material into meaningful knowledge structures. [9]

## **The PQRS Method**

Another method, PQRS (Preview, Question, Read, Summary, Test), organizes study material for effective retention and exam application. Students begin with an overview, generate guiding questions, read with focus, summarize in personalized formats (notes, diagrams, recordings), and finally test their understanding by answering the formulated questions. Research indicates that peer communication further enhances these processes, with evidence of improved academic outcomes. [10]

### Active Recall and Self-Testing

Active recall techniques, such as creating personalized cues or practicing self-testing, are superior to passive rereading. The Testing Effect demonstrates that students who engage in self-assessment exhibit stronger long-term retention compared to those relying solely on review. Conversely, computer-based note-taking often reduces depth of processing, as students tend to transcribe verbatim rather than reframe content in their own words. [10]

### Flashcards

Flashcards provide portable, discrete learning aids, encouraging random recall and reorganization of knowledge. Digital equivalents extend this principle. [11]

## **Summary Methods**

Summary techniques, including outlines, spider diagrams, and mind maps, condense complex material into key facts while preserving logical relationships, aiding both organization and visualization of concepts. [12]

## **Visual Imagery**

Visual imagery strategies, such as the method of loci, harness spatial memory by associating information with physical locations. Self-generated diagrams and illustrations reinforce comprehension and accelerate recall, especially when converted into flashcards for review. [13]

## **Mnemonics**

Mnemonics enhance memory by encoding information into narrative, sonic/textual, visual, or topical forms. Examples include acronyms, rhymes, or spatial associations. These techniques transform abstract material into memorable symbolic patterns. [14]

## **Examination Strategies**

Examination strategies further refine study outcomes. The Black-Red-Green method helps analyze exam questions by distinguishing explicit instructions, reference points, and subtle cues. The PEE method (Point, Evidence, Explain) guides structured responses, ensuring logical coherence and maximization of marks. [15]

### **1.2.2 Tips of Studying at night:**

Interval studying involves incorporating scheduled breaks into prolonged study sessions, with short periods of rest or brief power naps that enhance alertness and restore cognitive efficiency. Such intervals optimize knowledge acquisition and sustain mental performance. [16]

An engaging study environment is also essential, as monotony and excessive silence may induce cognitive fatigue and reduce attentiveness. Incorporating background stimulation, such as soft instrumental music or interactive learning techniques, may help maintain focus and motivation. [17]

Group studying is frequently criticized for fostering distractions and informal conversation, yet when guided by disciplined members and effective leadership, it can facilitate cooperative learning, knowledge exchange, and mutual reinforcement of concepts. [18]

Adequate lighting is another determinant of effective study practices. While natural daylight is beneficial, nighttime learning requires artificial illumination of appropriate intensity and positioning to reduce ocular strain and prevent visual fatigue. Ensuring proper ergonomics between the light source and the eyes is essential for maintaining visual health during extended sessions. [18]

Nutritional support also plays a critical role. As studying constitutes a mentally demanding activity, adequate hydration and consumption of nutrient-dense foods, such as fruits, sustain cognitive endurance. Limited intake of caffeinated beverages may temporarily improve alertness, though excessive consumption can disrupt sleep and increase dependence. [18]

Night study carries both benefits and drawbacks. Prolonged wakefulness may delay morning arousal, impairing participation in social and occupational activities, a phenomenon often described as “social jetlag.” This circadian misalignment reduces daytime productivity and overall health if not managed appropriately. Nevertheless, nocturnal study can be advantageous during non-examination periods, allowing learners to engage deeply with academic material, strengthen comprehension, and consolidate fundamental concepts in an environment free from external distractions. Conversely, late-night cramming before examinations may lead to mental fatigue, poor concentration, and reduced performance outcomes. [19]

Ultimately, students must evaluate their chronotype whether they function optimally as morning-oriented “early birds” or evening-oriented “night owls.” Recognizing and respecting one’s intrinsic biological rhythm enables healthier academic practices and prevents the negative consequences of misaligned sleep– wake cycles. Social stigma or criticism regarding individual sleep patterns should not dictate study habits; the central consideration should be whether the chosen routine genuinely supports personal wellbeing and academic success. [20]

### **1.2.3 Academic Performance:**

Academic performance refers to the extent of a student’s achievement in meeting educational objectives, typically assessed through grades, standardized test scores, and overall academic progress. It demonstrates the student’s ability to comprehend, apply, and integrate acquired knowledge, as well as their level of engagement, consistency, and effort in learning activities. Multiple factors influence academic performance, including effective study habits, time management skills, intrinsic motivation, and external elements such as family support and social environment. Strong academic performance is often associated with enhanced future prospects, including eligibility for scholarships, academic recognition, and greater opportunities for professional advancement. [21]

The Academic Performance Index (API) was a measurement of academic performance and progress of individual schools in California, United States. The API was one of the main components of the Public Schools Accountability Act passed by the California State Legislature in 1999. It was last updated for the 2012–2013 school year, and on March 15, 2017, the California State Board of Education and the California Department of Education launched a new accountability system to replace the Academic Performance Index to better measure California's education goals. The replacement reporting interface is the California School Dashboard. [22]

A school's score or placement on the Academic Performance Index (API) was intended to serve as an indicator of performance level and was calculated annually by the California Department of Education, primarily using results from the CST and CAHSEE examinations. Because the API relied

heavily on standardized testing, with limited consideration of other factors such as attendance and graduation rates, many of the common criticisms of standardized testing also applied to the reliability and validity of API scores as indicators of academic achievement. [23]

The API was also linked to accountability measures, including monetary and incentive awards, through the establishment of Annual Percent Growth Targets for each school and evaluation of whether those goals were met or exceeded. In addition, the Public Schools Accountability Act created programs such as the Immediate Intervention/Underperforming Schools Program and the Governor's High Achieving/Improving Schools Program to further connect API performance with school improvement efforts. [24]

