Effect of Sleep Deprivation on the Academic Performance and Cognitive Functions among the College Students: A Cross Sectional Study

Sumi Rose¹, Sonumol Ramanan²

¹ Assistant Professor ² BPT Internee
College of Physiotherapy
Acharya Institute of Health Sciences
Bangalore, Karnataka, India.

CORRESPONDENCE:
1 Sumi Rose, MPT
Asst. Professor
College of Physiotherapy
Acharya Institute of Health Sciences
Bangalore
Karnataka, India.
E-mail: rosempl@yahoo.com

ABSTRACT

Background: Sleep is an important biological necessity, College students often have erratic sleep schedules, poor sleep hygiene and poor sleep quality, which might affect their performance and cognitive functions.

Objective: To find out the effect of sleep deprivation on the academic performance and cognitive functions among the college students.

Materials and Methods: A cross-sectional design- A self-administered paper questionnaire was administered of first-year through final-year BPT, BMLT and BMIT students. The grade point average was recorded for the academic performance.

Results: A total of 150 respondents, with a response rate of 75%, were obtained. 143 (95.3%) students obtained less than the recommended 7-8 hours of sleep. The students whose GPA was lower were associated with lesser sleep duration had sleep deprivation. The cognitive functions of college students like memory, attention, concentration was also impaired.

Conclusion: Academic performance and cognitive functions of the students who were sleep deprived was poor. Hence, appropriate sleep is integral part of better academic performance and cognitive function.

Keywords: Sleep deprivation, academic performance, cognitive function, grade point average
Hence, Current Research was intended to find how sleep deprivation effect the academic performance and cognitive functions of the college students? The objectives of the study was to determine the effect of sleep deprivation on the academic performance and cognitive functions among the college students.

MATERIALS AND METHODS

Research Design: Cross sectional design
Sample Size: 150 college students
Sampling Design: Convenient sampling
Source of Data: Data was collected from Acharya Institute of Health Science, Bangalore.

Inclusion criteria:
• Normal healthy college students
• Participants with age group 18-24 years
• Students willing to participate in this study

Exclusion criteria:
• Students with any sleeping disorders like insomnia
• Students on medications
• Students with part-time jobs

PROCEDURE

200 healthy subjects (N=200) were included in the study age group 18 to 24 years. Written consent was obtained from all the 200 subjects. Each subject was screened for, and excluded if the subjects had not met the inclusion criteria. Then the purpose of the study was explained to the subjects. An anonymous, voluntary, self-administered questionnaire was given to the subjects. The GPA of every subject was recorded. These average scores were considered as their academic performance in the present study.

DATA ANALYSIS

Performed using SPSS version 16. Descriptive statistics were performed for the demographic variables. Mean, standard deviation and percentage was calculated. PLUM ordinal regression was done for GPA.

RESULT

The questionnaire was distributed to 200 students and completed questionnaires were received from 150 students.

79 (52.7%) students feel that their academic performance is hindered due to insufficient sleep. 118(78.7%) students felt that they are sleep deprived as a college student.

Table 1: Demographic information of 150 students

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std.Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>73</td>
<td>18.00</td>
<td>24.00</td>
<td>19.8493</td>
<td>1.31942</td>
</tr>
<tr>
<td>Male</td>
<td>77</td>
<td>19.00</td>
<td>24.00</td>
<td>20.7922</td>
<td>1.46303</td>
</tr>
</tbody>
</table>

Table 2: Parameters of sleep deprivation

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Highest</th>
<th>Lowest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular sleeping hours</td>
<td>6-7 hours</td>
<td>7-8 hours</td>
</tr>
<tr>
<td>Time taken to fall asleep at night</td>
<td>30 minutes</td>
<td>7 minutes</td>
</tr>
<tr>
<td>Yawning during class hours</td>
<td>very often</td>
<td>not often</td>
</tr>
</tbody>
</table>

Table 3: Focus on Performance and Cognitive Function

<table>
<thead>
<tr>
<th>Do not sleep well or lack of sleep</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unable to stay awake or focused during classes</td>
<td>132</td>
<td>18</td>
</tr>
<tr>
<td>Unable to focus during exams</td>
<td>81</td>
<td>69</td>
</tr>
<tr>
<td>Feels less energy or motivation</td>
<td>125</td>
<td>25</td>
</tr>
<tr>
<td>Weakened immune system</td>
<td>62</td>
<td>88</td>
</tr>
<tr>
<td>Feels academic performance is hindered</td>
<td>79</td>
<td>71</td>
</tr>
</tbody>
</table>

