Effect of Sleep Quality on the Academic Performance and Cognitive Functions among the College Students

Krishna S[1], Mary Shalu Jose[2], J K Mukkadan[3]

[1]Department of Physiology, Little Flower Institute of Medical Science and Research, Angamaly, Kerala, India

[2]Professor, Department of Physiology, Little Flower Institute of Medical Science and Research, Angamaly, Kerala, India

[3]Research Director, Department of Physiology, Little Flower Institute of Medical Science and Research, Angamaly, Kerala, India

Abstract: _Introduction: Impaired quality of sleep affects the cognitive ability and has a negative impact on the academic performance of medical students. The relationship between sleep and cognitive function has been a topic of interest for over a century. In the last decades, excessive daytime sleepiness and poor quality of sleep have been increasingly recognized as symptoms that must be identified and managed early because of their high prevalence in the general population, their numerous and potentially serious consequences . Objectives: 1) To determine the effects of sleep quality on the academic performance of college students. 2) To evaluate the effect of sleep deprivation on cognitive functions among the college students. Methods and Materials: The data collection was done by stratified random sampling. Total of 94 students between the age group of 18 - 25 years are included in this study. A Standardized Questionnaire is used to assess the sleep quality of the subjects and The Epworth Sleepiness Scale is used as a subjective measure to assess patient's sleepiness. The MoCA's test is used as a cognitive screening test. Statistical Analysis: Statistical analysis was done using IBM SPSS 20.0 (SPSS Inc., Chicago, USA). Age is represented by Mean ±SD. All categorical variables presented as frequency and percentage. To find the correlation between MOCA score and Epworth score, Bi - serial correlation coefficient was computed and its statistical significance was tested using Linear Regression t test. To test the statistical significance of the association of sleep quality variables with cognitive impairment, Chi - square test was used. A p value < 0.05 was considered as statistically significant. RESULT: The results showed the students not getting sufficient amount of sleep have more chance for developing cognitive impairment compared to those getting sufficient amount of sleep. Other sleep quality variables showed statistically no significant association with cognitive impairment. Those students who have daytime sleepiness have more chance for cognitive impairment. Among 53 students who are getting sufficient amount of sleep, the distribution of grade was A+ 11.3% students, A for 28.3%, B+ for 30.2%, B for 20.8% and grade C+ for 9.4% compared to those who have no getting sufficient amount of sleep (41 students), the distribution of grade was A+ for 2.4% students, A for 26.8%, B+ for 46.3%, B for 24.4% and none of them have grade C+. Conclusion: Among the study population about 40% of the students believed that sleep quality affected their academic performance. Poor sleep quality affected the cognitive functions of the students._

Keywords: Impaired Sleep quality, academic performance, cognitive function

1. Introduction

Sleep is defined as naturally recurring state of mind and body characterized by altered consciousness, relatively inhibited sensory activity, inhibition of nearly all voluntary muscles and reduced interactions and memory processing. [1, 2]. Adequate sleep of high quality and optimum duration facilitates memory processing and learning, which helps in maintaining concentration executive cognitive functions, sensory motor integration and memory processing. [3, 4, 5]

Academic performance is defined as the extent to which a student has achieved their short or long term educational goals and the results that the students have achieved in their High School or Bachelor degree courses represent academic performance. [8, 9]

Cognitive functions can be defined as cerebral activities which lead to knowledge i. e. including all means and ways of acquiring information. Chronic and acute sleep deprivation negatively impact thinking and learning [1, 8]. Behavioral, physiological, and neuro - cognitive process are involved in sleeping process are involved in sleeping process, just as immune system is. [10].

Poor sleep quality remains a recurring feature of student life, not only does sleep affect cognitive process but is also key to the recovery from stress and elimination of fatigue [16].

This study hypothesized whether poor sleep quality may or may not affect the academic performance and cognitive functions of college students.