Grades and scores are among the most common indicators of academic performance, encompassing Grade Point Average (GPA), examination results, and marks on assignments. Classroom performance also serves as a measure, reflected in active participation, timely completion of projects, and demonstrated comprehension of course material. Standardized tests provide formal assessments to evaluate student knowledge and progress across multiple subjects. Graduation and attainment, such as the completion of secondary education or university degrees, further signify academic achievement. [25]

Several factors influence academic performance. Student-related factors include study skills, time management, motivation, personal effort, problem-solving abilities, and emotional well-being. Environmental factors involve the role of family, peers, teachers, and socioeconomic conditions in shaping academic outcomes. Institutional factors, such as the quality of instructional support, curriculum design, and the overall learning environment, also contribute significantly to student success. [26]

Academic performance is important because it not only reflects a student's intellectual development but also determines access to future opportunities. Strong performance can lead to scholarships, academic recognition, and career advancement, while also fostering personal growth, self-confidence, and lifelong learning skills. [26]

### 1.2.4 *Previous Studies:*

**Barley, B. K., & Scullin, M. K. (2025).** Reinforcing sleep education with behavioral change strategies: intervention effects on sleep timing, sleep duration, and academic performance. *Journal of clinical sleep medicine : JCSM : official publication of the American Academy of Sleep Medicine*, which is resulted in Following the educational program, both groups demonstrated improvements in self-reported sleep quality. However, only participants in the Education group exhibited actigraphy-measured changes in earlier bedtimes and increased sleep duration. Some of these effects persisted into the mid-semester and next- semester follow-ups. When adjusting for prior academic performance, students in the Education condition initially showed worse academic outcomes compared to those in the Education-Only condition, particularly among individuals with evening circadian preferences, though these differences did not persist long term. Incorporating behavioral change strategies into sleep education programs can enhance sleep outcomes, but the relationship between sleep and academic performance remains complex, especially within the context of demanding academic programs. [27]

**Al Shammari, M. A., et al (2020).** The quality of sleep and daytime sleepiness and their association with academic achievement of medical students in the eastern province of Saudi Arabia. Which is resulted in The sampled population comprised 36.7% males and 63.30% females. The mean global PSQI score was (standard deviation (SD)=4.66), while the mean global ESS score was 8.03 (SD=4.66). Further analysis showed that 80.60% had poor sleep quality and 37.80% of the students suffered from excessive daytime sleepiness. Multivariate regression showed that poor sleep quality was significantly associated with poor academic achievement (adjusted OR = 3.33, 95% confidence interval [CI] = 1.28-8.63). Furthermore, excessive sleepiness significantly increased the odds of poor academic performance (adjusted OR = 4.58, 95% CI = 1.09-20.81). [28]

**Maheshwari, G., & Shaukat, F. (2019).**

Impact of Poor Sleep Quality on the Academic Performance of Medical Students. Which is resulted in There were 512 (64.24%) students with global PSQI score  $\geq 5$  indicating poor sleep quality. The mean GPA of poor

sleepers was  $2.92 \pm 1.09$  which was significantly lower than that of good sleepers ( $p < 0.0001$ ). In the group of students who scored lower GPA (2.0-2.7), 28.2% had very bad subjective sleep quality, 29.05% had sleep latency of 16-30 min, 29.4% had sleep duration of <5-7 h, 27.8% had sleep efficiency of <85%, and 37.7% experienced daytime dysfunction almost every day. [29]

**Lawson, H. J., Wellens-Mensah, J. T., & Attah Nantogma, S. (2019).**

Evaluation of Sleep Patterns and Self-Reported Academic Performance among Medical Students at the University of Ghana School of Medicine and Dentistry. Sleep disorders, which is resulted in 153 medical students were recruited comprising 83 (54.2%) females and 70 (45.8%) males with a mean age of  $23.1 \pm 2.4$  years. The mean duration of night sleep was  $5.7 \pm 1.2$  hours; 88 (57.5%) students had sleep latency of 10-30 minutes while 18 (11.8%) woke up nightly. 23 (15%) students experienced nightmares, 13 (8.5%) snored at night, and only one student reported coffee intake of 2-3 times daily. Sleep quality was poor in 86 (56.2%) and was significantly associated with sleep latency, morning tiredness, daytime sleepiness during lectures, academic performance, living conditions, leisure time, frequency of nocturnal awakenings, waking up due to noise, sleep walking, and nocturnal awakening to use washroom. There was also a significant positive relation between sleep quality and academic performance ( $X^2 = 10.004$   $p = 0.019$ ). [30]

**El Hangouche, A. J., et al (2018).**

Relationship between poor quality sleep, excessive daytime sleepiness and low academic performance in medical students. Advances in medical education and practice, which is resulted in Among the included students, the median age was 20 (19; 21) years; 70.7% of the participants were females. Almost one-third of the students (36.6%) had excessive daytime sleepiness and this was more frequently observed in female students (43% vs 20.1%,  $<0.001$ ). Furthermore, 58.2% of the students were poor sleepers (PSQI  $\geq 5$ ), while 86.4% of them had psychological distress. The bivariate analysis showed that psychological distress was associated with decreased risk of low performance ( $\beta=0.04$ ; 95% CI=0.005- 0.07;  $P=0.024$ ). Being a poor sleeper was statistically associated with poor academic performance ( $\beta= -0.07$ ; 95% CI=-0.14 to -0.002;  $P=0.04$ ) in the

multivariate analysis. In our study, daytime sleepiness was not statistically associated with academic performance. [31]

## **1. Problem statement:**

Night study habits among medical students are increasingly prevalent, yet their impact on academic performance remains underexplored, particularly in Sudan. Globally, studies indicate that 59% of medical students experience sleep deprivation, with 41% averaging less than 6 hours of sleep per night [10]. In Sudan, research has shown that poor sleep quality is associated with lower academic performance among medical students [11]. Additionally, a study found that 39.5% of medical students performed poorly in exams due to daytime sleepiness [12].