Table 4 : Grade Point Average

<table>
<thead>
<tr>
<th>Grade Point Average</th>
<th>No. of students</th>
<th>No. of students who are sleep deprived</th>
<th>%</th>
<th>No. of students who are not sleep deprived</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 (distinction)</td>
<td>1</td>
<td>NIL</td>
<td>NIL</td>
<td>1</td>
<td>0.7%</td>
</tr>
<tr>
<td>3 (first class)</td>
<td>14</td>
<td>13</td>
<td>0.87%</td>
<td>1</td>
<td>0.7%</td>
</tr>
<tr>
<td>2 (second class)</td>
<td>24</td>
<td>21</td>
<td>14%</td>
<td>3</td>
<td>2%</td>
</tr>
<tr>
<td>1 (eligible)</td>
<td>34</td>
<td>21</td>
<td>14%</td>
<td>13</td>
<td>8.7%</td>
</tr>
<tr>
<td>0 (fail)</td>
<td>77</td>
<td>63</td>
<td>42%</td>
<td>14</td>
<td>9.3%</td>
</tr>
</tbody>
</table>
Effect of Sleep Deprivation on the Academic Performance and Cognitive Functions

**Interpretation:** This graph shows the students' grade that they have scored in the exams. According to the graph, 16 (10.7%) student had GPA > 4, about 24 (16%) students had GPA = 3, 35 (23.3%) had GPA = 2, and about 75 (50%) students had GPA = 1.

**Table 5: Sleep deprivation and cognitive functions**

<table>
<thead>
<tr>
<th>Due to lack of sleep</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency %</td>
<td>Frequency %</td>
<td></td>
</tr>
<tr>
<td>Memory problems</td>
<td>106 70.7%</td>
<td>44 29.3%</td>
</tr>
<tr>
<td>Hallucinations</td>
<td>48 32%</td>
<td>102 68%</td>
</tr>
<tr>
<td>Negative mood/behavioural changes</td>
<td>141 94%</td>
<td>09 6%</td>
</tr>
<tr>
<td>Depression</td>
<td>108 72%</td>
<td>42 28%</td>
</tr>
<tr>
<td>Unable to pay attention or to concentrate in the class</td>
<td>147 98%</td>
<td>03 2%</td>
</tr>
<tr>
<td>Feels sleep deprived as a college student</td>
<td>118 78.7%</td>
<td>32 21.3%</td>
</tr>
</tbody>
</table>

**Graph 1: Sleep deprivation and cognitive functions**

**Interpretation:** Respondents were asked some questions about the cognitive functions. Thus, the sleep deprivation had a negative effect on the cognitive functions.

**Table 6: Sleep Deprivation and Academic Performance**

<table>
<thead>
<tr>
<th>Hindered academic performance</th>
<th>No. of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>79</td>
</tr>
<tr>
<td>No</td>
<td>71</td>
</tr>
</tbody>
</table>

**Graph 2: Hindered Academic Performance**

**Interpretation:** This graph shows that out of 150 students, 79 (52.7%) students feel that their academic performance is hindered due to insufficient sleep.

**Table 7: Sleep deprived students in college**

<table>
<thead>
<tr>
<th>Sleep deprived</th>
<th>No. of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>118</td>
</tr>
<tr>
<td>No</td>
<td>32</td>
</tr>
</tbody>
</table>

**Graph 3: College students who are sleep deprived**

**Interpretation:** The students were asked whether they felt that they are sleep deprived as a college student. 78.7% students felt that they were sleep deprived and 21.3% students felt they were not sleep deprived.
X² value is greater than the table value at 4 degree of freedom and hence the null hypothesis is rejected and research hypothesis is proved.

Sleep deprivation adversely affect the academic performance and cognitive function. Hence sleep is an integral part of good cognitive function thereby improving academic function.

**DISCUSSION**

The main objective of the study was to find out the effect of sleep deprivation on the academic performance and cognitive functions in the college students. The results concluded that majority of students obtain less than the recommended 7-8 hours of sleep each night. Obtaining more than 7 hours of sleep per day for adults is essential 17 critical enough to be an objective by Healthy People 2020 to Improve national health.[18]

44.6% students in this study slept for 6-7 hours in the night. Studies have indicated that sleep deprivation has detrimental effects on the academic performance and health.[16] BaHammam et al.[16] showed that students who scored excellent in college had longer sleeping hours during weekdays. This was supported by our results that students whose GPA was < 4 were 149 (99.3%), out of which 118 (78.7%) were sleep deprived. Also, a study in University of Washington showed that less sleep-deprived students have higher GPA than more sleep deprived students.[19]

Out of 150 students, 81 (54%) students were unable to focus during examinations and had a low GPA score. This finding is consistent with Medeiros et al’s research among medical students that found students who reported sleeping for longer durations obtained higher scores on examinations.[20]

In the current study, 86 (57.3%) students require 30 minutes to fall asleep at night, 42 (28%) students take 1 hour or more to fall asleep at night and 22 (14.6%) students take only 10 minutes to fall asleep at night.

