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# THE EFFECT OF SLEEP DEPRIVATION IN STUDENTS AND ITS ROLE IN ACADEMIC PERFORMANCE

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***Abstract***

***Background:*** *The sleep deprivation affects the maturity, psychological development and academic success, among students who frequently struggle with sleep irregularities and issues related to both the quantity and quality of their sleep. Additionally, learning ability and grades were found to be significantly impacted by sleep rhythm and impairment. Attention span, academic performance and daytime functioning are all significantly impacted by sleep deprivation. Teenagers who don't get enough sleep frequently have cognitive impairments, which manifest as more attentional lapses and worse academic achievement. Both circadian rhythms, which synchronize sleep patterns with the day-night cycle and homeostatic mechanisms, which generate the desire for sleep are involved in the control of sleep. Cognitive performance is greatly impacted by these processes. The prefrontal cortex, a portion of the brain essential for executive processes including decision-making, impulse control and attention regulation is especially affected by sleep deprivation. This review highlights a close association between sleep deprivation and poor academic performance among students.* ***Conclusion****: Multiple studies correlate to back up the finding that sleep deprivation and improper sleep hygiene play a negative role in the academic performance of students. Maintaining brain health may be greatly aided by getting enough sleep. The link between sleep and cognitive development emphasizes how*

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*important sleep is in determining how the brain works and how people behave. Promoting a healthy lifestyle and mental well-being, will increase the academic performance among students.*

***Keywords**: Sleep Deprivation, Academic Performance, Healthy Life Style.*

## INTRODUCTION

One of the most essential components of a healthy life is proper sleep, both the duration and quality of sleep. It plays a vital role in good health and well-being and during sleep the body works continuously to support healthy brain function and sustain physical health. Sleep affects the heart and circulatory system, metabolism, respiratory system and the immune system.

According to the US Centre for Disease Control and Prevention (US CDC) guidelines[1], people between the ages of 18 and 64 should sleep 7 to 9 hours every night, while older individuals should sleep for 7 to 8 hours.

In spite of this recommendation, according to a recent international poll that was carried out in more than 45 countries, factors like stress, anxiety and worry are becoming more common among adults who are categorized as Millennials and Generation Z. Emerging modern issues like poor sleep hygiene, increased social media use, academic stresses and difficulties in peer interactions may be attributed for this rise.[2]

Along with this abysmal rise in stress and anxiety leading to poor sleep hygiene, there are also the long-term effects of it on human health. For instance, numerous detrimental health outcomes, such as an elevated risk of hypertension, diabetes, obesity, depression, heart attack and stroke, have been linked to the cumulative long-term impact of sleep deprivation and sleep disorders.[3]

The characteristics of sleep, sleep duration and quality of sleep are discussed in reference to individual health. The themes of sleep and memory and the importance of memory consolidation during sleep, are discussed along with a brief overview of the neural mechanisms involved in memory. This is then tied into the concept of academic achievement and the decline of cognitive functions of the brain due to sleep deprivation. Finally, some measures are suggested as a mechanism to effectively counter the rising and harmful cases of sleep deprivation among the young population.

### Sleep Architecture

Reduced sensory sensitivity, altered consciousness, and lowered muscular tone are all symptoms of sleep, a bio-behavioural condition marked by variations in brain electrical activity. The fundamental structural arrangement of typical sleep is referred to as sleep architecture. Sleep cycles and stages were found using electroencephalographic (EEG) recordings, which track the electrical patterns of brain activity.[3]

The two main types of sleep phases in a sleep cycle are rapid eye movement (REM) sleep and non-REM sleep. During a sleep session, REM and NREM sleep cycles alternate. Each sleep cycle, which lasts roughly 120 minutes, occurs four to six times every night.[1]

Each cycle consists of one REM stage and three NREM stages. The various stages of sleep are associated with distinct brain physiology and activity. Each has distinct traits, such as differences in muscle tone, eye movements and brain wave patterns. During REM sleep, the brain is active and eyes move quickly. REM sleep helps focus and control emotions and in addition to it, is also critical for learning and memory. Bone and muscles get repaired and regenerated during REM sleep. Body temperature and heart rate drop during NREM sleep and this leads to deeper sleep. The immune system is also strengthened by non-REM sleep.[4]