## **2. Justification:**

Medical education demands extensive study and information retention, leading many students to adopt night study patterns for better focus and fewer distractions. However, such habits can disrupt sleep quality, circadian rhythm, and overall well-being, which may negatively affect learning and academic performance. In Sudan, little research has examined how night study specifically impacts medical students' outcomes, despite its widespread practice. This study is therefore justified, as it will provide empirical evidence on the relationship between night study and academic performance at Bahri University, offering insights to guide students' study habits and inform educators and policymakers in promoting both academic success and student well-being.

## **3. Research question:**

What is The Effect of Night Study Patterns on Academic Performance among Medical Students at Bahri University, Khartoum State, Sudan, 2025?

## **4. Research objectives:**

### **4.1 General objective:**

To assess The Effect of Night Study Patterns on Academic Performance among Medical Students at Bahri University, Khartoum State, Sudan, 2025.

### **5.2. Specific Objectives:**

1. To determine the prevalence of night study habits among medical students at Bahri University.
2. To assess the relationship between night study patterns and academic performance.

3. To compare academic performance between students who primarily study at night and those who study during the day.
4. To explore the motivational and psychological factors influencing night-time study habits.
5. To propose recommendations for improving study behaviors to enhance academic outcomes.

## **Materials and Methods**

This study employed a cross-sectional, institution-based design conducted from August to October 2025. The research took place at the Faculty of Medicine, University of Bahri, located in Khartoum Bahri, Sudan. Established in 1990, the Faculty of Medicine launched its medical program in 1995 and offers the Bachelor of Medicine and Bachelor of Surgery (MBBS) degree in addition to various health sciences programs. The university is accredited by the Sudanese Ministry of Higher Education and Scientific Research and is recognized by the Sudan Medical Council. Medical education in Sudan is highly competitive, with admission depending on students' performance in high school exit examinations. The University of Bahri admits approximately 200 new medical students annually, with an overall enrollment of about 1,200 students within the College of Medicine.

The study population consisted of male and female medical students aged 16–30 years who were enrolled at the University of Bahri during the study period. For the purpose of the study, inclusion criteria were restricted to students aged 18–30 years who were in their final year of medical school. Students who declined participation were excluded. The study assessed several independent variables, including age, sex, residency, socioeconomic status, and educational level, while the dependent variables focused on the impact of night-time studying on academic performance and stress levels.

A convenience sampling technique was used to recruit participants. The required sample size was determined using Cochran's formula, applying a 90% confidence level ( $Z = 1.64$ ), a prevalence estimate ( $p$ ) of 0.5, a margin of error of 10% ( $e = 0.10$ ),

and a population size of 1,200 medical students. The final calculated sample size was 65 participants.

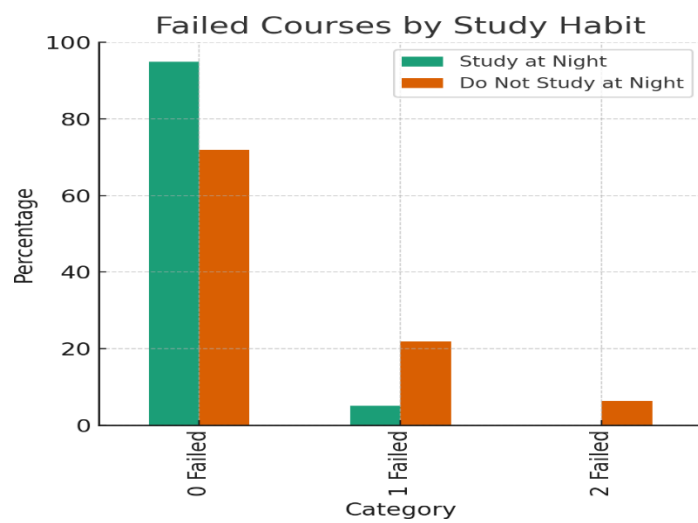
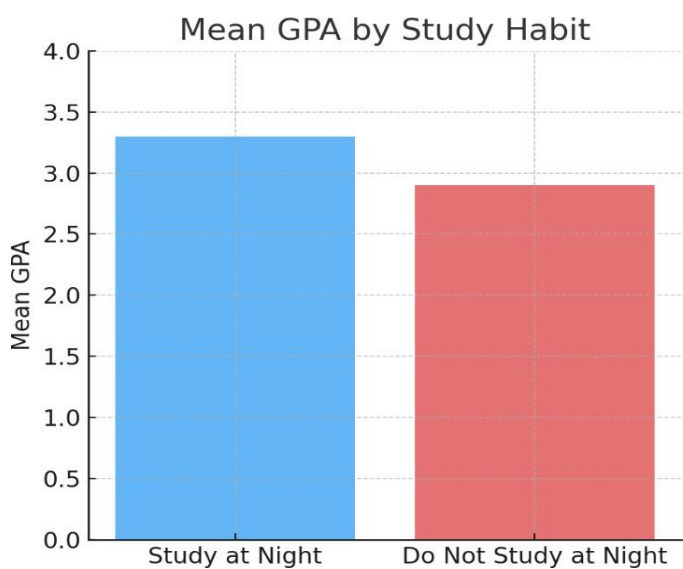
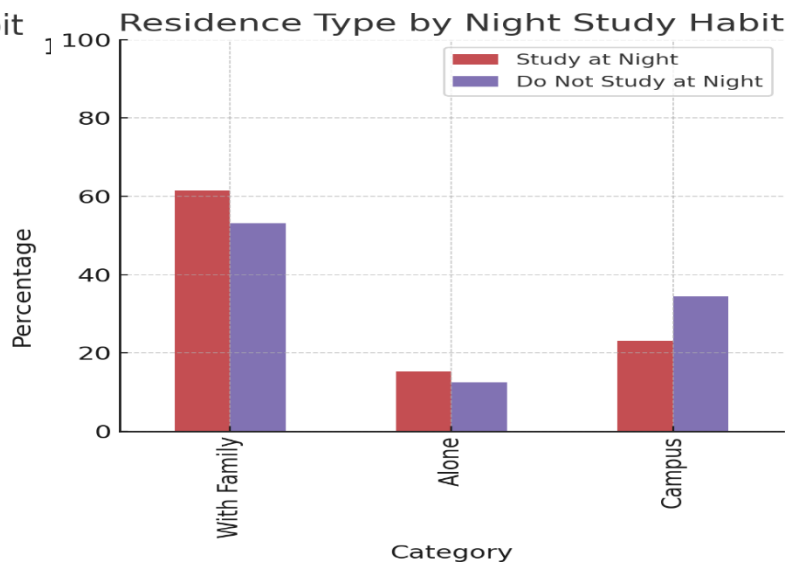
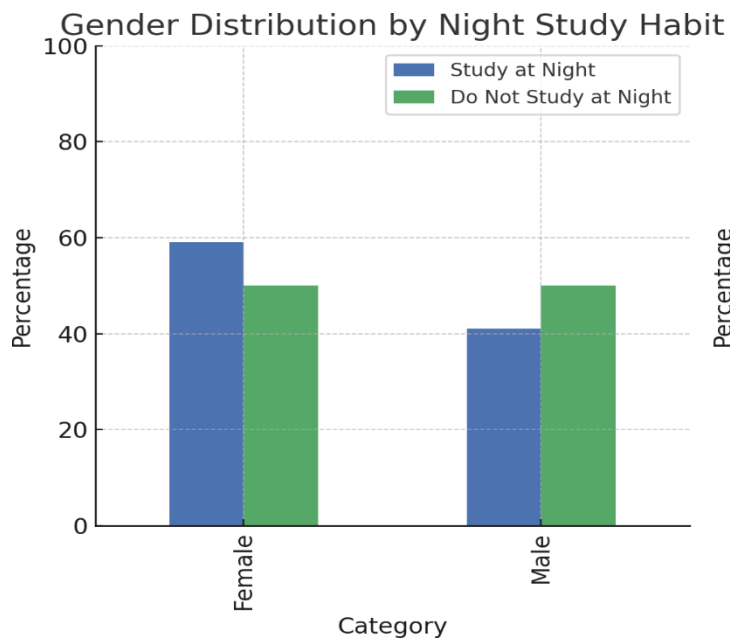
Data collection was conducted using a structured Google Forms questionnaire developed by the researchers and adapted from validated instruments used in previous studies. Collected data were analyzed using Jamovi statistical software (version 2.6.8). Results were presented in tables, figures, and graphs, and inferential statistics were performed using the chi-square test, with a significance threshold set at  $p < 0.05$ .