2. Material and Method

- Research Design: observational, Cross Sectional Study
- Sample Size: 94 college students
- Assessment of sleep quality: By using Standardized Questionnaire [9]
- Assessment of sleep quantity: By using EPWORTH SLEEPINESS SCALE [18]
- Assessment of cognitive function: By Mo CA's TEST [14]
- Assessment of Academic Performance: percentages of marks will be considered for the assessment [9, 19]

All the materials are selected on the basis of earlier researches done related to the topic

Inclusion Criteria
- Normal healthy college students
- Male and female students between the age group 18 and 25 years
- Students willing to participate in this study

Exclusion Criteria
- Students with chronic medical illness. (A screening was performed through an interview to find out any chronic illness or any psychiatric illness)
- Students on medications that cause sleepiness
- Students with any sleeping disorders like insomnia, sleep apnoea, restless leg syndrome, parasomnia, narcolepsy etc.

Methods of Data Collection
The data for the study was collected from students within the age group 18 - 25 years from LIMSAR, Angamaly, Ernakulum district, Kerala for a period of 6 months (October 2021 - March 2022) after getting written informed consent and the details was entered to demographic proforma. Each subject was screened for confirming that the subject had not met with the inclusion criteria and the purpose of the study was explained to the each subject. The percentage of marks were recorded and considered as their academic performance in the study.

Statistical Analysis
Statistical analysis was done using IBM SPSS 20.0 (SPSS Inc., Chicago, USA). Age is represented by Mean ±SD. All categorical variables presented as frequency and percentage. To find the correlation between MOCA score and Epworth score, Bi - serial correlation coefficient was computed and its statistical significance was tested using Linear Regression t test. To test the statistical significance of the association of sleep quality variables with cognitive impairment, Chi - square test was used. A p value < 0.05 was considered as statistically significant.

3. Result

The study included 94 college students within the age group range 18 - 25. The mean age was 21.32±1.77 years. All the students were Indian and taken only 1 course. Most of the courses class time starting at 9 am, the staring time of two courses were 11 am and only 1 course starting at 7 am and 8 am each.

Table 1: Distribution of Age class

Age Class	Frequency	Percentage
18 - 20	26	27.7%
21 - 23	55	58.5%
>23	13	13.8%
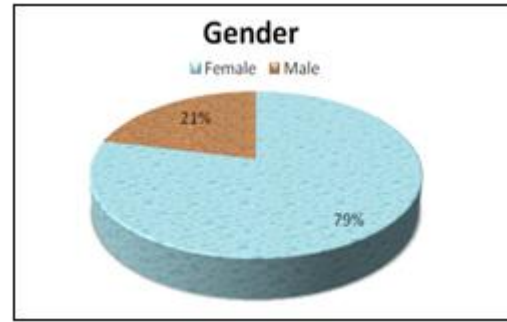
Figure 1

Academic Evaluation

Table 2: Distribution of Student classification

Student classification	Frequency	Percentage
Graduate	48	51%
Post graduate	46	48.9%

Table 3: Distribution of grades and marks

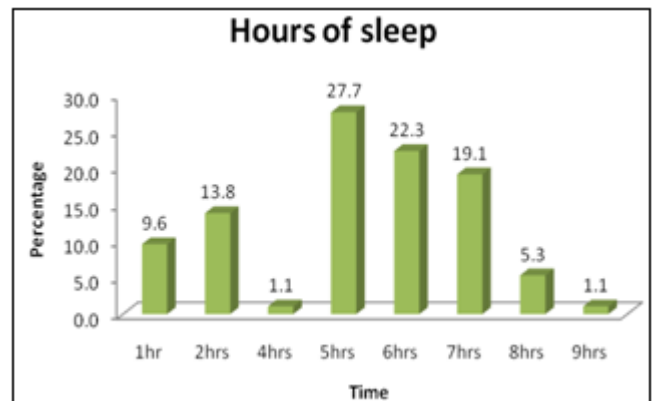| Percentage marks	Frequency	Percentage
A+	7	7.4
A	26	27.7
B+	35	37.2
B	21	22.3
C+	5	5.3