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The initial NREM-REM sleep cycle typically lasts between 70 and 100 minutes. The second and subsequent cycles last between 90 and 120 minutes. About 75 to 80 percent of total sleep time is made up of NREM sleep, with the remaining 20 to 25 percent being made up of REM sleep. The extent of REM sleep in healthy individuals rises during the night and peaks in the last part of the sleep cycle. As the sleep period progresses, stages 3 and 4 may sometimes entirely disappear and stage 2 begins to comprise the majority of NREM sleep.[3]

**Sleep and Memory**

The three stages of memory include registration, short-term memory and long-term memory. The two types of memory that are actively and consciously learned are declarative memory and procedural memory which is long term unconscious memory of how to perform tasks and skills.[5] The latter is learnt implicitly, or unconsciously, the former is categorized as explicit and includes episodes, memories, time, specific space and semantic memory that you can consciously recall.

It has been demonstrated that procedural memory happens during late REM sleep, while declarative memory consolidation is selectively facilitated during early Slow Wave Sleep (SWS), which is characterized as the deepest stage of sleep in NREM. SWS specifically improves declarative memories and gross motor system activities through neuro-cortical pathways, whereas REM sleep primarily promotes procedural and emotional memory.[6]

In addition to the activation of the hippocampus and the integrative prefrontal cortical-hippocampal network, memory regulation involves a variety of endogenous mechanisms that are triggered by hormonal and neurological inputs and have an adaptive effect.[6] Learning precise sequences of a difficult motor task is an example of a generalized sensorimotor talent that demonstrates learning benefits in both implicit and explicit tasks.

Sleep affects synaptic connections, which are necessary for long-term memory formation, integration, and remodelling, as well as for learning ability renewal. During the first few hours of sleep, when synaptic and cellular homeostasis is restored, expression of a number of proteins and genes required for synaptic plasticity rises. Sleep is when the highest cognitive and motor demands occur, necessitating more intense synaptic stability.[7]

**Sleep and Memory Consolidation**

In order to maximize cognitive function, sleep is essential. Studies on experimental sleep deprivation reveal that sleep deprivation impairs performance across a wide range of cognitive domains, including short-term memory, executive function and attention. Cognitive functions that significantly depend on the prefrontal cortex are especially impacted. One of the most researched cognitive areas in connection to sleep is memory and a growing body of research describes how sleep supports and enhances recent learning that has been preserved, including procedural and episodic memory.

Features of non–rapid eye movement sleep (especially slow oscillations and sleep spindles) and REM sleep play overlapping and complementary roles in the underlying process of memory consolidation in which new, unstable memories are relocated from the hippocampus to the neocortex, where they are more durable. Compared with younger adults, older adults may exhibit deficits in the consolidation of episodic memories, probably because of age related decline in brain health.[1]

**Academic Achievement**

Academic performance refers to students' mastery of course content and skills, their ability to complete academic tasks and their overall academic achievement.[8]

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Numerous factors, such as lifestyle, diet and mental health, are proven to have an impact on high academic accomplishment, which is a significant predictor of future success.[2] Family support, community facilities, learning environment attributes and student characteristics like motivation and perception of well-being are some of the factors that influence academic achievement. The degree to which students accomplish their academic outcomes in general or reach specific educational goals is known as academic achievement and it is a concept that is essential for students' future success. There are several ways to evaluate it, but the most popular ones are test results and instructor grades, however other metrics and scales are emerging to predict academic achievement even more. Greater academic achievement during university coursework has been linked to more employment, greater wages, increased productivity at work, and more active and dynamic movement toward the future.

**Table 1: Given below is a table that shows the aim and conclusion of multiple different studies conducted between the years 2020 and 2025, to study the effect of sleep on grades and academic achievement.**