Ethical approval for this study was obtained from the Institutional Review Board of the University of Bahri, along with permission from the Community Medicine Department. Written informed consent was obtained from all participants prior to enrollment in the study.

## Results

The study included 71 participants. The mean age of participants was  $24.3 \pm 3.4$  years (range 18–30). Females represented slightly more than half of the sample (39, 54.9%). Most students were single (46, 64.8%), while 29.6% were in a relationship. Over half lived with their families (41, 57.7%), and 28.2% resided on campus. The majority were fifth-year students (43, 60.6%), with fewer from third (15, 21.1%) and second years (7, 9.9%) [Figure 1-4, Table 1].

<b>Table 1. Sociodemographic Characteristics of the Participants (N=71)</b>	
<b>Variables</b>	<b>Overall (N=71)</b>
<b>Age</b>	
Mean (SD)	24.3 (3.4)
Range	18.0 - 30.0
<b>Gender</b>	
Female	39 (54.9%)
Male	32 (45.1%)
<b>Marital status</b>	
Single	46 (64.8%)
In Relationship	21 (29.6%)
Engaged or married	4 (5.6%)
<b>Residence</b>	
With Family	41 (57.7%)
Alone	10 (14.1%)
Campus	20 (28.2%)
<b>Year of study</b>	
5	43 (60.6%)
4	6 (8.5%)
3	15 (21.1%)
2	7 (9.9%)



## Night Study Habits and Related Factors

More than half of the students (39, 54.9%) primarily studied at night, averaging  $7.7 \pm 2.8$  study hours daily and  $4.9 \pm 1.8$  hours of sleep per night. On average, students studied past midnight  $4.2 \pm 1.9$  nights weekly. The main reasons cited for night study were fewer distractions (39, 54.9%) and academic workload (35, 49.3%), while 33 (46.5%) believed it improved concentration and 30 (42.3%) identified personal preference as a factor [Table 2].

<b>Table 2. Night Study Habits and Related Factors</b>	
<b>Variables</b>	<b>Overall (N=71)</b>
<b><i>Do you primarily study at night?</i></b>	
Yes	39 (54.9%)
No	32 (45.1%)
<b><i>Average hours of study per day</i></b>	
Mean (SD)	7.7 (2.8)
Range	2.0 - 12.0
<b><i>Average hours of sleep per night</i></b>	
Mean (SD)	4.9 (1.8)
Range	2.0 - 8.0
<b><i>Number of nights per week you study past midnight</i></b>	
Mean (SD)	4.2 (1.9)
Range	2.0 - 7.0
<b><i>Reasons for night study</i></b>	
Fewer distractions	39 (54.9%)
Better concentration	33 (46.5%)
Personal preference	30 (42.3%)
Academic workload	35 (49.3%)
Other	37 (52.1%)

### Academic Performance and Study Environment

The most common preferred study environments were the library and quiet settings (each 19, 26.8%), followed by home (18, 25.4%) and group study (15, 21.1%). The mean GPA was  $3.1 \pm 0.6$  (range 2.0–4.0), with 84.5% reporting no failed courses. Academic satisfaction varied, with 24 (33.8%) satisfied and 13 (18.3%) very satisfied, while 12 (16.9%) expressed dissatisfaction [Table 3].