Figure 2

Table 4: Distribution of day time sleepiness affecting academic performance

Day time sleepiness affects your academic performance	Frequency	Percentage
No Daytime Sleepiness	25	26.6
Never	38	40.4
Daily	16	17.0
Weekly	9	9.6
Monthly	6	6.4

Sleep quality with Accadamic performance by percentage of marks

Table 5: Distribution of getting sufficient amount of sleep and percentage marks

Sufficient Amount of Sleep	Percentage Marks				
	A+ n (%)	A n (%)	B+ n (%)	B n (%)	C+ n (%)
Yes (53)	6 (11.3)	15 (28.3)	16 (30.2)	11 (20.8)	5 (9.4)
No (41)	1 (2.4)	11 (26.8)	19 (46.3)	10 (24.4)	0 (0)

The Epworth Sleepiness Scale

Table 6: Distribution of Epworth score

Epworth score	Frequency	Percentage
Would never doze	79	84.0
Slight chance of dozing	15	16.0

Table 7: Distribution of daytime sleepiness affects academic performance with Cognitive impairment

Day time sleepiness affects your academic performance	Cognitive impairment	
	Yes (n)	No (n)
No Daytime Sleepiness (25)	5	20
Never (38)	12	26
Daily (16)	7	9
Weekly (9)	7	2
Monthly (6)	0	6

Table 8: Association of sleep quality and Cognitive impairment

| Variables		Cognitive impairment		p value
		Yes n (%)	No n (%)	
Hours of sleep getting on average during any given night	<6hrs (49)	13 (26.5)	36 (73.5)	0.165
	>=6hrs (45)	18 (40)	27 (60)	
Getting sufficient amount of sleep	Yes (53)	12 (22.6)	41 (77.4)	0.015
	No (41)	19 (46.3)	22 (53.7)	
Amount of sleeping hrs. on a night before an exam	Below Average (70)	21 (30)	49 (70)	0.294
	Above Average (24)	10 (41.7)	14 (58.3)	
Sleeping disordersuspicion	1 (22)	8 (36.4)	14 (63.6)	0.700
	2 (72)	23 (31.9)	49 (68.1)	
No. of times Wake up during night	<=3times (87)	28 (32.2)	59 (67.78)	0.873
	>3times (7)	3 (42.9)	4 (57.1)	
Daytime sleep	Yes (70)	21 (30)	49 (70)	0.294
	No (24)	10 (41.7)	14 (58.3)	
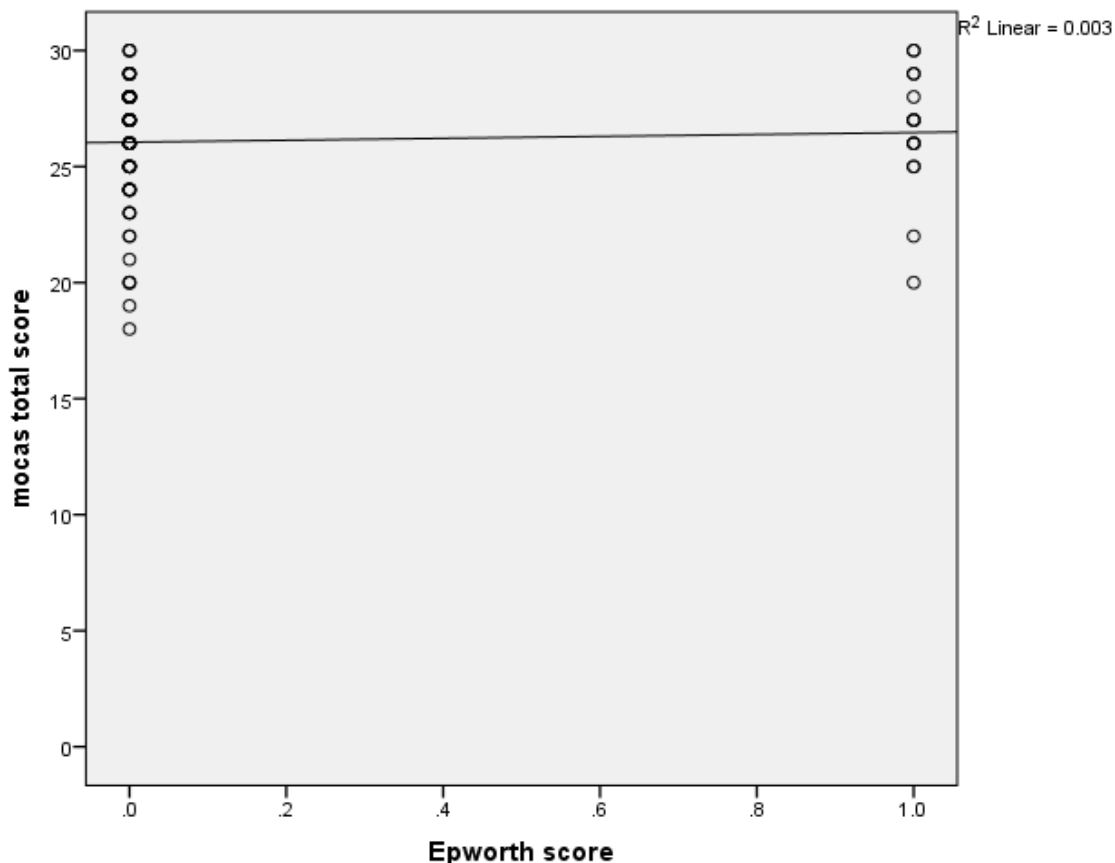
Figure 3: Relationship between MOCA score and Epworth score