| S. No. | Authors | Title | Conclusion |
|---|---|---|---|
| 1 | Mario J. Valladares-Garrido, Noelia Morocho-Alburqueque, J. Pierre Zila-Velasque et al. (2025)[9] | Sleep quality and associated factors in Latin American medical students: a cross-sectional and multicentre study | More than half the students had poor sleep quality.<br>Sleep quality worsened during the Covid pandemic, especially for medical students. |
| 2 | Abdulrahman Almalki, Moayad Shehata, Khaled Siddiqui et al. (2025)[10] | Sleep Quality Among a Sample of Medical Students and the Association with Academic Performance: An Updated Data | Nearly 80% of the students reported poor sleep quality. elevated excessive daytime sleepiness was indicative of disturbed sleep quality. During the day, this significantly affects alertness and functionality, which has detrimental effects on cognitive and academic performance. |
| 3 | Lingjia Hu, Kun Wang, Guihua Fu et al. (2024)[11] | Cross-Sectional Study on Analysis of the Prevalence and Influencing Factors of Sleep Disorders among College Students in a Certain University in China | At a particular university, 38% of students suffer from sleep difficulties. Poor academic performance, a high risk of smartphone addiction, high levels of stress and difficult family relationships are all factors that might cause sleep difficulties. |
| 4 | Khor Yong Jie, Noraini Mohamad, Munirah Mohd Adnan et al. (2024)[12] | Factors associated with poor sleep quality among dental students in Malaysia | According to the findings, students who thought they did poor in academics were 2.95 times more likely to have poor sleep quality than those who thought they did well or very well. |
| 5 | Aderinto Nicholas, Olatunji Gbolahan, Afolabi Samson et al. (2024)[13] | Sleep patterns and quality among Nigerian medical students: A cross-sectional study | Inadequate sleep was indicated by the average reported sleep duration of 5.74 hours per night. Significant connections between academic performances, sleep quality, sleep patterns and other sleep-related characteristics were found by correlation analysis. |

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| 6 | Chithambara Thanu Sivakumar, Mahalakshmi Rajan, Umapathy Pasupathy et al. (2022)[14] | Effect of sleep habits on academic performance in schoolchildren age 6 to 12 years: a cross-sectional observation study | According to an analysis of the children's sleep habits questionnaire, 71.9% of the children in the study scored greater than 41, which is within the clinical range and suggests that changed sleep habits are significantly more common. Children of school age who have different sleep patterns score significantly less academically. |
| 7 | Robert W. Turner II, Kalpana Vissa, Christine Hall et al. (2021).[15] | Sleep problems are associated with academic performance in a national sample of collegiate athletes | A higher probability of B/C averages was linked to sleep difficulties. A higher chance of B/C and D/F averages was linked to sleeplessness. Fatigue was linked to higher chances of B/C and D/F averages.<br>Overall, a 60% higher chance of a grade-level drop in GPA was linked to sleep difficulties. An 11% higher chance of receiving a poorer grade was linked to each day of inadequate sleep. |
| 8 | María Dolores Toscano-Hermoso, Félix Arbinaga, Eduardo J. Fernández-Ozcorta et al (2020)[16] | Influence of Sleeping Patterns in Health and Academic Performance Among University Students | When examining the connection between academic performance and sleep quality, it is shown that students who have bad sleep quality, scoreless academically than those who have better sleep quality. |
| 9 | Mohammad Alqudah, Samar A. M. Balousha, Othman Al-Shboul et al. (2019)[17] | Insomnia among Medical and Paramedical Students in Jordan: Impact on Academic Performance | A considerable frequency of insomnia was identified and academic performance exhibited a substantial correlation with insomnia severity index (ISI) scores and self-reported sleep quality. |
| 10 | Andrew J. K. Phillips, William M. Clerx, Conor S. O'Brien et al (2017)[18] | Irregular sleep/wake patterns are associated with poorer academic performance and delayed circadian and sleep/wake timing | The study demonstrates that college students' erratic sleep and light exposure habits are linked to delayed circadian rhythms and poorer academic achievement. |

**DISCUSSION**

Sleep quality generally refers to the overall satisfaction of sleep experience. It includes various aspects, such as sleep duration, the individual's ease of falling asleep, staying asleep and feeling refreshed after waking up. The reduction in sleep duration and deterioration of sleep quality leads to various health hazards. Sleep disorders are increasingly becoming a public health problem.

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Previous researches have revealed that students with poor academic performance often experience severe insomnia symptoms. They cannot fall asleep within 30 minutes and wake up frequently at night. Moreover, the pressure to maintain average grades can adversely affect their sleep quality. Poor academic performance is a common and serious issue among college students, leading to increased academic pressure. Research has indicated a positive correlation between poor academic performance and the incidence of sleep disorders[9-11].

Mario J. Valladares-Garrido et al.[9] conducted a study to ascertain the prevalence and factors related to sleep quality among medical students in Latin America. A cross-sectional analysis of secondary data was carried out. Sleep quality and its relationship to psychosocial-academic factors, anxiety and depression symptoms, resilience, eating disorders, physical activity, alcohol and cigarette use were evaluated. Sixty-two percent of students reported having poor quality sleep. Female students, smoking and symptoms of anxiety and sadness were associated with poor sleep quality. Since inadequate sleep has an impact on both mental and physical health as well as academic achievement, these findings are crucial for public health.