<b>Table 3. Academic Performance and Study Environment</b>	
<b>Variables</b>	<b>Overall (N=71)</b>
<b>Preferred study environment:</b>	
Library	19 (26.8%)
Home	18 (25.4%)
Quiet	19 (26.8%)
Group study/ With Friends	15 (21.1%)
<b>Current GPA</b>	
Mean (SD)	3.1 (0.6)
Range	2.0 - 4.0
<b>Number of failed courses (if any) in the current academic year</b>	
0	60 (84.5%)
1	9 (12.7%)
2	2 (2.8%)
<b>Self-reported satisfaction with academic performance</b>	
very dissatisfied	4 (5.6%)
dissatisfied	8 (11.3%)
neutral	22 (31.0%)
satisfied	24 (33.8%)
very satisfied	13 (18.3%)

### Perceived Effects of Night Study on Well-Being and Performance

Nearly half of participants (34, 47.9%) reported that daytime sleepiness affected their academic performance. Stress during night study was common, with 44 (62.0%) describing it as stressful or very stressful. Mood changes due to night study were reported by 51 (71.8%) students. Regarding perceived benefits, 38 (53.5%) agreed or strongly agreed that night study improved performance, while 14 (19.7%) disagreed or strongly disagreed [Table 4].

<b>Table 4. Perceived Effects of Night Study on Well-Being and Performance</b>	
<b>Variables</b>	<b>Overall (N=71)</b>
<b>Do you feel daytime sleepiness affects your academic performance? (Yes)</b>	34 (47.9%)
<b>Stress levels during night study:</b>	
very stressful	16 (22.5%)
stressful	20 (28.2%)
slightly stressful	17 (23.9%)
neutral	17 (23.9%)
not stressful at all	1 (1.4%)
<b>Do you experience mood changes due to night study? (Yes)</b>	51 (71.8%)
<b>Do you believe night study improves your academic performance?</b>	
strongly agree	16 (22.5%)
agree	22 (31.0%)
neutral	19 (26.8%)
disagree	9 (12.7%)
strongly disagree	5 (7.0%)

### Sociodemographic Characteristics by Night Study Habit

No significant associations were observed between studying at night and gender, year of study, residence, or marital status (all  $p > 0.05$ ). Night study was slightly more common among females (59.0%) and fifth-year students (59.0%), while most students across all groups lived with family (57.7%) and were single (64.8%)

[Table 5].

<b>Table 5. Sociodemographic Characteristics by Night Study Habit</b>				
<b>Variables</b>	<b>Yes (N=39)</b>	<b>No (N=32)</b>	<b>Total (N=71)</b>	<b>p value</b>
<b>Gender</b>				<i>0.450<sup>l</sup></i>
Female	23.0 (59.0%)	16.0 (50.0%)	39.0 (54.9%)	
Male	16.0 (41.0%)	16.0 (50.0%)	32.0 (45.1%)	
<b>Year of study</b>				<i>0.569<sup>l</sup></i>
5	23.0 (59.0%)	20.0 (62.5%)	43.0 (60.6%)	
4	2.0 (5.1%)	4.0 (12.5%)	6.0 (8.5%)	
3	10.0 (25.6%)	5.0 (15.6%)	15.0 (21.1%)	
2	4.0 (10.3%)	3.0 (9.4%)	7.0 (9.9%)	
<b>Residence</b>				<i>0.572<sup>l</sup></i>
With Family	24.0 (61.5%)	17.0 (53.1%)	41.0 (57.7%)	
Alone	6.0 (15.4%)	4.0 (12.5%)	10.0 (14.1%)	
Campus	9.0 (23.1%)	11.0 (34.4%)	20.0 (28.2%)	
<b>Marital status</b>				<i>0.381<sup>l</sup></i>
Single	28.0 (71.8%)	18.0 (56.2%)	46.0 (64.8%)	
In Relation ship	9.0 (23.1%)	12.0 (37.5%)	21.0 (29.6%)	
Engage d or married	2.0 (5.1%)	2.0 (6.2%)	4.0 (5.6%)	

## 1. Pearson's Chi-squared test

### Academic Performance by Night Study Habit

Night study was significantly associated with higher academic achievement. Students who studied at night had a higher mean GPA ( $3.3 \pm 0.5$ ) compared to those who did not ( $2.9 \pm 0.6$ ,  $p = 0.002$ ). Additionally, 94.9% of night studiers had no failed courses versus 71.9% among non-night studiers ( $p = 0.024$ ). Although satisfaction with academic performance did not differ significantly ( $p = 0.115$ ), a higher proportion of night studiers reported being satisfied or very satisfied (61.5% vs. 40.6%) [Table6].

**Table 6. Academic Performance by Night Study Habit**

Variables	Yes (N=39)	No (N=32)	Total (N=71)	p value
<b>Current GPA</b>				0.002 <sup>1</sup>
Mean (SD)	3.3 (0.5)	2.9 (0.6)	3.1 (0.6)	
Range	2.1 - 4.0	2.0 - 4.0	2.0 - 4.0	
<b>Number of failed courses (if any) in the current academic year</b>				0.024 <sup>2</sup>
0	37.0 (94.9%)	23.0 (71.9%)	60.0 (84.5%)	
1	2.0 (5.1%)	7.0 (21.9%)	9.0 (12.7%)	
2	0.0 (0.0%)	2.0 (6.2%)	2.0 (2.8%)	
<b>Self-reported satisfaction with academic performance</b>				0.115 <sup>5</sup>
very dissatisfied	0.0 (0.0%)	4.0 (12.5%)	4.0 (5.6%)	
dissatisfied	3.0 (7.7%)	5.0 (15.6%)	8.0 (11.3%)	
neutral	12.0 (30.8%)	10.0 (31.2%)	22.0 (31.0%)	
satisfied	16.0 (41.0%)	8.0 (25.0%)	24.0 (33.8%)	
very satisfied	8.0 (20.5%)	5.0 (15.6%)	13.0 (18.3%)	

1. Linear Model ANOVA
  2. Pearson's Chi-squared test
- Perceived Effects of Night Study on Sleep, Stress, and Mood

differ significantly between the groups ( $p = 0.064$ ) [Table7].