70 (46.6%) students yawn very often during the class hours due to insufficient sleep. Hardly 4 (2.6%) students do not often yawn during the class hours if they do not get sufficient sleep. So, it is inferred that most of the students who are sleep deprived yawn very often during their class hours. 132 (88%) students are facing problem to stay awake or focused during the classes whereas only 18 (12%) students are able to focus in the classes due to sufficient sleep. 125 (83.3%) students feel that they have less energy or motivation throughout the day.

Around 66 (44%) students stress interfered their sleep. 44 (29.3%) students had lack of time management skills, hence diminished the quality or quantity of their sleep. In a study done by Ahrberg and colleagues (2012), they found that different modes of stress affect the circadian sleep rhythms of the students.[21] A study conducted at James Madison University worked with 124 college students, and results from the research revealed that over 50 percent of the students reported high levels of stress that was related to academic workload and time management, which was linked to unhealthy behaviours such as decreased quantity of sleep (Britz and Pappas, 2014).[22]

Sleep has an integral role in learning and memory consolidation, for memory formation of learned information, thus enabling students to recall information.[23] In the current study, 106(70.6%) students have memory problems due to insufficient sleep. A study by Curcio, Ferrara, and De Gennaro (2006) explored the idea that sleep plays an essential role in learning and memory.[24]

A study conducted by Shelley D Hershner and Ronald D Chervin proved that depression and sleep are interrelated and disturbed sleep is a cardinal feature of depression.[11] Current study among 150 students, 108(72%) students felt depressed if they have had insufficient sleep for consecutive days. 48(32%) students felt hallucinations in the night during sleep if they have had insufficient sleep. Kelly and colleagues (2001), short sleepers are more prone to hallucinate in the night.[25] 141(94%) students experience negative mood or behavioural changes when they had consecutive days of insufficient sleep and 147(98%) students face difficulty in paying attention or to concentrate lectures in the class due to lack of sleep.

Most students had the effects of sleep deprivation on academic achievements and the abilities of cognition. This was supported by a study done by Pilcher and Walters that showed that college students are unaware to what extent their sleep deprivation has on their ability to complete cognitive tasks and retain memory and deterring them from academic achievement.[26]

Few strategies to increase sleep quality. Go to bed and wake up schedule, will help the body get used to a regular sleep cycle.[29] Conductive Bedroom for a distraction free sleep by making it quiet, dark, comfortable in

<table>
<thead>
<tr>
<th>Table 8: Plum Ordinal Regression For GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>Final GPA - Sleep deprived</td>
</tr>
<tr>
<td>not deprived</td>
</tr>
</tbody>
</table>
Effect of Sleep Deprivation on the Academic Performance and Cognitive Functions

The problem of sleep deprivation can be effectively solved by integrating appropriate health interventions within the college student population.

LIMITATIONS
1. Self-reporting of the sleep habits was relying on the students’ subjective accounts, which raised the possibility of accuracy.
2. Many hidden variables might have influenced the measurement of academic performance such as self-concept, motivational changes, mental stress, and social class.
3. This study was only conducted at a single institution, which makes it difficult to generalize results to students of other institutions.

RECOMMENDATIONS
1. Future research could enhance generalizability and provide further understanding of the effect of students’ sleep duration and patterns.
2. Future researchers should ask participants to perform a cognitive task and compare their results to their average sleep hours per night.
3. Future researches to investigate effective and feasible interventions, which disseminate both sleep knowledge and encouragement of healthy sleep habits to college students in a time and cost-effective manner.

CONCLUSION
The main objective of the study was to find out the effect of sleep deprivation on the academic performance and cognitive functions in the college students. The results concluded that majority of students obtain less than the recommended 7-8 hours of sleep each night. The sleep deprivation had a negative effect on the students’ academic performance and the cognitive functions like memory, attention, concentration etc. So, health education programs regarding duration and quality of the sleep should be emphasized in colleges to increase the awareness of the importance of a healthy sleep. It is the responsibility of the educators and college authorities to identify the variables that lead to poor sleep quality and take a active role to empower and educate college students about good sleep habits to improve their performance.

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CONFLICT OF INTEREST:
The authors declared no conflict of interest.

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