4. Discussion

Obtaining more than 7 hours of sleep per day for adults is essential for optimum health and well - being. The main objective of the study was to find out the effect of sleep quality on the academic performance and cognitive functions among the college students. In the present study we included 94 students. Most of the students age was between 21 to 23 years, 55 (58.5%), 26 (27.7%) students age between 18 to 23 years and 13 (13.8%) students age more than 23 years (Table 1), including 74 females and 20 males

(Fig 1). Out of 94 students (Table 2), 48 (51%) were graduates and 46 (48.9%) were postgraduates.

Sleep deprivation is a common occurrence among college students, by depriving themselves they are not only increasing their feelings of sleepiness during the day, but also decreases their ability to pay attention in class which negatively affect their academic performances. [6, 7]

26 (27.7%) of students gets an average sleep 5 hours during any given night, 21 (22.3%) of students gets 6 hours of sleep, 18 (19%) gets 7 hours of sleep, 13 (13.8%) gets only 2 hours of sleep, 5 (5.3%) getting 8hours of sleep, 9 (9.6%) gets only 1 hour sleep. (Fig 2)

Academic performance is defined as the extent to which a student has achieved their short or long - term educational goals [21]. Most students had the effects of sleep deprivation on academic achievements and the abilities of cognition.25 (26.6%) students have no daytime Sleepiness, 38 (40.4%) students believed day time sleepiness never affected their academic performance, 16 (17%) students believed day time sleepiness daily affected their academic performance9 (9.6%) students believed day time sleepiness weekly affected their academic performance and 6 students believed day time sleepiness affected their academic performance monthly (Table 4).