Significant differences were observed in perceived daytime sleepiness, mood, and beliefs about academic benefits. Only 17.9% of night studiers reported daytime sleepiness compared with 84.4% of non-night studiers ( $p < 0.001$ ). Mood changes were more frequent among non-night studiers (87.5% vs. 59.0%,  $p = 0.008$ ). Furthermore, a majority of night studiers (87.2%) agreed or strongly agreed that night study improved performance, whereas 43.7% of non-night studiers disagreed ( $p < 0.001$ ). Stress levels did not differ significantly between the groups ( $p = 0.064$ ) [Table7].

*Table 7. Perceived Effects of Night Study on Sleep, Stress, and Mood*

<i>Variables</i>	<i>Yes (N=39)</i>	<i>No (N=32)</i>	<i>Total (N=71)</i>	<i>p value</i>
<i>Do you feel daytime sleepiness affects your academic performance?</i>	7.0 (17.9%)	27.0 (84.4%)	34.0 (47.9%)	< <i>0.001</i> 1
<i>Stress levels during night study: very stressful</i>	5.0 (12.8%)	11.0 (34.4%)	16.0 (22.5%)	<i>0.064</i> 1
<i>stressful</i>	10.0 (25.6%)	10.0 (31.2%)	20.0 (28.2%)	
<i>slightly stressful</i>	11.0 (28.2%)	6.0 (18.8%)	17.0 (23.9%)	
<i>neutral</i>	13.0 (33.3%)	4.0 (12.5%)	17.0 (23.9%)	
<i>not stressful at all</i>	0.0 (0.0%)	1.0 (3.1%)	1.0 (1.4%)	
<i>Do you experience mood changes due to night study?</i>	23.0 (59.0%)	28.0 (87.5%)	51.0 (71.8%)	<i>0.008</i> 1
<i>Do you believe night study improves your academic performance? strongly agree</i>	16.0 (41.0%)	0.0 (0.0%)	16.0 (22.5%)	< <i>0.001</i> 1
<i>agree</i>	18.0 (46.2%)	4.0 (12.5%)	22.0 (31.0%)	
<i>neutral</i>	5.0 (12.8%)	14.0 (43.8%)	19.0 (26.8%)	
<i>disagree</i>	0.0 (0.0%)	9.0 (28.1%)	9.0 (12.7%)	
<i>strongly disagree</i>	0.0 (0.0%)	5.0 (15.6%)	5.0 (7.0%)	

1. Pearson's Chi-squared test

## Discussion

This study found that students who habitually studied at night reported higher mean GPA (3.3 vs 2.9), fewer failed courses (94.9% vs 71.9% with zero failures), and were more likely to believe night study improved performance than their peers who did not study at night. At first glance these results suggest a potential academic advantage for night studiers; however the finding contrasts with a large body of sleep research showing that shorter or poorer quality sleep impairs memory consolidation attention and ultimately grades. For example, large-scale work has shown that each hour of lost nightly sleep is associated with measurable declines in end of term GPA, and experimental and meta analytic data link sleep restriction to worse memory encoding and consolidation. [32, 33]

There are several plausible explanations for this apparent discrepancy. Night studiers in our sample also reported long study times (mean 7.7 hours/day) and frequently cited fewer distractions and greater concentration as reasons for studying at night; these behaviors may reflect higher overall study effort, better time allocation for revision, or advantageous study strategies that counterbalance shorter sleep and lead to better academic outcomes in a cross-sectional snapshot. At the same time, self-selection is likely: more motivated or higher performing students may choose night study because it fits their schedules (or because they prefer it) producing an association that does not imply causation. Comparable surveys of students show that study timing is often driven by personal preference and workload rather than sleep physiology alone.

[34, 35]

Some of our sleep related findings are counterintuitive but potentially informative. Non night studiers reported far more daytime sleepiness (84.4% vs 17.9% among night studiers) and more frequent mood changes opposite of the expectation that night study produces daytime dysfunction. This pattern may reflect measurement and reporting issues (self perception bias, different thresholds for reporting sleepiness), or other hidden contributors such as inconsistent sleep schedules, poor sleep quality, or circadian mismatch among the “non-night” group. [36, 37]

### Limitations

This study had several limitations. First, its cross-sectional design prevents establishing causality between study habits and academic outcomes. Second, the small, single-institution sample (N=71) limits generalizability to other universities or student populations. Third, all data—

including GPA, study hours, sleep duration, and perceptions were self-reported, which introduces recall and reporting bias.

Additionally, confounding variables such as caffeine use, stress levels, chronotype, and mental health were not controlled for, potentially influencing both study habits and academic results. Finally, the absence of objective sleep measurements limits the accuracy of assessing true sleep quality and duration.

Overall, while night study appeared linked to better grades in this sample, the findings should be interpreted cautiously. Balanced study schedules that prioritize both effective learning and sufficient rest remain essential for optimal academic and health outcomes.

## **Conclusion**

This study examined the effect of night study patterns on academic performance among medical students at Bahri University, Khartoum State, Sudan. The findings revealed that students who primarily studied at night achieved higher mean GPA (3.3 vs. 2.9) and had fewer failed courses compared to those who did not. Moreover, most night studiers believed this habit enhanced their academic performance. However, despite these seemingly positive associations, previous evidence consistently links insufficient sleep with poorer cognitive function, attention, and academic achievement. Therefore, while night study may offer flexibility and fewer distractions, its long-term impact on learning efficiency and health remains uncertain.