The purpose of the study by Abdulrahman Almalki et al.[10] was to assess medical students' sleep habits and quality and ascertain whether they were associated with academic success. Sleep patterns and general well-being of students are greatly impacted by the rigorous environment of medical school.

Lingjia Hu et al.[11] carried out a cross-sectional study in 2022 where college students from a particular Chinese university completed a well-designed questionnaire. The incidence of sleep issues among college students was also found to be influenced by a number of independent risk factors, including academic achievement, pressure level, family relationships and the possibility of smartphone addiction, according to multifactor logistic regression analysis.

Dentistry students from four public universities in Malaysia participated in a cross-sectional study by Khor Yong Jie et al.[12] The multiple logistic regression analysis showed a strong correlation between self-perceived poor academic achievement and poor sleep quality.

Data from 802 medical students from three medical colleges in Southwest Nigeria on their demographics, sleep habits, and self-reported sleep quality were gathered through an online survey by Aderinto Nicholas et al.[13] found a significant relationship between academic performance, sleep quality, sleep patterns and other sleep-related characteristics. Poor sleep quality, irregular bedtimes, late-night coffee intake and inadequate sleep length were all noted in the study.

Children's cognitive and neurodevelopmental outcomes are greatly influenced by sleep, therefore getting enough sleep is essential for enhancing academic performance. The primary objective of Chithambara Thanu Sivakumar et al.[14] was to determine how prevalent sleep patterns are and how they impact academic achievement in schools for students aged 6 to 12 years. The results were then interpreted for an association between academic achievement and prevalent sleep patterns.

To find out how sleep issues affect academic performance, Robert W. Turner II et al. [15] examined data from 8,312 collegiate and collegiate athletes in the United States. The study postulated that a correlation between collegiate athletes' sleep issues and worse academic achievement would hold true for a variety of sleep issue categories.

María Dolores Toscano-Hermoso et al.[16] found that women are less efficient at sleeping than men. When examining the connection between academic performance and sleep quality, it is shown that students who get less sleep score lower academically than those who get more sleep. Additionally, it has been demonstrated that students who report poor sleep quality have worse subjective assessments of their academic accomplishments than students who report good sleep quality.

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A cross-sectional, self-administered questionnaire was employed by Mohammad Alqudah et al.[17] academic achievement was substantially correlated with both self-reported sleep quality and ISI scores.

Andrew J. K. Phillips et al.[18] showed that in comparison to students on a more regular sleep/wake schedule, a particular population of college students with irregular sleep schedules exhibits a significant circadian phase delay in the timing of both the endogenous melatonin rhythm and the sleep propensity rhythm. Additionally, it was discovered that academic achievement and sleep regularity are positively connected[18].

Because of this, adolescents who don't get enough sleep could take more risks, have mood swings and struggle in school. Teenagers who don't get enough sleep frequently have trouble focusing, remembering things, and solving problems, which affects their academic performance and grades.[19] Academic performance can be further hampered by chronic sleep loss, which can further worsen diseases like Attention Deficit Hyperactivity Disorder (ADHD).School burnout, which is defined by emotions of tiredness from academic expectations, a cynical and disinterested view towards schoolwork and a sense of inadequacy as a student, is associated with disrupted sleep brought on by social media use.[20]

Sleep hygiene should be given priority, especially for students, as sleep disruption is known to be a major influence in memory consolidation and the acquisition of new knowledge. Maintaining brain health may be greatly aided by getting enough sleep. The link between sleep and cognitive development emphasizes how important sleep is in determining how the brain works and how people behave. Maintaining high levels of attention and cognitive function requires adequate sleep, whereas sleep loss can seriously damage these capacities. Given that adolescents are frequently at risk of chronic sleep deprivation as a result of a variety of biological and social stresses, this suggests the need for focused interventions to address sleep disorders.

## CONCLUSION

Multiples studies correlate to back up the finding that sleep deprivation and improper sleep hygiene play a negative role in the academic performance of students. Education and information regarding this concept may be spread to students and educators may plan for suitable interventions and awareness campaigns regarding the same, promoting a healthy lifestyle and mental well-being, thus increasing the academic performance among students.

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