Among 53 patients who gets sufficient amount of sleep, the distribution of grade was A+ for 6 (11.3%) students A for 15 (28.3%), B+ for 16 (30.2%), B for 11 (20.8%) and grade C+ for 5 (9.4%) compared to those students with insufficient amount of sleep (41 students), the distribution of grade was A+ for 1 (2.4%) students, A for 11 (26.8%), B+ for 19 (46.3%), B for 10 (24.4%) and none of them have grade C+. (Table 5)

The Epworth sleepiness score results showed 79 (84%) students would never doze and 15 (16%) had slight chance of dozing. (Table 6) The study showed there was statistically no significant correlation between MOCA score and Epworth score (r=0.06, p value=0.577). (Fig3)

Sleep has an integral role in learning and memory consolidation, for memory formation of learned Information, thus enabling students to recall information. In the current study, 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. During adolescence, often viewed as an important time frame in terms of acquisition and development of academic and cognitive skills, sleep might play a key role in memory consolidation, brain plasticity and cognitive functioning. [22]

Among the students who have no daytime sleepiness (25), 5 students had Cognitive impairment, among the students who never have daytime sleepiness (38), 12 students had Cognitive impairment, among the students who have daily daytime sleepiness (16), 7 students had Cognitive impairment and among the students who have Weekly daytime sleepiness (9), 7 students had Cognitive impairment. Those students who have daytime sleepiness have more chance for cognitive impairment.

The results showed the students not getting sufficient amount of sleep have more chance for developing cognitive impairment compared to those getting sufficient amount of sleep, which is statistically significant (p value=0.015). Other sleep quality variables showed statistically no significant association with cognitive impairment. 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 [13] (Table8).

Among the study population about 40% of the students believed that sleep quality affected their academic performance. Poor sleep quality affected the cognitive functions of the students. Good sleep quality is associated with better academic performance among college students. Sleep might play a key role in memory consolidation, brain plasticity and cognitive functioning [22]

5. Conclusion

The results showed the students not getting sufficient amount of sleep have more chance for developing cognitive impairment compared to those getting sufficient amount of sleep. Other sleep quality variables showed statistically no significant association with cognitive impairment

The main objective of the study was to find out the impact of sleep quality on the academic performance and cognitive functions among the college students. The results concluded that majority of students obtain less than the 7 - 8 hours of sleep each night. The sleep quality had a negative effect on the student's academic performance and the cognitive functions like memory, attention, concentration etc. So, educational programs together with health care sector should be conducted to create awareness about the importance of duration and quality of healthy sleep. It is the responsibility of the mentors and tutors together with the institutional authorities to have a look on these variables that are responsible for poor sleep quality and should take proper role in educating the good sleep habits to improve their performance.

References

[1] Rose S Sumi, Ramanan Sunumol: Effect of sleep deprivation on the academic performance and cognitive functions among the college students: a cross sectional study. J Chalmeda AnandraoInst Med Sci.2017, 14: 51 - 56.

[2] Brain Basics: *Understanding sleep.* Office of Communications and Public Liaison, National Institute of Neurological Disorders and Stroke, U. S. National Institutes of Health, Bethesda, MD.2017.

[3] Maheswari G, Shaukat F, Impact of poor sleep quality on the academic performance of medical students, *Cureus*: 2019April; 11 (4): e4357. published online; doi: 10.7759/cureus

[4] Hershner SD, Chervin RD. Causes and consequences of sleepiness among college students. Nature and Science of Sleep, 2014; (6) 73 - 84. doi: 10.2147/NSS. S62907.

[5] Vyazovskiy VV: Sleep, recovery, and meta regulation: explaining the benefits of sleep. Nat Sci Sleep.2015, 7: 171 - 184. 10.2147/NSS. S54036

[6] Raley H R, Naber JL, CrossS, Perlow MB. The impact of Duration of sleep on Academic performance in University students. Madridge J Nurs.2016; 1 (1): 11 - 18 ISSN 2638 - 1605

[7] Rasekhi S, Pour Ashouri F, Pirouzan A. Effects of Sleep Quality on the Academic Performance of Undergraduate Medical Students, Health Scope.1970; 5 (3): e31641. doi: 10.17795/jhealthscope - 31641.