## ***Recommendation***

Given these results and known harms of chronic short or poor sleep, the practical implications are cautious: educators and student health services should promote sleep hygiene, consistent sleep schedules, and time-management and study-skills training rather than recommending a universal “study-at-night” strategy. Future research should use longitudinal designs and objective sleep measurement (actigraphy or polysomnography where feasible), larger and multisite samples, and statistical control for motivation, baseline academic ability, chronotype and stimulant use to clarify whether and when night study can be an adaptive strategy for some students or is simply a marker of other advantages. In addition, qualitative work exploring why high-performing students choose night study at Bahri University (fewer distractions, cultural or household factors, coursework scheduling) would help tailor interventions. Finally, given the high prevalence of sleep problems in medical students reported in other studies, targeted screening for excessive daytime sleepiness and sleep disorders and offering time-management and wellness programs remain important priorities.

## Authorship

The authors listed below have all met the authorship criteria based on substantial contributions to the conception, design, data collection, analysis, interpretation of data, drafting, and critical revision of the manuscript. All authors approved the final version and agree to be accountable for all aspects of the work.

- **Ziryab Imad Taha Mahmoud**  
Consultant Physician and Rheumatologist, University of Bahri; Ziryab Research Group
- **Asgad Ahmed Ismail Ahmed**
- **Rofida Ahmed Mohammed Alamin**
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## Author Contributions

- **Ziryab Imad Taha Mahmoud:** Led study conceptualization, supervised methodology, guided interpretation of findings, contributed to manuscript writing and final approval.
- **Asgad Ahmed Ismail Ahmed:** Collected data, performed data entry, assisted in analysis, drafted sections of the manuscript.
- **Rofida Ahmed Mohammed Alamin:** Contributed to study design, literature review, questionnaire preparation, and manuscript editing.
- **Methag Faroug Ali Mohammad:** Assisted in data collection, statistical analysis, results interpretation, and manuscript revision.

All authors reviewed and approved the final manuscript.

## Declaration of Interests

The authors declare that they have **no competing interests** and no conflicts of interest related to this study or its publication.

## Ethical Considerations

Ethical approval for this study was obtained from the Institutional Review Board (IRB) of the University of Bahri, Sudan. Additional permission was granted by the Community Medicine Department. Written informed consent was obtained from all participants prior to data collection. Participation was voluntary, and confidentiality and anonymity were strictly maintained throughout the research process.

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### **References:**

1. Edu4Sure. Night study facts & tips [Internet]. [cited 2025 Sep 14]. Available from: <https://edu4sure.com/night-study-facts-tips/>
  2. Bremer R. The manual: a guide to the ultimate study method. 2nd ed. Fons Sapientiae Publishing; 2016. ISBN: 9780993496424.
  3. University of Oxford. Study skills [Internet]. Oxford: Weblearn; 2008 Jul [cited 2025 Sep 14]. Available from: <https://weblearn.ox.ac.uk> (archived 2009 Mar 19).
  4. Creme P, Lea MR. Writing at university: a guide for students. Buckingham (UK): Open University Press; 1997.
  5. Contributions of study skills to academic competence. Sch Psychol Rev. 2009 [cited 2025 Sep 14];(ISSN: 0279-6015). Available from: <https://eric.ed.gov/>
  6. Robnolt VJ, Rhodes JA. Study skills in the digital age. In: Academic knowledge construction and multimodal curriculum development. Hershey (PA): IGI Global; 2014. p. 256–64. doi:10.4018/978-1-4666-4797-8.ch016. ISBN: 9781466647978.
  7. Preston R. Teaching study habits and skills. New York: Rinehart; 1959.
  8. Kranyik R, Shankman FV. How to teach study skills. New York: Teacher's Practical Press; 1963.
  9. Cohn M. Helping your teenage student: what parents can do to improve reading and study skills. New York: Dutton; 1979. ISBN: 9780525930655.
  10. Gruber G. Dr. Gary Gruber's essential guide to test taking for kids, grades 3, 4, 5. New York: Quill; 1986. ISBN: 9780688063504.
  11. Gruber G. Dr. Gary Gruber's essential guide to test taking for kids, grades 6, 7, 8, 9. New York: Quill; 1986. ISBN: 9780688063511.
  12. Hilgard ER, Irvine RP, Whipple JE. Rote memorization, understanding, and transfer: an extension of Katona's card-trick experiments. J Exp Psychol. 1953;46(4):288–92. doi:10.1037/h0062072. PMID: 13109128.
  13. Spencer-Waterman S. Handbook on differentiated instruction for middle & high schools. New York: Routledge; 2014. p. 61. ISBN: 9781317930082.
  14. Gopalakrishnan K. Students tackle stress as board exams draw. The Times of India. 2009 Jan 8.
  15. Stangl W. The PQRST method of studying [Internet]. stangl-taller.at. [cited 2025 Sep 14]. Available from: <https://stangl-taller.at>
- Robinson FP. Effective study. New York: Harper & Row; 1970.