[8] Kelly w, Kelly K, Clanton R. The relationship between sleep length and grade point average among college students. *Coll Student J.2*001; 35: 84

[9] Len Kravitz. Sleep deprivation: cognitive function and health consequences. *IDEA Fitness J.2*011; 9: 73 - 86.

[10] Curcio G, Ferrera, dkk.2006. Sleep Loss, Learning Capacity and Academic Performance. Sleep Med Rev; 10 (5): 323 - 337

[11] Orzech KM, Salafsky DB, Hamilton LA. The state of sleep among college students at a large public university. *Journal Of American College Health*, 2011; *59* (7), 612 - 619. doi: 10.1080/07448481.2010.520051

[12] Shochat T, Cohen - Zion M, Tzischinsky O. Functional consequences of inadequate sleep in adolescents: A systematic review. Sleep Medicine Reviews, 2014; 18 (1), 75 - 87. doi: 10.1016/j. smrv.2013.03.005

[13] Pilcher JJ, Walters AS. How sleep deprivation affects psychological variables related to college students' cognitive performance. *J Am Coll Health.1*997; 46: 121–126.

[14] Giannotti F, Cortesi F, Sebastiani T, Ottaviano S. Circadian preference, sleep and daytime behaviour in adolescence. *Journal Of Sleep Research*, 2002; *11* (3), 191 - 199. doi: 10.1046/j.1365 - 2869.2002.00302n. x

[15] Toglia J, Fitzgerald KA., O'Dell, M. W., Mastrogiovmi R., Lin, C. D.2011. The Mini Mental State Examintion and Montreal Cognitive Assesment in Persons with mild sub acute stroke: Relationship to Functional Outcome. Archives of Physical Medicine and Rehabilitation, 92: 792 - 798

[16] Shad R, Thawani R, Goel A: Burnout and sleep quality: a cross - sectional questionnaire based study of medical and non - medical students in India. Cureus.2015, 7: 361.10.7759/cureus.361

[17] Alalageri KM, Sobagaih RT: A cross sectional study to determine the sleep pattern and impact of sleep deprivation on the health and academics of medical students of BMCRI Bengaluru. Int J Community Med Public Health.2017, 4: 3731 - 3734. 10.18203/2394 - 6040. ijcmph20174241

[18] ALOE, Flávio; PEDROSO, André and TAVARES, Stella Márcia. EpworthSleepiness Scale outcome in 616 brazilian medical students**.** *Arq. Neuro - Psiquiatr.* [online].1997, vol.55, n.2, pp.220 - 226. ISSN 0004 - 282X. http: //dx. doi. org/10.1590/S0004 - 282X1997000200009

[19] Kassarnig. V, Moneṣ E, Bjerre - Nielsen. A. *et al.* Academic performance and behavioral patterns: *EPJ Data Sci.7*, 10 (2018); https: //doi. org/10.1140/epjds/s13688 - 018 - 0138 - 8

[20] Mirghani, H. O., Mohammed, O. S., Almurtadha, Y. M. et al. Good sleep quality is associated with better academic performance among Sudanese medical students. BMC Res Notes 8, 706 (2015). https: //doi. org/10.1186/s13104 - 015 - 1712 - 9

[21] Ahrberg K, Dresler M, Niedermaier S, Steiger A, Genzel L. The interaction between sleep quality and academic performance. J Psychiatr Res.2012 Dec; 46 (12): 1618 - 22. doi: 10.1016/j. jpsychires.2012.09.008. Epub 2012 Oct 3. PMID: 23040161.

[22] Adelantado-Renau M, Beltran-Valls MR, Migueles JH, et al. Associations between objectively measured and self-reported sleep with academic and cognitive performance in adolescents: DADOS study. J Sleep Res.2019; 28: e12811. https: //doi. org/10.1111/jsr.12811