16. Roediger HL, Karpicke JD. Test-enhanced learning. *Psychol Sci*. 2006;17(3):249–55. doi:10.1111/j.1467-9280.2006.01693.x. PMID: 16507066.
17. Mueller PA, Oppenheimer DM. The pen is mightier than the keyboard. *Psychol Sci*. 2014;25(6):1159–68. doi:10.1177/0956797614524581. PMID: 24760141.
18. The fiction and facts of speed reading. *BBC News*. 2017 Feb 14.
19. Foer J. Forget me not: how to win the U.S. Memory Championship. *Slate*. 2005 Mar 16 [cited 2025 Sep 14]. Available from: <https://slate.com>
20. Diezmann C, English L. Promoting the use of diagrams as tools for thinking. In: *The roles of representation in school mathematics: 2001 yearbook*. Reston (VA): National Council of Teachers of Mathematics; 2001. p. 77–89. ISBN: 9780873534956.
21. California Department of Education. API reports – Academic Performance Index [Internet]. Sacramento (CA): CDE; [cited 2025 Sep 14]. Available from: <https://www.cde.ca.gov> (archived 2006 Aug 18).
22. Chan C. The old and the new: comparing the Academic Performance Index and new California School Dashboard. *Educate78*. 2017 Apr [cited 2025 Sep 14]. Available from: <https://educate78.org>
23. California Department of Education. Warning and alerts [Internet]. Sacramento (CA): CDE; [cited 2025 Sep 14]. Available from: [https://www.cde.ca.gov/wa/alert.html?event\\_transid=0922d6a9986dbdc7c617482b8e77e666b71baff2381527991284ef2cf5c11d62](https://www.cde.ca.gov/wa/alert.html?event_transid=0922d6a9986dbdc7c617482b8e77e666b71baff2381527991284ef2cf5c11d62)
24. Understanding the API [Internet]. *Ed-data.k12.ca.us*. 2008 Dec 18 [cited 2025 Sep 14]. Available from: <https://web.archive.org/web/20081218163416/http://www.ed-data.k12.ca.us/articles/Article.asp?title=Understanding%20the%20API>
25. California Department of Education. Warning and alerts [Internet]. Sacramento (CA): CDE; [cited 2025 Sep 14]. Available from: [https://www.cde.ca.gov/wa/alert.html?event\\_transid=0922d6a9986dbdc7c617482b8e77e6661836e5323509549e0175f7e84b836945](https://www.cde.ca.gov/wa/alert.html?event_transid=0922d6a9986dbdc7c617482b8e77e6661836e5323509549e0175f7e84b836945)
26. Data Commons [Internet]. [cited 2025 Sep 14]. Available from: <https://datacommons.org/>
27. Barley BK, Scullin MK. Reinforcing sleep education with behavioral change strategies: intervention effects on sleep timing, sleep duration, and academic performance. *J Clin Sleep Med*. 2025. doi:10.5664/jcsm.11780. Epub ahead of print.

28. Al Shammari MA, Al Amer NA, Al Mulhim SN, Al Mohammedsaleh HN, AlOmar RS. The quality of sleep and daytime sleepiness and their association with academic achievement of medical students in the eastern province of Saudi Arabia. *J Family Community Med.* 2020;27(2):97–102. doi:10.4103/jfcm.JFCM\_160\_19.
29. Maheshwari G, Shaukat F. Impact of poor sleep quality on the academic performance of medical students. *Cureus.* 2019;11(4):e4357. doi:10.7759/cureus.4357.
30. Lawson HJ, Wellens-Mensah JT, Attah Nantogma S. Evaluation of sleep patterns and self-reported academic performance among medical students at the University of Ghana School of Medicine and Dentistry. *Sleep Disord.* 2019;2019:1278579. doi:10.1155/2019/1278579.
31. El Hangouche AJ, Jniene A, Abouddrar S, Errguig L, Rkain H, Cherti M, et al. Relationship between poor quality sleep, excessive daytime sleepiness and low academic performance in medical students. *Adv Med Educ Pract.* 2018;9:631–8. doi:10.2147/AMEP.S162350.
32. Creswell JD, Tumminia MJ, Price S, Sefidgar Y, Cohen S, Ren Y, Brown J, Dey AK, Dutcher JM, Villalba D, Mankoff J. Nightly sleep duration predicts grade point average in the first year of college. *Proceedings of the National Academy of Sciences.* 2023 Feb 21;120(8):e2209123120.
33. Crowley R, Alderman E, Javadi AH, Tamminen J. A systematic and meta-analytic review of the impact of sleep restriction on memory formation. *Neuroscience & Biobehavioral Reviews.* 2024 Dec 1;167:105929.
34. Zhang N, He X. Exploring students' study time, sleep duration, and perceptions of course difficulty on final examination results: A cross-sectional study. *Journal of Chiropractic Education.* 2025 Feb 28;39:eJCE-24.
35. Email, Stacy Kish. *Nightly Sleep Is Key to Student Success - News - Carnegie Mellon University.* 17 Feb. 2023, <https://www.cmu.edu/news/stories/archives/2023/february/nightly-sleep-is-key-to-student-success>.
36. Alqudah M, Balousha SA, Balusha AA, Al-U'datt DA, Saadeh R, Alrabadi N, Alzoubi K. Daytime sleepiness among medical colleges' students in Jordan: Impact on academic performance. *Sleep Disorders.* 2022;2022(1):7925926.
37. Okano K, Kaczmarzyk JR, Dave N, Gabrieli JD, Grossman JC. Sleep quality, duration, and consistency are associated with better academic performance in college students. *NPJ science of learning.* 2019 Oct 1;4(1):16.

# Annex

## 1. *Questionnaire*

**Do you agree to participate in this study? Yes-No**

### **Section A: Sociodemographic Information**

**Age: \_\_years**

**Gender:**

- Male
- Female

**Marital Status:**

- Single
- In a relationship
- Engaged / Married

**Current Year of Study:**

- 2nd Year
- 3rd Year
- 4th Year
- 5th Year

**Residence Type:**

- With family
- Campus dormitory
- Living alone

### **Section B: Study Habits and Patterns**

**Do you primarily study at night?**

- Yes
- No

**Average number of hours you study per day: \_\_hours**

**Average number of hours you sleep per night: \_hour.**

**How many nights per week do you study past midnight? \_\_\_\_night.**

**What are your main reasons for studying at night? (select all that apply)**

- Fewer distractions
- Better concentration
- Personal preference
- Academic workload
- Other (please specify): \_\_\_\_\_

### **Section C: Study Environment and Academic Performance**

**Preferred study environment:**

- Library
- Home
- Quiet room
- With friends / Group study

**Current GPA: \_**

**Number of failed courses in the current academic year: \_\_\_\_subject/course.**

**Self-reported satisfaction with academic performance:**

- Very dissatisfied
- Dissatisfied
- Neutral
- Satisfied
- Very satisfied

### **Section D: Effects of Study Habits on Well-being**

**Do you feel daytime sleepiness affects your academic performance?**

- Yes
- No

**How stressful do you find night study sessions?**

- Very stressful
- Stressful

- Slightly stressful
- Neutral
- Not stressful at all

**Do you experience mood changes due to night study?**

- Yes
- No

**Do you believe night study improves your academic performance?**

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree